DEPARTMENT OF MINES
SOUTH AUSTRALIA

RB 52/65.

A GRAVITY SURVEY FROM THE BIRDSVILLE TRACK TO OODNADATTA

by

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Rept.Bk.52/65
G.S.1964
D.M.1202/60

15th March, 1960.

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Associated Drawings

Rept.Bk.52/65
G.S. 1964
D.M. 1202/60

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ABSTRACT:

A regional gravity traverse has been run from Mirra Mitta bore to Oodnadatta in northern South Australia. The results described and it is concluded that a seismic traverse over a portion of the area covered by the gravity traverse should add to knowledge of the geological structure and oil exploration potential of the area.

INTRODUCTION:

Aerial and ground reconnaissance surveys were made by the South Australian Mines Department during June and July 1960, of the western portion of the Great Artesian Basin between the Birdsville Track and Oodnadatta. It was decided to conduct a geophysical exploration programme in the area to determine the geological structure and oil exploration potential of the area.

This report covers the first phase of the programme, the running of a gravity traverse between the Birdsville Track and Oodnadatta. The field work was carried out in September and October 1960. The second phase of the work, the running of a seismic traverse through the area is planned for the winter of 1961.

GEOLOGY:

The area through which the traverse was run forms the western portion of the Great Artesian Basin in South Australia. The traverse crosses basement rocks at Mount Dutton, at the northern end of the Peake and Dennison Ranges, mainly Archaean and Proterozoic rocks. The rest of the traverse is over the Artesian Basin. The surface sediments are mostly Tertiary and Quaternary sands and clays while the subsurface geology is almost unknown. Mirra Mitta Bore at the eastern end of the traverse was drilled to a total depth of 3534 feet in Cretaceous sediments.

PREVIOUS GEOPHYSICAL WORK:

Regional gravity traverses have previously been made along the Central Australian Railway by the University of Sydney, Department of Geology and Geophysics, and along the Birdsville Track by Geosurveys of Australia Ltd. Pendulum stations were established at Leigh Creek and Oodnadatta in 1950-51 by the Commonwealth Bureau of Mineral Resources. Regional gravity surveys have been made in the Oodnadatta area by the South Australian Department of Mines and Geosurveys of Australia Ltd. An absolute gravity station was established at Oodnadatta by C. Muekenfuss of the Madison School of Geophysics, University of Wisconsin as part of a world-wide gravimeter survey.

An aeromagnetic reconnaissance survey has been made over the Artesian Basin by the Commonwealth Bureau of Mineral Resources but no flight line was located near the gravity traverse of the present survey.

METHODS USED:

The gravity traverse was commenced from a station established at Kalamunna, H.S. by Geosurveys of Australia Ltd. Further stations were established in groups generally of four or five stations at two mile intervals along the route taken, each station being repeated within two hours of the original observation. The stations were located on aerial photographs and plotted on 4 mile to 1 inch photomosaics of the area. The latitudes were determined from the photomosaics and latitude corrections were applied using the values for the International Ellipsoid of 1931.

The heights of the stations were determined by barometric levelling between points of known height at Oodnadatta and Mount Dutton (Railway levels) and at Mirra Mitta bore (Lands Department levels). The misclose in levels between Mount Dutton and Mirra Mitta (24 feet) was distributed linearly.

The absolute value of gravity was determined by reoccupation of the pendulum stations at Oodnadatta and Leigh Creek. Values of 979.1001 gals and 979-3204 gals were used for these stations. Gravity ties to all previous surveys were also made. The sensitivity of the gravity meter was determined by running a calibration over the range established by the Commonwealth Bureau of Mineral Resources between Magill and Norton Summit, South Australia.

The results of Geosurveys traverse from Leigh Creek to Kalamunna were recomputed adjusting the observed gravity values to the interval established between the Leigh Creek Pendulum station and Kalamunna and closing the levels to the Lands Department value at Mirra Mitta bore.

The Bouguer gravity anomaly was computed for all stations using an elevation correction factor of 0.063 milligals per foot corresponding to a density for the surface sediments of 2.4 No terrain corrections were applied as they were considered negligible.

RESULTS AND INTERPRETATION:

The results are presented as a set of plans of the area at a scale of 4 miles to 1 inch showing the locations of the gravity stations, Bouguer anomaly values and contours of Bouguer anomaly. A profile of the Bouguer anomaly from Mt. Dutton to Mirra Mitta at a scale of 8 miles to the inch has also been drawn.

A small positive anomaly was obtained over the basement outcrop at Mount Dutton. Immediately east of this is a region about 20 miles wide with anomaly - 15 milligals bounded by steep gravity gradients and east of this the anomaly is irregular but becoming more negative generally from - 5 milligals at Duckhole bore to - 35 milligals at Cowarie. The anomaly then becomes more positive rising to - 18 milligals at Mirra Mitta Bore.

The interpretation of a reconnaissance gravity survey of this type is necessarily very indefinite. The simplest

interpretation is to regard the anomaly as a reflection of the bedrock topography. The general gradient of the anomaly from west to east represents the known general deepening of the basin in this direction. The narrow gravity trough immediately east of Mount Dutton is the southernmost extension of a much more extensive trough indicated by a traverse made by Geosurveys of Australia Ltd. along the Macumba and may represent an area underlain by possibly Palaeozoic sediments.

The gravity highs at longitudes 137° 50' and 137° 5' may represent anticlinal structures either in the Cretaceous rocks of the basin or in the underlying rocks.

CONCLUSIONS:

The gravity survey is considered to have limited the area of interest for running seismic traverses to the deep gravity trough east of Mount Dutton and extending to the northward, and the two possible structures at longitudes 137° 50' and 137° 5'. Correlations between these areas at wide shot point intervals should be successful. In particular in the area between the Kallakoopah and the northerly bend of the Warburton at longitude 137° 42' the gravity profile is without interest. It is in this area that a seismic survey could be made only with extreme difficulty and from the gravity traverse no significant results are to be expected. A seismic traverse over the rest of the area covered by the gravity traverse could be made with the present equipment. The running of such a traverse could easily be done and should add a great deal to knowledge of the geological structure and oil exploration potential of the area.

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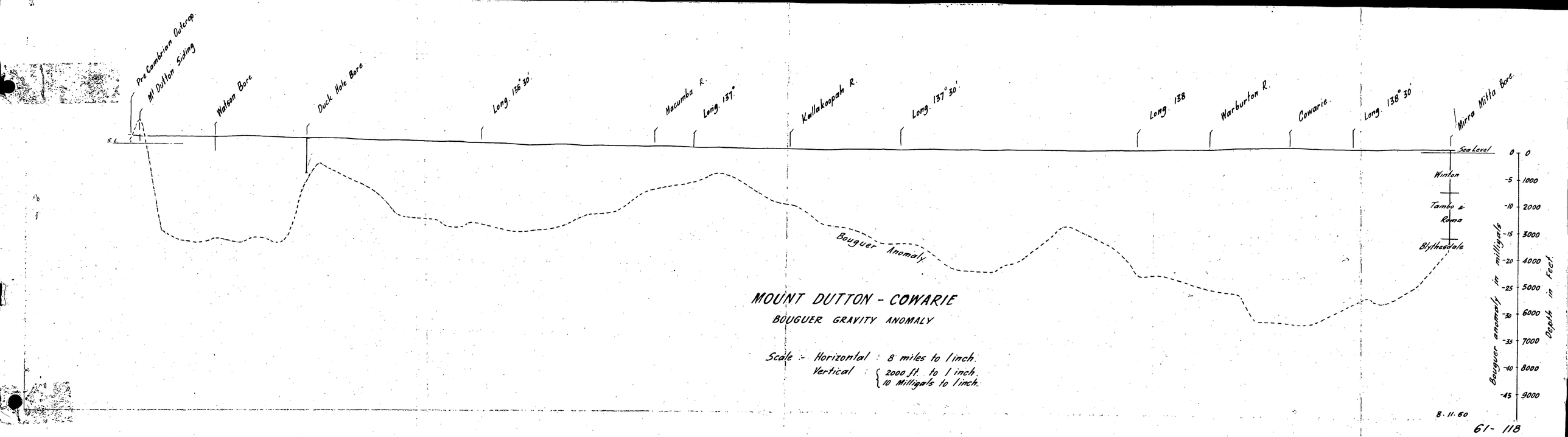
DMP:PAL
15/3/61



MOUNT DUTTON - COWARIE

BOUGUER GRAVITY ANOMALY

Scale :- Horizontal : 8 miles to 1 inch.
Vertical : { 2000 ft. to 1 inch.
10 Milligals to 1 inch.

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MURLOOCOPPIE SH/53/2

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ROYAL AUSTRALIAN SURVEY CORPS 1960

133°30'
134°00'
28°30'
28°45'
135000mE
1460000yN
40
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55
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65
70
75
80
85
Sand
Dunes
Sand
Dunes
8A/2118
19
20
21
22
23
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8A/2127
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10/2046
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11/5272
11/5275
Karkaroo
ALL DRAINAGE NON-PERENNIAL
ABSTRACT OF WORK
Control 9
Topography 3
Compilation 4
Total 16 days
Compiled by
Supervised by WO' Laker
KARKAROO
L61-117