Section

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

EXPLORATION SERVICES DIVISION

GEOPHYSICAL REPORT NO. 1

ON

A GRAVITY AND MAGNETIC SURVEY

OF THE ROOPENA VOLCANICS

by

B.G. RISELY
GEOPHYSICIST
EXPLORATION GEOPHYSICS SECTION

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L68-52	Roopena Volcanics Geological Sketch Plan	1" = 1000'
L68-53	Roopena Volcanics Gravity, Magnetic and Elevation Profiles	1" = 1000'
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ABSTRACT

The survey was planned as an aid in positioning a stratigraphic drill hole. Preliminary depth estimates were not particularly accurate but the drill holes encountered low grade copper mineralization which changed the emphasis of investigation. Some structural trends are postulated and recommendations made for further work.

INTRODUCTION

At the request of the Regional Surveys Division of the Department, an attempt was made to determine a sectional depth of the Roopena Volcanics which surround Roopena homestead approximately 14 miles east of Iron Knob. This information was required for siting stratigraphic diamond drill holes to penetrate a reasonable thickness of the section for radiometric age-determination.

Gravity readings were initially taken along two traverses which crossed the volcanics but the results were inconclusive as there was no way of determining whether a strong positive gradient to the west was due to a regional gravity effect or to a thickening of the volcanics. Additional gravity work was then carried out in an attempt to determine the regional gravity. In addition, magnetic readings were taken to try to resolve the local geological structure.

The complex regional gravity environment made it impossible to determine the thickness of the volcanics accurately even with adequate drilling control and the two holes subsequently drilled were mainly sited on geological evidence. As the magnetic results appeared to reflect the geological structure and one of the diamond drill holes intersected copper mineralization, emphasis was then shifted from depth determination to structural interpretation and possible environments favourable to copper mineralization. It should be emphasized that this interpretation is highly speculative due to the limited amount of factual information obtained.

The geophysical field work was carried out by B.A.C. Brice and B. Risely during the periods 10/7/67 - 13/7/67 and 25/7/67 - 5/8/67.

PREVIOUS GEOPHYSICAL WORK

An aeromagnetic survey was flown over the Corunna and Roopena 1-mile areas at a height of 1,500ft. by the Bureau of Mineral Resources during 1951. The contour plan does not appear to map the Roopena Volcanics but it does show an anomaly of several hundred gammas west of the Roopena Fault which might correspond to the gravity ridge causing the strong regional gradient over the Roopena Volcanics as shown in Plan L68-51.

During 1955 and 1956 a regional gravity survey was carried out over the northern portion of the Pirie-Torrens Basin by Geosurveys of Australia Pty. Ltd. (Pegum, 1957). Only two traverses with a station spacing of approximately one mile were read in the area of interest. One traverse extended sixteen miles along the Eyre Highway from the junction with the Flinders Highway towards Iron Knob. The other extended from this junction to the Middleback homestead on the Whyalla-Iron Knbb highway.

A gravity tie between the Isogal gravity control stations established by the Bureau of Mineral Resources at Cowe 11 and Hawker has been carried out by Rowan in 1966. The present survey was tied to an absolute gravity value at one of the intermediate stations. No other stations were used as the station spacing was of the order of 10 - 20 miles.

GEOLOGY

Surface Geology

A detailed description of the surface geology and the diamond drilling results will be given by B.P. Thomson, Supervising Geologist, in a report in preparation. Plan No. L68-52 shows a provisional sketch of the surface geology from this work. The following geological description is largely based on Thomson's work, however it should be stressed that a number of inferences have been made by the writer.

Basalts, trachytes and andesites of the Roopena Volcanics (Adelaide System? - Willouran) underlie a plain which extends northwards, eastwards and southwards for approximately a mile from the homestead, westwards to the north-south trending Roopena Fault and north-westwards to Trig Dam. Outcrops on the plain are small and scarce with the area masked with pebble float and red loam. Along Traverse S, long low mounds of volcanic float with some outcrop can be seen trending northwest - southeast. Both on the ground and on aerial photographs the nature and attitude of these mounds is difficult to determine. They might indicate volcanic flows, sills, or dykes cutting across flows or sills. The dominant creek pattern west of Traverses N and S tends to follow this trend. To the east the creek pattern trends to swing to an east-west direction and then to a north-south direction just before Traverse A and may reflect the trends in the volcanics.

The Roopena Volcanics unconformably overlie grits and siltstones of the Corunna Conglomerate (Pre-Adelaide System - Carpentarian) which in turn overlie grits and sandstones of the Moonabie Formation (Pre-Adelaide System - Early Carpentarian?). The Moonabie Formation outcrops in two small isolated hills near "Roopena" and again in low lying hills running east-west approximately a mile south of the homestead. In these hills the unconformity between the Moonabie Formation and the Corunna Conglomerate is hidden but appears to trend north-northeast-south-southwest towards the western side of the two hills near the homestead. West of this inferred unconformity the Corunna Conglomerate outcrops to approximately ½ mile east of the Roopena Fault. Going westwards over the fault there is a topographic rise of several feet with Moonabie Formation possibly on the other side.

Gently dipping grits, sandstones and siltstones of the Pandurra Formation (Adelaide System - either Torrensian or Willouran) unconformably overly the Roopena Volcanics with the Pandurra Formation in contact with the Moonabie Formation approximately 2 miles southeast of "Roopena".

The Pandurra Formation outcrops in the low lying hills surrounding the volcanics on the northern, northeastern, eastern and southeastern sides. On the eastern side the dips to the east steepen somewhat.

A red porphyry appears to intrude the Corunna Conglomerate approximately 1¼ miles southwest of "Roopena" and porphyry float extends to the east and west. Silicification and the introduction of some feldspar into the Moonabie Formation? at 14,300 S may have come from this porphyry. Another outcrop of porphyry lies just south of the Eyre Highway and east of the Roopena Fault. Regionally, these porphyries lie on the projection of the eastern end of the porphyries of the Gawler Range Volcanics of the Gawler Ranges southeast to the Cultana Granite outcropping at the coast.

Radiometric age-determination (Compston et al, 1966) indicates ages of 1535 ± 20 m.y. and 1500 ± 20 m.y. for the Corunna Conglomerate and 1535 ± 25 m.y. for the Gawler Range Volcanics confirming their contemporariety as suggested by field evidence. The Roopena Volcanics have been dated at 1345 ± 30 m.y. and a doubtful minimum age of 1,320 m.y. has been given to the Cultana Granite. If the porphyries near "Roopena" belong to the Gawler Range Volcanics then they would not intrude the Roopena Volcanics but if they belong to the Cultana Granite then they possibly could. Hand specimens of the Roopena Volcanics taken along Traverse N are a pink-brown colour in contrast to the grey colour along Traverse S. The pink colour appears to be due to blebs and laths of feldspar and quartz and quartz filled vesicles, together with patches of a pink-brown groundmass enveloping patches of a black groundmass. The mean density of 2.67 gm/cc for surface volcanic samples taken on Traverse N is closer to the density of 2.60 gm/cc for the porphyry on Traverse B than the density of 2.89 for the volcanics on Traverse S (See Plan No. L68-54). This difference in colour and density might suggest that the porphyry has altered the Roopena Volcanics and is consequently younger.

A gabbro intrudes Moonabie Formation? at 25,000 S and might have been a feeder for the Roopena Volcanics which have been eroded on this side of the Roopena Fault but partly preserved in the down-thrown eastern side.

Slight copper and lead mineralization has been reported from the Roopena Volcanics in an area approximately 3,500' west of 4,000 N.W.

Drilling

Two stratigraphic diamond holes were drilled immediately west of the hills at "Roopena", the first verfically at 600 D and the second depressed at 65° to the east at 1300 D. These were put down after the geophysical field work but were sited mainly on geological evidence. The summarized logs are as folows:

ROOPENA D.D. HOLE NO. 1

Depth in Ft. From	To	Description
Surface	431'	Basalts and andesites of the Roopena Volcanics.
431	490	Grits, conglomerates and phyllitic siltstones of the Corunna Conglomerate with fine-grained chalcopyrite in siltstone giving the following copper assays:- 460' - 463' :- 3' @- 0.05% 463' - 467' :- 4' @ 0.35% 467' - 469' :- 2' @ 0.52% 478' - 483'5" :- 5'5" @ 0.30% 483'5" = 490' :- 6'7" @ 0.20%
490	511	Siliceous siltstone possibly of the Corunna Conglomerate.

ROOPENA D.D. HOLE NO. 2

Depth in Ft. From	To	
Surface	337+	Basalt and andesite of the Roopena Volcanics.
337+	390	Dense grit of the Moonabie Formation. No copper mineralization.

The logs indicate that the unconformity between the Roopena Volcanics and the Corunna Conglomerate has an apparent dip of approximately 30° west from the outcrop to D.D.H. No. 2 flattening out to 10° west from D.D.H. No. 2 to D.D.H. No. 1. They also show that the holes straddle the westerly dipping unconformity between the Corunna Conglomerate and the

Moonabie Formation. A change in slope of the gravity profile along Traverse D suggests that the Corunna Conglomerate pinches out east of 1200 D.

GEOPHYSICAL FIELD WORK

Traverse Layout

Initially, two traverses were laid out to cross the volcanics with their origins just west of "Roopena". Traverse N was pegged at a 200' interval from 00S/00N to 15,600S. The coverage was later increased by extending traverse S from 15,600S to 26,000S with a 200' peg interval and including Traverses B(0-8,000', 400' int.), N.W. (0 - 21,000', 400' int.), C(0 - 2000', 200' int.), D(0 - 1800', 200' int.), E (0 - 9000', 200' int.), A (0 - 8,000', 400' int.) and D.M. (9 - 18, .3M - .6M int.). This layout gave a series of traverses radiating out from "Roopena" with the regional traverse DM linking the local work to the Flinders Highway as shown in Plan No. L68-51.

Regional gravity was carried out around the Flinders, Eyre and Whyalla - Iron Knob Highways surrounding the local area, with a station spacing ranging from 2½ to 5 miles and averaging 4 miles.

Surveying

In the local survey, stations were pegged out along tracks and fence lines except for Traverses C, D and E, Stations 0 - 7,000N and 0 - 15,600S were marked with 2" x 2" x 1' wooden pegs, stations DM8 - DM17 with 1" x 1" x 40" pegs and the remainder with 1" x 1" x 1' pegs. The traverse and coordinates were marked on all pegs. Distances were measured by tape and the stations were optically levelled at ground level and tied to the levels of the Department of Lands 3rd order bench marks B.M. 3353 near "Pandurra" on the Eyre Highway and B.M. 1693 near Myall Creek Bridge on the Flinders Highway. Station positions were located on aerial photographs and not by ground survey.

In the regional part of the survey, Department of Lands

3rd Order bench marks were used as stations along the Eyre and Flinders Highways. Along the Whyalla - Iron Knob Highway a number of highway level pegs were used as stations. These are yellow 2" x 2" x 1' yellow wooden pegs stamped in hundreds of feet from Whyalla and placed every 100' along the southern side of the highway, 40' from the centre-line. Every third peg has been levelled. This surveying was carried out for the Highways Department by K.W. Lange and Associates, Consulting Engineers at Whyalla, who kindly gave us their original level sheets. The Lands Department bench mark levels are related to M.S.L. Pt. Adelaide but the Highways Department levels were related to the E. & W.S. levels at Whyalla and have been converted to M.S.L. Pt. Adelaide by subtracting 5.9'. The conversion figure was obtained by tying from the 159,100' highway peg to the Department of Land's bench mark B.M. 3361 at Iron Knob.

Gravity

Readings were taken with the Sharpe CG-2 gravity meter No. 201. Instrument drift was controlled with the leap frog method with the control stations re-read within an hour. Absolute values of observed gravity were obtained by tying the survey to gravity station 6610.0015 with a value of 979, 512.62 milligals. Stations 56I0.0002 and 56I0.0003 at the Iron Knob Hotel and 56I0.0103 at the Whyalla Institue were re-occupied to tie previous local surveys to the State gravity network.

During the regional work between Whyalla and the Eyre Highway, the meter behaved very erratically with tares or jumps of up to ± 3.6 divisions. Tests on the meter that night at Pt. Augusta gave average tares of the order of ± 1.5 divisions with a major tare of 426 divisions. In spite of this an attempt was made to use the meter. A known gravity interval was repeated satisfactorily and the link was completed without any obvious tares and with a total loop misclosure around the highways of only 0.1 dial divisions.

Magnetic

In general, readings were taken every 200'. Closer spacing was attempted over the Roopena Volcanics due to the irregular magnetic pattern but was discontined as the number of peaks continued to increase as the spacing was decreased.

It was intended to cary out the survey using two total field Elsec Proton Magnetometers, type 592/H. As both instruments behaved erratically in the field the Jalander vertical force fluxgate magnetometer No. 57136 was used instead. Magnetic profiles along Traverses C, D and part of S from the two types of magnetometer as shown in Plan L68-53 appeared to be similar enough to justify using the less sensitive Jalander. Readings could be taken more quickly with the Jalander but care was necessary in orienting the instrument due to a heading error which could have been several hundred gammas on rotating the instrument 180°. Using a watch and the sun to point the Jalander always northwards the readings could be repeated to within approximately 10 gammas.

Diurnal drift was controlled by returning to a station within two hours and the readings were tied to stations 200E and 400E used as a double base. These stations were not tied to any absolute value.

RESULTS

Gravity Reduction

The observed gravity was obtained by correcting the dial readings for drift, using a calibration factor of 0.10556 milligals/division and tying the results to an observed gravity value of 979,512.62 milligals at Station 6610.0015 (Rowan). An elevation correction of 0.06 milligals/division was used corresponding to a surface density of 2.67 grams/cc. This value may be too low over the Roopena Volcanics but is a compromise for the whole area. The value was accepted as the correlation between the gravity and elevation profiles was not too high. No terrain corrections were applied due to the relatively low relief.

The relevant results from the previous surv ey carried out by Geosurveys of Aust. Pty. Ltd. (Pegum, 1957) have been incorporated in the present work. As a contour plan was the only available source of information and a new elevation correction had to be used, these results cannot be very accurate.

Magnetic Reduction

After correcting for diurnal drift, calibration factors of 9.7 gammas/division (Scale 1) and 28.0 gammas/division (Scale 2) were used for the Jalander magnetometer and a factor of 24051.1×10^5 gammas/ $\frac{1}{\text{meter count}}$ was used for the Elsec magnetometers. No geographic correction was applied and all values are relative.

Presentation

The results are presented as:-

(a) Inferred contours of Bouguer gravity anomaly for the whole survey (Plan No. L68-51). Because of the limited number of gravity stations these contours are very much an interpretation especially outside of the local area.

(b) Superimposed profiles of Bouguer gravity anomaly, elevation and smoothed and unsmoothed vertical and some total magnetic intensity. These are shown in Plan L68-53.

(c) A fence diagram of Bouguer gravity anomaly and un-smoothed vertical magnetic intensity superimposed on the inferred geological structure (Plan L68-54).

Gravity Description

Regional

The dominant regional gravity feature is a north-south trending ridge just west of the Roopena Fault (Plan L68-51).

East of this fault the contours are more open. North of "Roopena" and east of the fault there are a series of troughs and ridges trending northwest - southeast and plunging to the southeast. One of these trough containing minor troughs and ridges appears to turn eastwest through "Roopena", then swing southwards to a prominent "low" in the middle of the area and south-southwest towards Middleback homestead and away from a "high" over Whyalla.

Two east-west troughs may cross the area, one trough "Roopena" and the other through the prominent "low" just mentioned.

Local

The dominant feature of the local gravity is the steep positive gradient of approximately 3.3 milligals/mile to the west, which the regional gravity indicates to be the eastern slope of a relatively large gravity ridge running north-south just west of the Roopena Fault (See Plans L68-51, L68-53 and L68-54). The fault itself is indicated by a step up in gravity to the west of approximately 1.2 milligals on Traverse S. On traverse NW there is a reversed effect with a step down in gravity to the west of approximately 0.7 milligals.

The local gravity is strongly masked by the regional effects but it does appear that the Roopena Volcanics generally coincide with a gravity trough. This trough extends at least as far north as Trig Dam and plunges to the southeast towards "Roopena". It then turns east terminating at the small gravity high just east of Traverse A. On the other side of this high it may continue southwards into the prominent regional low at the centre of the eastern half of the area. A gravity low over the Roopena Volcanics at first sight appears odd as their mean specific gravity in a number of surface samples was found to be greater than that of the surrounding rocks as shown in the following table and in Plan No. 68-800.

Station	Position of Sample Relative to Station	Rock	Specific Gravity (g.m./c.c.)	Mean Specific Gravity	
400B	400'E	Weathered Roopena Volcanic	2.42		
600N	100'W	Roopena Volcanic	2.73		
600N		" "	2.74		
1400N		" "	2.61	2.68	
1800N		" "	2.63		
2000N		" "	2.71		
200S		" "	2.75		
1600S		" "	2.88		
3600S		" "	2.85		
3800S	600'NW	(Dolerite ?)	2.75		2.82
4400S		Roopena Volcanic	2.99		
4750S		" "	3.35	2.87	
4800S		" "	2.80		
4980S		" "	2.89		
6930S		" "	2.83		
8000S		(Dolerite ?)	2.80		
8000S		Roopena Volcanic	2.82		
9000S		" "	2.78		
2000E	1000'N	Moonabie Formation Quartzite	2.63	2.645	
3200E	1000'N	" " "	2.66		
14300S		" " "?	2.64	2.63	2.64
25000S		" " "?	2.62		
4950N		Pandurra Formation Quartzite	2.44		
2500S		Gabbro	3.07		
6800B	1000'E	Gawler Range Granophyre	2.57	2.60	
8000B	300'SW	Gawler Range Porphyry	2.62		

The only other local gravity features of interest appear to be the small negative anomaly of approximately 0.25 milligals over the Moonabie Formation outcropping immediately north of "Roopena", a small positive anomaly of approximately 0.3 milligals immediately east of this negative anomaly and a small but broad positive anomaly of approximately 0.6 milligals extending from 5000S to 8000S.

Magnetic Description

Radiating out from the centre of the local traverses, the magnetics are extremely irregular with the number of magnetic peaks increasing as the station spacing is decreased. This pattern extends to approximately 19,300NW, 12,800S, 5,400B, 8,500E and 3,800N. Although the traverses are too far apart to correlate these fluctuations with any certainty, there does appear to be a recurring pattern shown in the smoothed fluctuations on traverses S, N, B and possibly NW. This pattern comprises a group of fluctuations with the base level dipping into a characteristic centre consisting of a relatively broad low amplitude peak. The fluctuations are asymmetric with the long slopes having apparent dips towards this centre. These centres occur at 1800N, 1700B, 2100S, 10,200S and possibly at 17,800NW (See Plans L68-53 and L68-54). It seems possible to correlate one such pattern on Traverse B with the easterly pattern on Traberse S giving a northwest-southeast trend. This inferred trend is almost parallel to Traverse NW and tends to be confirmed by the long slopes of the smoothed fluctuations possibly having apparent dips to the northwest as far as from 00NW to 17,800NW. The fluctuations from 00NW to 17,800NW might then be correlated with those from 00S to 2100S and from 00B to 1700B. A similar pattern occurs east of "Roopena" on Traverse E except that the peak at the centre is sharper. Apart from the centres of these patterns the amplitude over the area of magnetic fluctuations decreases from 6100S to 8000S and over the outcrop of Moonabie Formation near "Roopena".

Outside of this central area of pronounced magnetic fluctuations the magnetic wave-form is less characteristic but still capable of being separated into a number of different types. From 12,800S to the Roopena

Fault at 13,900S the wave-form has a very low amplitude and is similar to that from 5400B to 9000B and from 3800N to 4600N. West of the Roopena Fault on Traverses S and NW the base level is higher and the fluctuations have a larger period than over the central area although their amplitude is approximately the same. Similar fluctuations are found from 8500E to appmximately 6200A and slightly lower amplitude fluctuations from 5400N to 8000N. An almost flat wave form is found from 4600N to 5400N and from 6200A to 8000A.

INTERPRETATION

Regional Gravity

The dominant N-S gravity ridge just west of the Roopena Fault may have a deep seated source in the Archean. It coincides approximately with an aeromagnetic anomaly of several hundred gammas above background and could be due to an iron formation. The more open gravity contours on the eastern side of the fault might suggest that this is the down-thrown side.

In the vicinity of "Roopena" the gravity troughs and ridges may indicate folding which generally trends northwest - southeast and pitches to the southeast. However, a monoclinal fold in the axial planes causes the folds to trend east-west through "Roopena". The exposed Roopena Volcanics tend to follow an inferred syncline from at least as far north as Trig Dam to immediately west of Traverse A where they may be terminated locally by a minor pitch reversal. If a syncline is indicated by a gravity trough, then it is possible that the downfolded Roopena Volcanics which are denser than the surrounding rocks may not fully compensate this gravity low so that the effect is still a low. The presence of the volcanics may account for this syncline being smaller than the next one to the east but it is doubtful whether there are no volcanics there. Volcanic float has been found in Stud Dam over the eastern syncline, but it is probably transported material.

Local Gravity

The local gravity was found to be of little value in interpreting the extent and depth of the volcanics due to the complex regional effects including those from the large gravity ridge just west of the Roopena Fault and the unknown effect from the inferred syncline containing the volcanics. If the volcanics are indicated by magnetic fluctuations as will be suggested, then on Traverses Band N which give a cross-section of the volcanics it can be seen in Plan L68-53 that the gravity effect from the volcanics may have partly flattened out a gravity low containing a small gravity high in the middle due to an anticline which exposes the basement of Moonabie Formation just north of "Roopena". The effect of the Volcanics does not completely compensate the low from the syncline so that a low still results. Even with relatively close drilling control the gravity depth calculations were found to be unreliable. The calculated depth at D.D.H. No. 1 agreed exactly with the depth found from drilling, but this was found to be a coincidence as the calculated depth for D.D.H. No. 2 using the control available from D.D.H. No. 1 was in error by approximately 30%, with the holes only 700ft. apart. About all that can be said here concerning the depth of the volcanics is that it probably does not exceed 1000ft.

The broad gravity low from 5000S to 8000S may indicate an anticline. This tends to be confirmed by the corresponding decrease in magnetic fluctuations.

Over the Roopena Fault the reversal of the gravity step ups on Traverses NW and S might be explained by differences in folding across the fault.

Magnetic

Quantitatively the magnetics appeared to be more useful in indicating the geological structure than the gravity. The character of the waveforms appears to be indicative of the geological formations as suggested in the following table.

Range	Wave - Type (200' station spacing)	Geological Formation
00NW - 19,300NW 00S - 12,800S 00B - 5400B 00E - 8500E 00N - 3800N	Characteristic relatively short period fluctuations of the central area (See Plans L68-53 and L68-54)	Roopena Volcanics
19,300NW - 22,200NW 13,900S - 26,000S 8500E - 9000E 00A - 6200A	Similar to that over the Roopena Volcanics but with a larger period.	Moonabie Formation? (Requires confirmation over more outcropping Moonabie Formation.
5400N - 8000N	Similar to that over the Moonabie Formation but with a smaller amplitude.	Moonabie Formation overlain by Pandurra Formation?
3800N - 4600N 12,800S - 13,900S 5400B - 9000B	Similar to that over the Roopena Volcanics but with a smaller amplitude.	Corunna Conglomerate
4600N - 5400N 6200A - 8000A	Almost flat	Corunna Conglomerate overlain by Pandurra Formation?

In addition, the apparently recurring pattern over the Roopena Volcanics referred to under "Magnetic Description" has been taken as a guide to the structure of the volcanics. The fluctuations over the volcanics may indicate layering in the flows or sills and the characteristic pattern might arise from the volcanics being folded into a syncline. The layers dripping towards the centre of a syncline would give the asymmetrical nature of the smoothed fluctuations and the higher magnetic intensity on the limbs might be due to more magnetic layers at the bottom. Although the volcanics would be thicker at the fold axis these layers would be deeper giving a general low. A relatively broad low amplitude peak at the axis may result from the segment shape of the uppermost layer. The suggested northwest-southeast trend of a syncline passing through traverses B, S and possibly NW might be confirmed by the similar trend of the long mound-like outcrops seen along traverse S and showing up on the aerial photographs. The trend is accentuated on the photographs by the stream pattern. Changes in the stream pattern to a north-northeast - south-southwest direction in the Trig Dam - Tank Hill area, to an east-west direction near Roopena and to a north-south direction just west of Traverse A have also been used in the interpretation of the structure of the volcanics.

A decrease in the magnetic fluctuations over the volcanics from 6100S to 8000S may indicate that the underlying rocks have been brought close to the surface by a northwest-southeast trending anticline. This same anticline may have contributed to the exposure of the underlying Corunna Conglomerate on Traverse B. The main cause of the exposure might be a -

north-northeast-south-southwest anticlinal crossfold pitching to the north-northeast which in conjunction with an east-west trending anticline exposes the Moonabie Formtion just north of "Roopena". An adjacent north-northeast-south-southwest synclinal cross-fold to the east of "Roopena" may be indicated by a pattern somewhat similar to the inferred synclinal magnetic pattern. The sharper magnetic peak at the centre may be due to the influence of the east-west anticline. It is more likely that the axis of the anticline lies to the north of Traverse E but has been shown to the south in Plan No. L68-54 for clarity in the diagram. The larger period fluctuations on Traverse A may indicate that the adjacent anticlinal crossfold to the east has brought the Moonabie Formation to the surface although it is not exposed directly.

From the geological mapping and the patterns of the magnetic wave-forms there appears to be an unconformity between the Corunna Conglomerate to the west and the underlying Moonabie to the east which trends north-northeast - south-southwest just west of "Roopena" and may turn north-westerly to pass through 5400N. Another unconform ity between the Corunna Conglomerate to the east and the Moonabie to the west might pass through 6200A but this is highly speculative.

The Corunna Conglomerate may lie under a thin alluvial cover from 12,800S to 13,900S due to folding. No exposures have been found. At the Roopena Fault at 13,900S and also at 19,300NW Corunna Conglomerate and Roopena Volcanics respectiv ely could be faulted against Moonabie to the west.

General

The Roopena Volcanics may have been folded and preserved in a synclinorium generally trending northwest-southeast to north-northwest - south-southeast but trending east-west through "Roopena" due to the effect of two anticlinal crossfolds trending north-northeast - south-southwest and pitching steeply to the north-northeast. On the west the volcanics are terminated against the Roopena Fault and on the east by the eastern crossfold. The Roopena Volcanics overlie the Corunna Conglomerafe with an angular unconformity which in turn overlies the Moonabie Formation with an angular unconformity. At the surface, the Cormnna Conglomerate - Moonabie Formation unconformity trends north-northeast - south-southwest just west of "Roopena" with theCorunna Conglomerate to the west.

The synclinorium appears to contain two anticlines. The southern anticline causes the Corunna Conglomerate to possibly come close to the surface from 6100S to 8000S beneath a thin cover of Roopena Volcanics. Together with the western anticlinal crossfold it causes the Corunaa Conglomerate to come to the surface under a thin cover of soil and float south of 5400B and the Moonabie Formation to outcrop approximately a mile south of "Roopena". The northern anticline together with the western anticlinal crossfold causes the Moonabie Formation to outcrop at "Roopena". Although porphyry float has been found along the inferred anticline south of the synclinorium the major outcrops occur south of "Roopena" on this anticlinal crossfold. If the anticlinal folding was a control for the porphyry then it could intrude the Roopena Volcanics which were also subjected to the folding and may be related to the Cultana Granite rather than the Gawler Range Volcanics. The fact that the porphyry has not been found intruding the volcanics may be due to the volcanics occurring in a synclinorium.

Evidence of copper minerlaization found in D.D.H. No. 1 might be related to this porphyry, and siltstones in the Corunna Conglomerate appear to have been favourable for deposition. An unconformity might have been another control for the mineralization which was possibly closer to the Corunna Conglomerate - Roopena Volcanics unconformity than the Corunna Conglomerate - Moonabie Formation unconformity. If the porphyry is older than the volcanics then the copper minerlization may have come directly from the porphyry and have been controlled by the Corunna Conglomerate - Moonabie Formation unconformity. If the porphyry is younger than the Roopena Volcanics then the mineralization may have a similar origin but could be controlled by both unconformities. Alternatively the mineralization may have been due to solutions heated by the porphyry leaching disseminated copper minerals from the Roopena Volcanics and be controlled by the unconformity at the base of the volcanics. Slight copper and lead mineralization has been reported from the volcanics at the surface. Folding affecting the Roopena Volcanics may have also been a control for mineralization provided that it is older than the porphyry. The anticlines might be more favourable than the synclines due to increased fracturing. In Diamond Drill Hole No. 1 the mineralization may have been approximately two-thirds up the southern side of a syncline and might have increased towards the anticline. As the siltstones of the Corunna Conglomerate do not follow the overlying unconformity with the Roopena Volcanics, the distribution of the siltstones in the Corunna Conglomerate may have been a major control.

The Pandurra Formation unconformably overlies the Roopena Volcanics which has a general easterly dip of 10^{o} steepening up east of the local area. As the strike appears to follow that of the underlying Roopena Volcanics, it may have been controlled by differential erosion over the structure of the volcanics.

CONCLUSIONS AND RECOMMENDATIONS

Although the survey failed in its original aim of determining the thickness of the Roopena Volcanics for siting two stratigraphic diamond drill holes it did indicate that the ground magnetics might be of considerable help in determining the geological structure. As evidence of slight copper mineralization was found in the first diamond drill hole attention was then shifted to a rough structural interpreation with emphasis on possible controls for the mineralization. The interpretation given has been taken far beyond that justified by the limited amount of work done. It should prove interesting to compare this interpretation with one based on adequate magnetic coverage. The present interpretation suggests certain structural environments which might have been suitable for mineralization. A primary control may have been the siltstones in the Corunna Conglomerate which at present would limit the environment to one between the Roopena Fault on the west and the Corunna Conglomerate - Moonabie Formation unconformity just west of "Roopena". Inside this area another control might have been the axes of anticlines, synclines, or possibly both. The anticlinal axes may have been more favourable due to increased fracturing. A third control might have been the unconformity between the Roopena Volcanics and the Corunna Conglomerate putting the suitable environment immediately beneath the volcanics. This control appears necessary to explain the fact that no copper mimerals have been found over the inferred anticline and syncline in the siltstones of the Corunna Conglomerate outcropping at thesouth of the so-called favourable area. It is not known if mineralization was associated with this unconformity as it has not been found exposed. If mineralization was associated with the axes of anticlines this would be favoufable, due to the shallow depth beneath the Roopena Volcanics. In view of controls which might be suggested from the limited field work carried out, it is recommended that magnetic readings be taken every 100ft. along northeast - southwest traverses 500ft. apart, covering the local area. From the more detailed character of the waveforms obtained over the outcrops these rock types could possibly be resolved more accurately where covered. Apart from any economic significance, this should be carried out as an exercise in magnetic structural interpretation over an area where there is sufficient outcrop to obtain characteristic wave-forms. The new interpretation should then be compardd with the initial one to gain some idea of how far an interpretation should be taken with a limited amoufit of information. In magnetic work the importance of using it as a tool for structural interpretation can easily be overlooked in concentrating on the more eye-catching anomalies. These anomalies may in fact have nothing to do with the problem in hand serving only to detract attention from the real issues. If this recommendation cannot be carried out then an alternative would be to determine the characteristic wave-forms over the outcrops more accurately and test the present interpretation with a number of short traverses in key areas.

The initial interpretation has suggested that the siltstones of the Corunna Conglomerate immediately beneath the Roopena Volcanics and possibly along anticlinal axes sycnlinal axes or both may have been favoufable for mineralization. If the initial interpretation remains unchanged with more detailed magnetic work then an induced polarization survey is recommended to cover D.D.H. No. 1, the Corunna Conglomerate - Moonabie

Formation unconformity to the east and the inferred anticlinal and synclinal axes trending approximately through 00N and 2000N respectively. It is hoped that the survey would determine whether the mineralization was restricted to the Corunna Conglomerate and if it favoured either anticlinal or synclinal axes. Should it have been restricted to the Corunna Conglomerate and have favoured anticlinal axes then the inferred anticline through 7000S might be tested to the southeast by the I.P. method as the Corunna Conglomerate - Roopena Volcanics unconformity may be broughtto the surface under a thin layer of alluvium by the cross-folding through "Roopena". If synclinal axes were more favourable then the inferred syncline through 10,000S might also be tested to the southeast. The syncline through 1700B might be tested but as with the syncline through 2000N the Corunna Conglomerate - Roopena Volcanics unconformity is not exposed by the cross-folding.

In view of the relatively large area which might have been favourable for copper mineralization it is strongly recommended that the extent of the chalcopyrite found in D.D.H. No. 1 should be determined. The possibliity of the Roopena area lying in a zone of regional cross-folding trending north-west-southeast and embracing the old Mongolata Goldfield, the old Burra Copper Mine, copper mineralization at Spalding and iron mineralization at Iron Monarch may be significant.

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BGR:CC:RW
1.11.1968

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GEOPHYSICIST
EXPLORATION GEOPHYSICS SECTION

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To accompany report by B.G. Risely

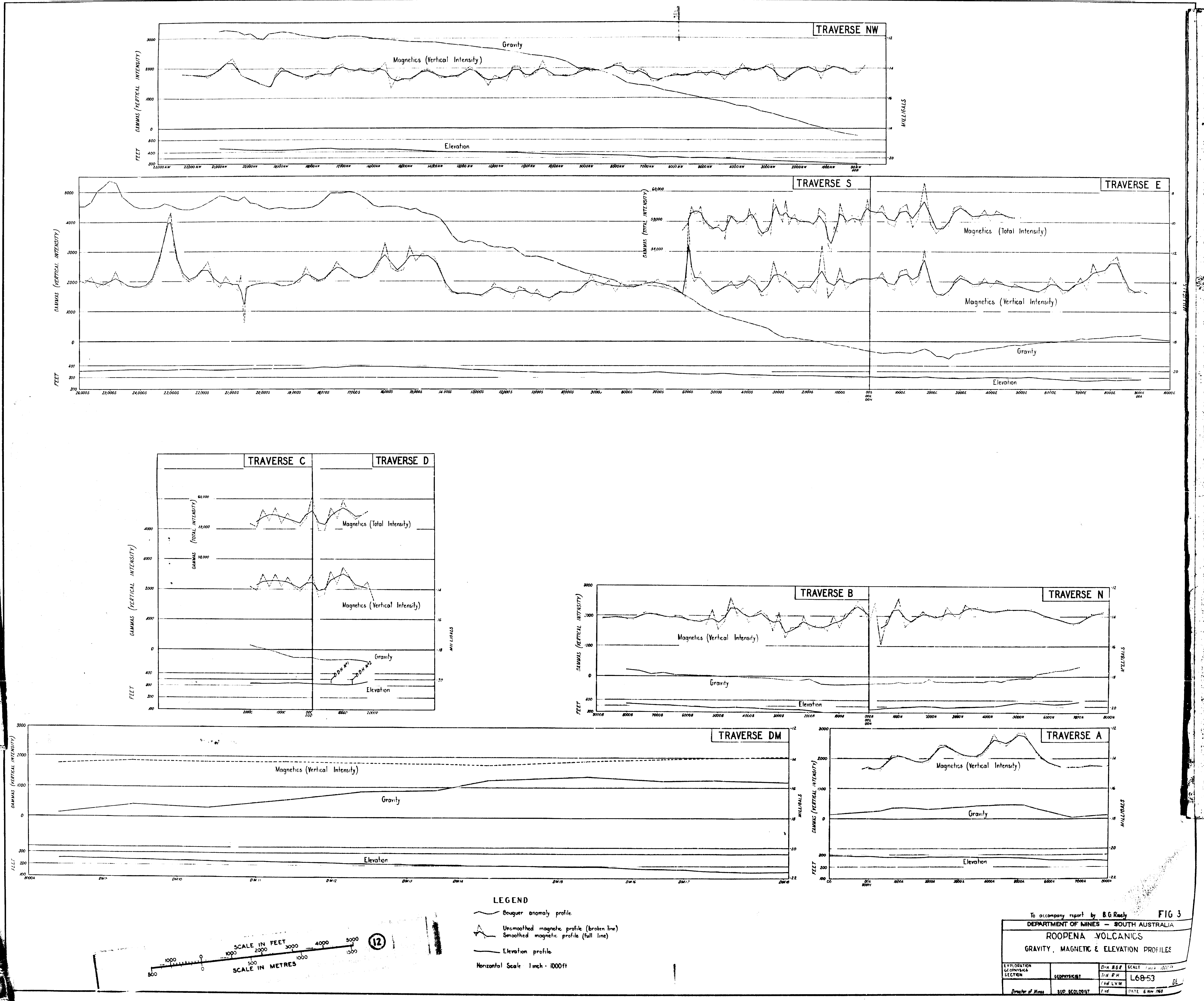
FIG. 4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

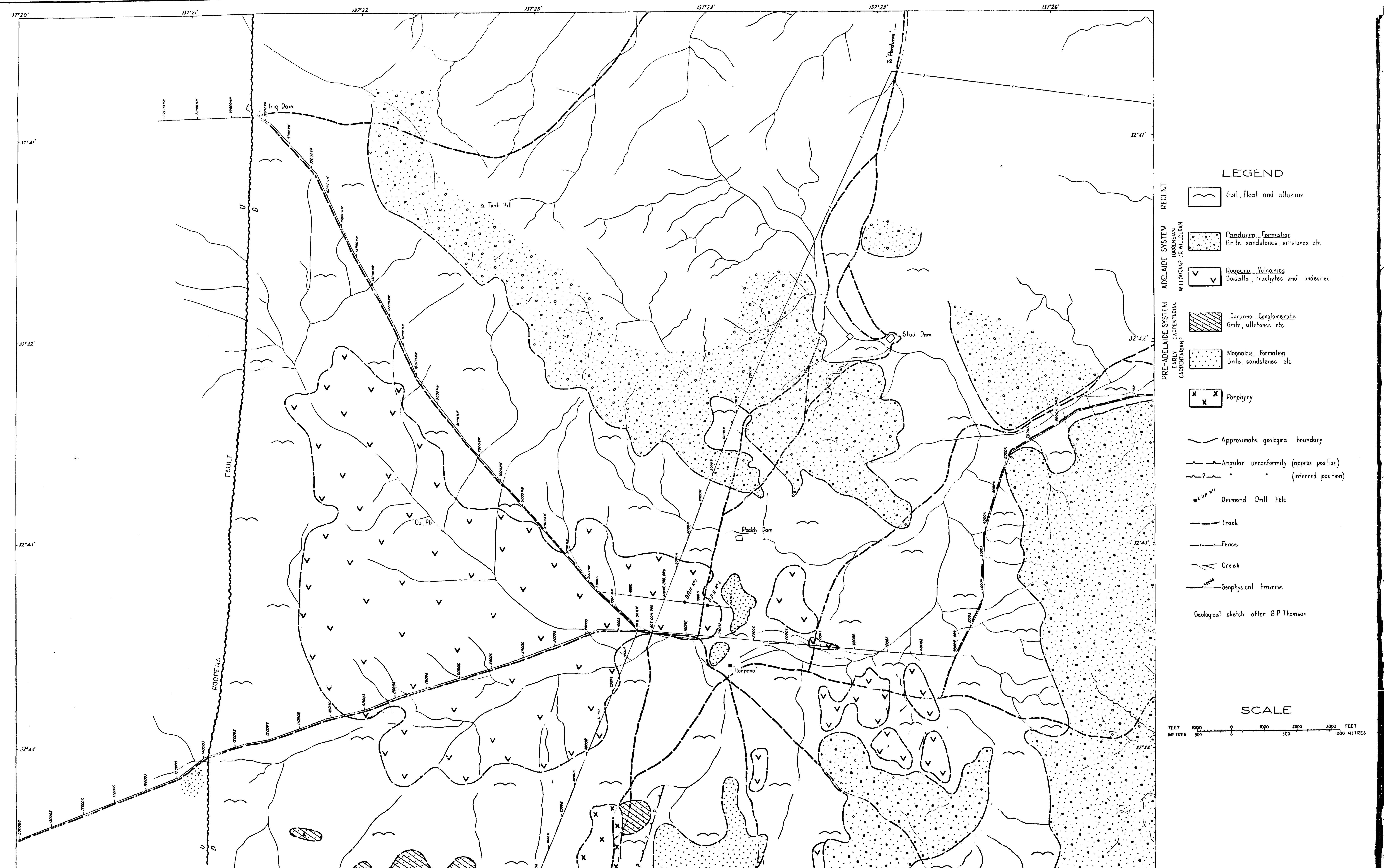
ROOPENA VOLCANICS

GRAVITY AND MAGNETIC FENCE DIAGRAM WITH STRUCTURAL INTERPRETATION

EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn BGR	SCALE As shown
		Tcd RH	L68-54 DE
		Ckd LVW	
Director of Mines	SUP GEOLOGIST	Exd	DATE 28 Nov 1968



TRAVERSE NW
Gravity
Magnetics (Vertical Intensity)
GAMMAS (VERTICAL INTENSITY)
MILLIGALS
FEET
Elevation
TRAVERSE S
TRAVERSE E
Magnetics (Total Intensity)
GAMMAS (TOTAL INTENSITY)
TRAVERSE C
TRAVERSE D
DDH No1
DDH No2
TRAVERSE B
TRAVERSE N
TRAVERSE DM
TRAVERSE A
LEGEND
Bouguer anomaly profile
Unsmoothed magnetic profile (broken line)
Smoothed magnetic profile (full line)
Elevation profile
Horizontal Scale 1 inch - 1000 ft
SCALE IN FEET
SCALE IN METRES
12
To accompany report by B.G.Riely
FIG 3
DEPARTMENT OF MINES — SOUTH AUSTRALIA
ROOPENA VOLCANICS
GRAVITY, MAGNETIC & ELEVATION PROFILES
EXPLORATION GEOPHYSICS SECTION
GEOPHYSICIST
Director of Mines
SUP. GEOLOGIST
Drn. BGR
Trd RH
Ckd L.V.W.
Exd
SCALE 1 inch - 1000 ft
L68-53
DL
DATE 6 Nov 1968



To accompany report by B.G. Risely

FIG.

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
ROOPENA VOLCANICS GEOLOGICAL SKETCH PLAN			
EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn RGR	SCALE As shown
		Tcd RH	L68-52 DE
		Ckd LVW	
Director of Mines	SUP GEOLOGIST	Exd	DATE 11 Nov 1968

Reduce to 8 inches