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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

MINERAL RESOURCES DIVISION

GRANITE DEPOSIT, YARWONDUTTA ROCKS

Section 27, Hd. Minnipa, Co. Le Hunte

- S.A. Railways -

by

R.K. TARVYDAS
GEOLOGIST
NON-METALLICS SECTION

17th April, 1968

D.M. 56/68

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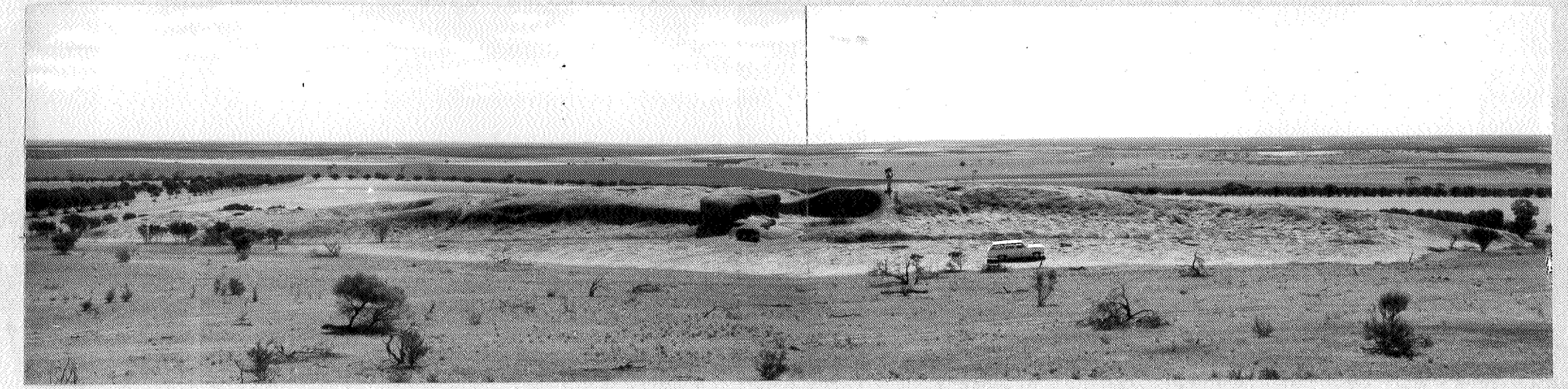

Fig. 1. Smaller granite outcrop, Yarwondutta Rocks, Minnipa.
(S.A.D.M. photo nos. 17339, 17340)

Fig. 2. Larger granite outcrop, Yarwondutta Rocks, Minnipa.
(S.A.D.M. photo nos. 17341, 17342)

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ABSTRACT

Two granite inselbergs known as Yarwondutta Rocks have been defined by a plane-table survey. Because of the desirability of preserving geomorphic features on the larger rock, an additional shallow-seismic survey was carried out on the smaller rock to determine its subsurface configuration. The smaller rock is calculated to have up to 350,000 cu.yds. of granite within the 15ft. overburden isopach.

The rock appears similar physically to that from Tcharkuldu Hill, which is considered satisfactory for ballast.

INTRODUCTION

The South Australian Railways require a source of ballast for the Pt. Lincoln-Thevenard narrow-gauge railway. A deposit of at least 80,000 cu.yds. and preferably in excess of 200,000 cu.yds., is required.

For this purpose, three granite outcrops in the Minnipa district were surveyed in 1967 (Hiern and Russ, unpublished report, S.A. Department of Mines, Rept. Bk. No. 64/72). For various reasons none of these deposits is now available for quarrying and a further request was received from the S.A. Railways to evaluate the granite outcrops known as Yarwondutta Rocks, located 2.5 miles north of Minnipa.

The site comprises of two elliptical granite inselbergs approximately 600 and 1000ft. long respectively and some 220ft. apart. They are located in a reserve known as Minnipa Research Station, in which mineral rights, including those to construction stone, are reserved to the Crown, but are under the control of the Minister of Agriculture.

A plane-table survey of the site was carried out by M.N. Hiern, Senior Geologist, and the author during the period 7th to 11th November, 1967. A geophysical survey using shallow-seismic equipment was conducted by geophysicist I.S. Rowan between 6th and 8th February, 1968. (Rowan,

unpublished report, S.A. Department of Mines, Rept. Bk. No. 66/82). These surveys have shown that the required reserve of ballast will be available from the small rock by quarrying below the level of the plain.

GEOLOGIC SETTING

Central Eyre Peninsula, on which Minnipa lies, constitutes a gently undulating plain of extensive dunes and sand-spreads of Recent age. Towards the western coast there is a blanket of Pleistocene aeolianite (calcareous shell-sand). The basement of granite and possibly metasediments is nowhere far below the plains and forms isolated outcrops over the greater part of the region. In the Minnipa-Wudinna area there are a number of granite monoliths or inselbergs. The Yarwondutta Rocks are of the latter type, exhibiting interesting geomorphic features pertaining to inselbergs. (Twidale, 1962 and 1964).

ECONOMIC GEOLOGY

The two Yarwondutta Rocks are more or less elliptical mounds rising above the surrounding plain to heights of approximately 25 and 35ft. respectively.

Both have a northeast-southwest orientation. The lower, western rock (Fig. 1) is the smaller with dimensions of approximately 570ft. x 300ft.; the higher rock (Fig. 2) is 970ft. long and 370ft. across at its widest point. The surrounding plain dips at approximately 2° to the west.

Relief on the two rocks may be divided into macroscopic and microscopic elements. Macroscopic features have linear dimensions greater than about 5ft. and include stream courses, depressions, clefts, ravines, ledges and tors. Microscopic relief, usually no more than a few feet across, consists mainly of shallow, circular depressions (similar to small water-holes on a wave-cut platform) and small tributaries of the main streams. The microscopic relief is not recorded on the accompanying plan due to the limitations of scale; in any case the features are not sufficiently large to affect reserve calculations.

A number of near-vertical joints transect the rocks, mainly along ESE-WNW and NNE-SSW directions. Although not numerous they have an important effect on the morphology. Most of them are tight, but some enclose veins of quartz to 1cm. thick, while others are filled with pegmatit quartz and feldspar to 2cm. All the erosional ravines within the main rock-mass are superimposed on major joints. Joints may also have played an important part in determining the outline and shape of the rocks.

Except for a little soil in some of the depressions and ravines there is no overburden over the exposed parts of the rocks. The depth of overburden surrounding the small rock has been defined by geophysical methods and shows a large, shallow shelf on the southwestern side. Surfac outcrop is mainly sand and travertine limestone. To test overburden at depth drilling is recommended (see later).

PHYSICAL PROPERTIES

In hand specimen the fresh rock is a very hard coarse-grained granite composed of a mosaic of pink feldspar (55%) white feldspar (20%), quartz (20%), biotite and opaques (5%) (compositions approximate). Rock exposed to the weather has not been affected chemically. There is a tendency for physical breakdown along grain boundaries, and this is confined to the upper few feet of the deposit.

Resistance to abrasion has not been determined, but the results of testing a similar granite from Tcharkuldu Hill are probably applicable. A drill-core from this rock showed the following Los Angele Abrasion Test losses from the -2 inch +1 inch fraction:

0 - 24.1 ft.	35%
24.1 - 57.9 ft.	21%
57.9 - 100.0ft.	22%

In addition, a surface sample of the Tcharkuldu granite was similarly tested, and showed an L.A. loss of 41% (Hiern and Russ, unpublished Report, S.A. Dept. of Mines, Rept. Bk. No. 64/72).

Large-scale breakdown of rock is mainly through exfoliation, which is in two sizes. One, a few inches thick, is developed over much

of the surface. Such scales disintegrate into their constituent minerals after prolonged exposure to the atmosphere. Slabs 1-3ft. thick are developed in two places, over about 5% of the surface. It is possible that with blasting spalls may develop over most of the surface, but below this, there will probably be no subhorizontal fractures.

The nature of the Yarwondutta granite below the apron of overburden is not known. Seismic velocities of 15,000-16,000 f.p.s. are interpreted as fresh granite and their distribution implies that this type of granite underlies much of the area of shallow overburden. To determine the maximum possible depth of overburden a velocity of 3,000 f.p.s. has been used for this material, which will probably include calcrete (travertine limestone) and weathered granite, as well as sand.

Twidale (1962 and 1964) makes several observations regarding granite inselbergs of Eyre Peninsula which may have a bearing on the stat of the rocks below ground-level at Yarwondutta. At Pildappa Hill and Chilpudie Hill excavations show that about 3ft. of overburden of sand and decomposed to friable granite rest on a distinct surface of fresh granite At Ucontitchie Hill, besides the similarly sharp transition from weathere to fresh granite, Twidale (1964) also observes that the granite is much more closely jointed below the surrounding apron of overburden than it is over the exposed part of the rock; the weathering in the vicinity of these close joints is intense, producing spheroidal 'corestones' by frittering away of the joint-block edges.

One conclusion from this work appears to be that the change fron weathered to unweathered rock at Yarwondutta is likely to be sharp. This is partly confirmed by Twidale (1964) who reproduces a photograph of the excavation for the watertank at the northern end of the larger Yarwondut rock. The photo shows the surface of the fresh granite descending from the ground surface at about 40° for some 5ft. vertically; from there on the granite descends at a more moderate angle of about 15°. Another conclusion is, that, if Ucontitchie Hill can be taken as an analogue, then the granite below the soil overburden will be more closely jointed than the exposed mass of the rock. This may mean that the granite below the overburden will be quarried more easily.

RESERVES

Using the contour-difference method the following reserves of granite in situ have been calculated. In the larger rock there are 100,000 cu.yds. to R.L. 80, which is approximately ground-level, and in the smaller rock, reserves are 62,000 cu.yds. to R.L.70, which, again, nearly corresponds to ground-level.

Reserves of granite beneath the area of shallow overburden around the smaller rock have been calculated using the seismic interpretation of subsurface contours. Assuming the interpretation to be correct, the following figures are arrived at. The error in the method of calculation is approx. ± 10%.

overburden isopach in feet	reserves of solid rock in cu.yds.	overburden in cu.yds.	overburden-granite ratio	approx. working depth RL in feet
0 - 5	140,000	7,000	0.05	60
0 - 10	220,000	30,000	0.14	50
0 - 15	350,000	80,000	0.23	45

FURTHER EXPLORATION

In order to check the seismic interpretation drilling to a total depth of about 400ft. is recommended at points shown on the accompanying plan. Specifically, the holes situated on seismic spreads will provide a control to establish absolute values for depth of overburden. Other holes in the area of shallow overburden are designed to check the assumption that the subsurface topography has an even slope between the recording points.

QUARRYING

The effect of blasting on the proposed PMG installation on Minnipa Hill has been reported on separately by the Mining Branch in a letter to the Commissioner of Railways dated 5th February, 1968. Briefl restricted firing with delay detonators is required. Much of the granite is sparsely jointed, and the restriction on blasting may have a significant effect on quarrying costs.

If the small rock is worked horizontally from the lowest point on the western side, the maximum face heights on the opposite side will be as follows:

For the	5ft.	overburden isopach	27ft.
" "	10ft.	" "	36ft.
" "	15ft.	" "	48ft.

Batter slopes for the granite should be steep to vertical. For the overburden, normal slopes for sandy soils will apply.

Existing fences will require shifting to create room for a crusher and dumps. A new access to the main road may also be required.

SUMMARY AND CONCLUSIONS

Preliminary calculations show that above ground level the following reserves of solid rock exist:

smaller rock	62,000 cu.yds.
larger rock	100,000 cu.yds.

Because of the desirability of preserving the geomorphic features of the larger rock a shallow-seismic survey was conducted on the smaller rock to define subsurface extensions of the granite. This showed an area of shallow overburden on the southwestern side. Assuming that the interface shown on Plan L68-4 denotes the top of the fresh granite, the following figures have been calculated within the different isopachs of overburden:

Isopach	Reserves	Overburden
5 ft.	140,000 cu. yds.	7,000 cu. yds.
10 ft.	220,000 " "	30,000 " "
15 ft.	350,000 " "	80,000 " "

Exploratory drilling is recommended to provide control for the seismic work and to determine the nature of the overburden and that of granite at depth. Borehole locations are shown on the accompanying plan (L68-4), and the maximum footage required amounts to 400.

No physical laboratory testing has been carried out on the Yarwondutta granite, but the rock is similar to that from Tcharkuldu Hill

which is regarded as being satisfactory for ballast.

Blasting costs may be high because of the toughness of the rock and the necessity to restrict the size of the charges in order to avoid interference with the PMG installation on Minnipa Hill.

Relocation of existing fences and the construction of an access road may be necessary.

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RKT:SMA
17.4.1968

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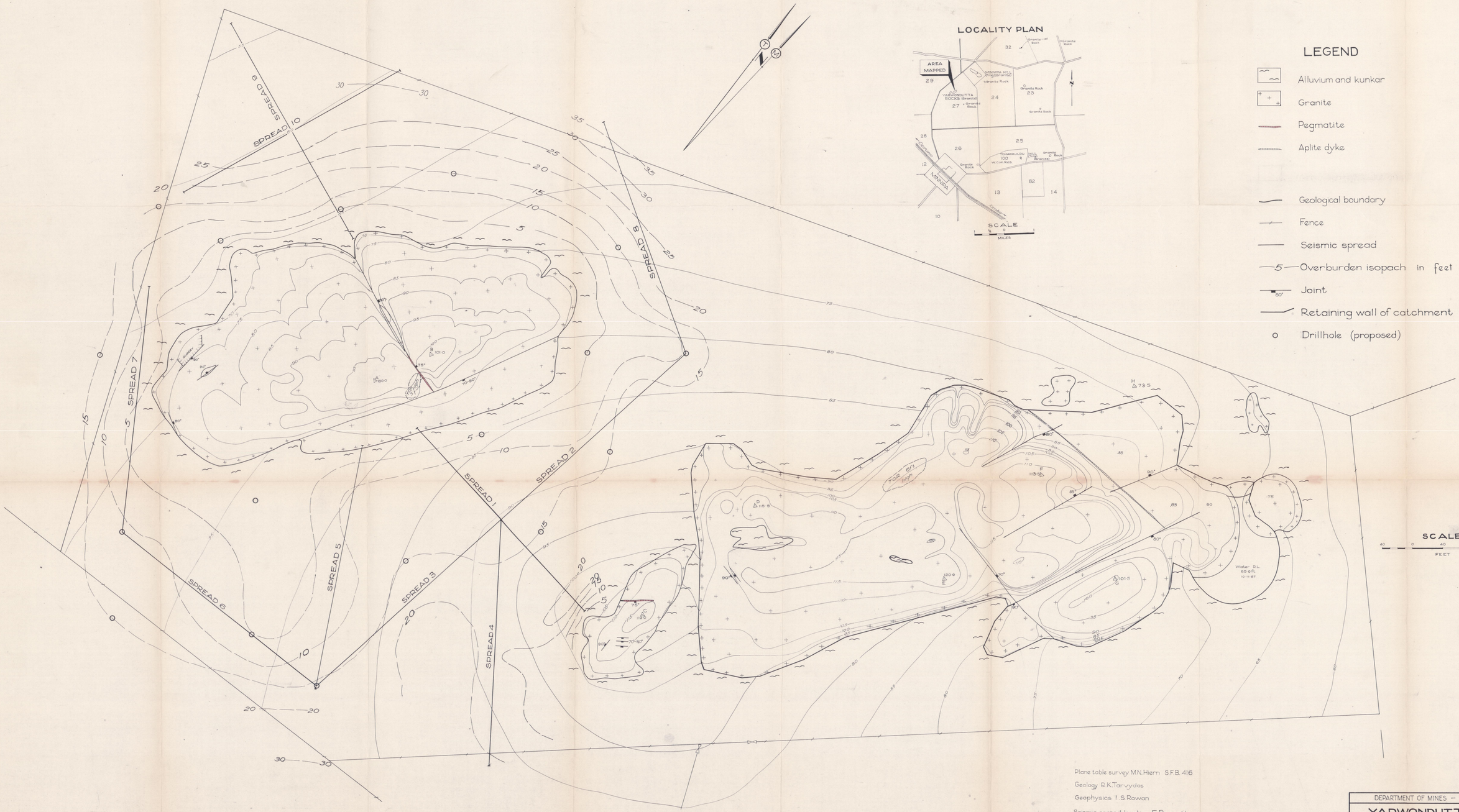

LEGEND

- Alluvium and kunkar
- Granite
- Pegmatite
- Aplite dyke
- Geological boundary
- Fence
- Seismic spread
- 5 — Overburden isopach in feet
- 80° — Joint
- Retaining wall of catchment
- o Drillhole (proposed)

Plane table survey M.N. Hiern S.F.B. 416

Geology R.K. Tarvydas

Geophysics I. S. Rowan

Seismic spread location F. Barrett

Assumed datum A = 100·0 feet

DEPARTMENT OF MINES — SOUTH AUSTRALIA

YARWONDUTTA ROCKS SECS. 27 Hd MINNIPA GEOLOGY AND GEOPHYSICS

		Drn.	SCALE: 40 Feet to 1 inch
		Tced/M	L 68-4 Ph1
Director of Mines		Chkd/VM	
		Encl.	DATE: 29-3-68