

COMMONWEALTH OF AUSTRALIA

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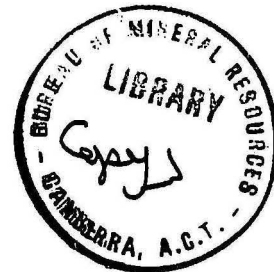
FOL 6

## DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES,  
GEOLOGY AND GEOPHYSICS.

RECORDS

1958, NO.84



PRELIMINARY REPORT ON A RECONNAISSANCE  
GRAVITY SURVEY AT OIL PROSPECTING PERMIT  
NO. 14 AREA, NEAR HORSHAM, VIC.

by

F.J.G. NEUMANN

and

J.R.H. van SON

## Comments

- ① Abstract - Terminology - should read "faulted" not  
"associated with faults."
- ② Map. - No differentiation between "contours" and "inferred  
contours"
- 12/1. K. S.

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## CONTENTS

	<u>Page</u>
ABSTRACT	(ii)
1. INTRODUCTION	1
2. CONDUCT OF FIELD WORK	1
3. DISCUSSION OF RESULTS	1
4. INTERPRETATION OF RESULTS	2

## ILLUSTRATIONS

Plate 1.            Map of area, showing Bouguer  
                     Anomalies.

### ABSTRACT

In order to investigate potential oil structures in the southern part of the Murray Basin, a reconnaissance gravity survey was carried out in the area between Hamilton and Warracknabeal. The results of the survey reveal that the main tectonics of the Palaeozoic formations, outcropping in the Grampians, extend northwards for a considerable distance. The strong gravity gradients suggest that the central area of the Grampians is associated with faults.

faulted

## 1. INTRODUCTION

A reconnaissance gravity survey was conducted by the Bureau of Mineral Resources, Geology and Geophysics during early 1958 over the area covered by O.P.P. No. 14 in Western Victoria. This investigation was in response to a request by Woodside Lakes Entrance Oil Company N.L.

The boundaries of the leased area are shown on Plate 1. The surveyed area lies approximately between Warracknabeal, Stawell, Cavendish (north of Hamilton) and Edenhope.

## 2. CONDUCT OF FIELD WORK

Topographic surveying was carried out by the company prior to the gravity survey. Levels were read to the nearest .02 feet. Station positions were identified on Victorian Lands Department Property Survey Plans. Elevations were referred to Mean Sea Level. Base maps were prepared by the B.M.R. Geophysical Drawing Section from the most reliable information available.

Two hundred and seventy-nine new gravity stations were established by J. van Son, Geophysicist, using Worden gravity-meter No. 140. Stations were distributed over about 450 miles of survey traverses which followed main roads. The average interval between stations was 1.6 miles.

Gravity ties were made to 17 Regional Gravity Stations established by the Bureau during 1956.

The gravity-meter was calibrated against the observed gravity values of the regional gravity stations. Drift of the gravity-meter was determined by regularly repeating readings on previously read stations. The accuracy of the observed gravity data is relatively high and mean loop errors are less than 0.1 milligal.

## 3. DISCUSSION OF RESULTS

Bouguer anomaly contours shown on Plate 1 are likely to include larger errors for the following reasons :-

- (a) There is no control to guide the contours between traverses. This can lead to substantial errors particularly where strong local anomaly gradients occur.
- (b) In the hilly portions of the lease, particularly in the Grampians, insufficient topographic information was available to correct for the effect of the terrain irregularities.
- (c) A uniform rock density ( $=2.0$ ) between station sites and Sea Level was assumed over the whole area of the lease for calculation of Bouguer correction. A higher rock density between 2.3 and 2.6 would be more applicable for the outcrops of Palaeozoic formations which occur in the southern portion of the lease.

A density gravity-meter profile was run south of Horsham over an area covered by younger sediments and an average density equal to 2.0 grammes per cc. was determined for beds of Tertiary and younger age. Samples of Palaeozoic rocks and granite, collected from outcrops in the Grampians and tested in the laboratory ranged in density from 2.32 to 2.65 grammes per cc.

## 2.

The Bouguer gravity anomalies shown on Plate 1 indicate the following principal features :-

- (a) A zone of high Bouguer anomalies occurring in the north-eastern portion of the lease, extends from Lake Lonsdale Reservoir between Stawell and Halls Gap into the area between Dimboola and Warracknabeal. Within this zone high anomaly values (reaching +16.0 milligals) were found directly north of Dooen. This gravity high is accompanied on the east by low Bouguer anomaly values.
- (b) The Bouguer anomaly pattern in the centre part of O.P.P. No. 14 shows alternate gravity "Highs" and "Lows" of north-northwest trend, generally bounded by strong gravity gradients. A relatively narrow gravity high is found parallel to, and mainly east of, the McKenzie River between Zumstein and Norton Creek. A broader high extends north of Mt. Thackeray, which appears to be bounded to the west by a very strong gradient. The northern and north-western boundary of this feature, however, is indefinite because of insufficient station coverage. A pronounced gravity low which appears to be centered between Jallumba and Toolondo follows west of the Mt. Thackeray high.
- (c) The western-most portion of O.P.P. No. 14 appears to have generally high Bouguer anomaly values. Additional gravity stations would be required to determine the closure and the magnitude of the anomaly more precisely.
- (d) A pronounced negative anomaly of local extent was found directly north of Kanagulk.
- (e) Highest Bouguer anomaly values found during the course of the survey occur beyond the south-western boundary of the lease near Vasey.
- (f) The general north-northwest anomaly trend of the centre part of the lease is intersected by a significant gravity low, occupying the area from Duffholme to Pimpinio and further north. This low is bounded to the south by anomaly contours, which run approximately perpendicular to the trends established further south and east.
- (g) A gravity high of limited extent directly southwest of Horsham also appears to be perpendicular to the predominating trends in the area further south, though there are insufficient stations to define the anomaly clearly.

## 4. INTERPRETATION OF RESULTS

Interpretation of gravity anomalies is principally based on the following :-

Relatively high Bouguer anomaly values indicate rocks of relatively high density being present on the surface or at shallow depth, while relatively low Bouguer anomaly values indicate a thickening of layers of relatively low density. In general, sedimentary beds are lower in density than metamorphic and igneous rocks.

Strong gravity gradients generally indicate either faulted or highly folded beds, the gravity high being indicative of the up-thrown side of a fault or the crest of a fold.

### 3.

Preliminary examination of the gravity anomaly pattern suggests an extension at relatively shallow depth of the Palaeozoic rocks that crop out in the Grampians in a north-northwest direction, approximately as far north as the Horsham-Garrolac railway line. This is confirmed by outcropping Palaeozoic formations known at "Mitre" near the boundary of the lease.

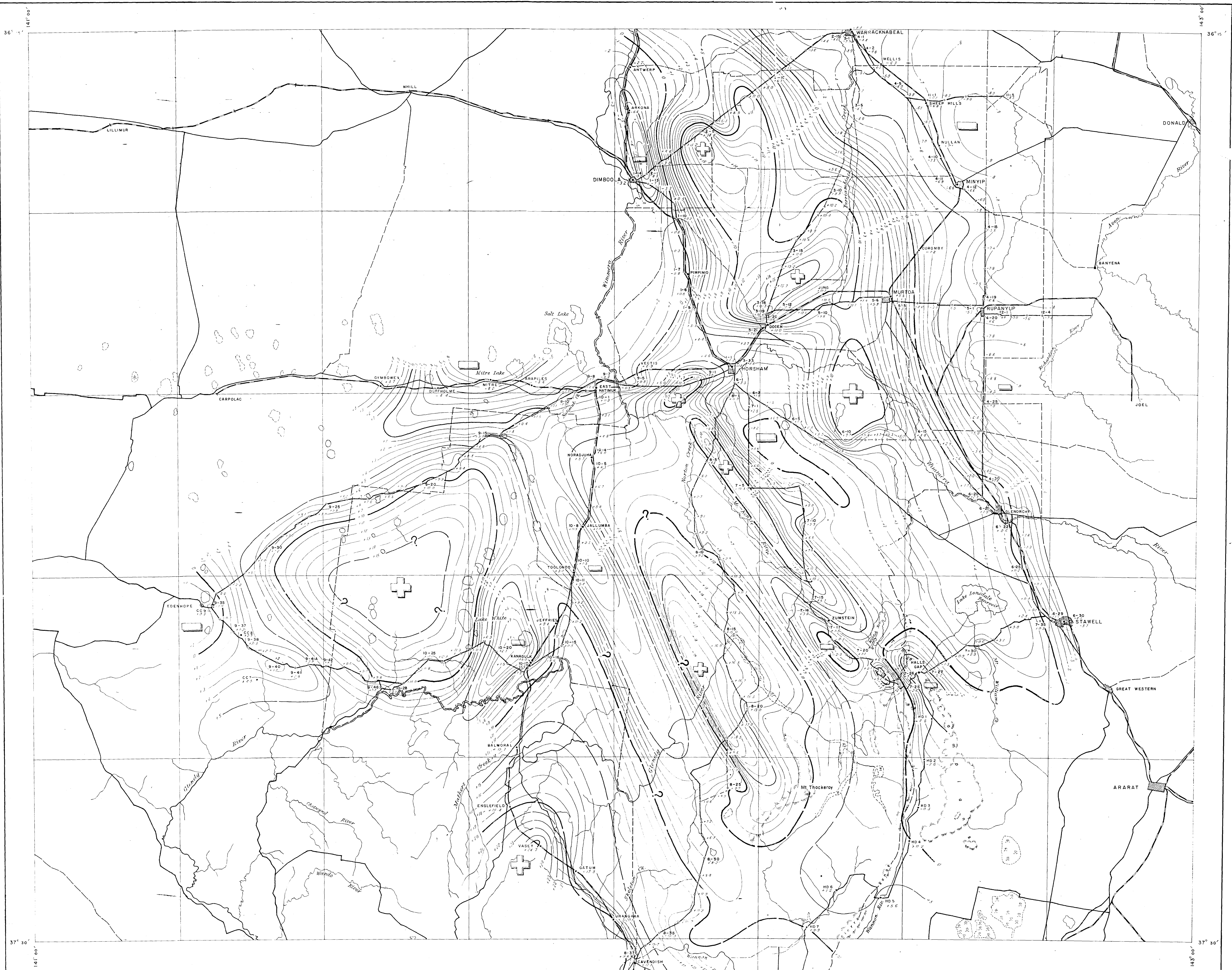
The gravity high described in para. 3(a) can be correlated in the Lake Lonsdale area with a tectonic high, indicated by Cambrian rocks outcropping south of the lake. The gravity contours suggest an extension of this tectonic high for quite a long distance north-northwesterly.



HORSHAM (SPECIAL)  
VICTORIA

AUSTRALIA 1:253,440

J54-3, 4, 7, 8 ZONE 6



LOCATION

MAP DATA

RECONNAISSANCE  
GRAVITY SURVEY (1958)  
HORSHAM AREA, VIC.

BOUGUER ANOMALIES

(OIL PROSPECTING PERMIT No 14)

SCALE IN MILES

LEGEND

TOPOGRAPHY

ROAD

TRACK

RAILWAY

GRAVITY

GRAVITY STATIONS

STATION NUMBER

RELATIVE BOUGUER ANOMALY

ALTITUDE IN FEET

WATERCOURSE

GRAVITY CONTOURS IN MILLIGALS

GRAVITY HIGH ANOMALY

" LOW "

EXPLANATION

RELATIVE BOUGUER ANOMALIES ARE BASED ON THE VALUES OF FOLLOWING B.M.R. PENDULUM STATIONS:

No 1 - FOOTSCRAY, VIC. - 979,979.0 MILLIGALS

No 40 - MILDURA, VIC. - 979,556.7

AN AVERAGE DENSITY 2.0 HAS BEEN ASSUMED FOR ROCKS BETWEEN STATION SITE AND SEA LEVEL IN REDUCTION OF GRAVITY VALUES.

ELEVATION DATUM: M.S.L. (L.W.M. WILLIAMSTOWN + 1.53' M.S.L.)

PLANIMETRIC DETAIL SHOWN FOR LOCATION OF GEOPHYSICAL DATA ONLY.