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PRELIMINARY REPORT ON A SEMI-DETAILED GRAVITY SURVEY AT THE MACKENZIE RIVER AREA, WESTERN VICTORIA

by

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ABSTRACT

A semi-detailed gravity survey was carried out on an area south of Horsham covering 500 square miles on both sides of the Mackenzie River to obtain closer detail of Bouguer anomalies, established in Western Victoria between Hamilton and Warracknabeal during the 1958 reconnaissance gravity survey.

The results of the survey confirm the existence of a major anomaly trend between Zumstein and Norton Creek.

South of the Wimmera River a steepening in the gravity gradients occurs, which in the McKenzie Creek Quarry area is evidently related to outcrops of Palaeozoic Grampian Sandstone.

The assumption of a vertical displacement of the Palaeozoic sandstones along a fault with 2,400 feet throw in conjunction with a density contrast of 0.4 between the Grampian Sandstone and younger sediments east of this fault would sufficiently explain this gravity anomaly.

1. INTRODUCTION

A semi-detailed gravity survey was carried out by the Bureau of Mineral Resources, Geology and Geophysics during the month of February, 1959, over an area of approximately 500 square miles south of Horsham, which extends on both sides of the Mackenzie River and forms a portion of the O.P.P. No.14, held by the Woodside Lakes Entrance Oil Company.

The investigated area is shown on Plate 1. It was the purpose of the survey to obtain closer detail of Bouguer anomalies established during the course of a reconnaissance gravity survey, conducted during the year 1958 over the area between Warracknabeal, Stawell, Cavendish and Edenhope (Western Victoria). The gravity investigation was made at the request of the lease holding company.

2. CONDUCT OF FIELD WORK

Topographic surveying was carried out by the company prior to the gravity field work. One hundred and twenty-seven new station positions were identified on the 1 mile to 1 inch Property Survey Map, Wonwondah 888, issued by the Victorian Lands Department. Levels were read to the nearest 0.02 feet with elevations referred to Mean Sea Level.

It was intended to cover the area selected for the survey by a regular grid of stations placed approximately one mile apart, using as gravity traverses the existing roads between latitudes 36°45' and 37°00 and longitudes 142°00 and 142°30'.

Gravity readings in the field were carried out by J.R.H. Van Son, Geophysicist, using the Worden gravity-meter No.140. Gravity ties were made to the observed gravity values of the stations established during the 1958 survey. The drift of the instrument was fairly regular. An average drift of 2.5 dial divisions per 24 hours was determined during the period of the survey by regularly repeating readings on previously read stations. The mean accuracy of the gravity ties is approximately five hundredths of one milligal.

After the end of the survey the gravity meter was calibrated against the observed gravity values of base stations near Melbourne and a scale factor of 0.11133 milligals per division was determined.

3. DISCUSSION OF RESULTS

The results of the Mackenzie River Gravity Survey of 1959 are shown as Bouguer contours on Plate 1. The contouring is based on the Bouguer anomaly figures obtained during the 1958 reconnaissance gravity survey in addition to the gravity data obtained by the semi-detailed work.

For calculation of Bouguer correction a uniform density (=2.0) of the rocks between station site and Sea Level was assumed over the whole area of the survey. The density of 2.0 grammes per ccm. was determined on a density gravity meter profile over beds of tertiary and younger age south of Horsham, occupied in 1958.

The combined gravity results of the 1958 and 1959 surveys confirm the existence of a major anomaly feature shown on Plate 1 as a zone of north-north west running contours. This anomalous zone is expressed by relatively strong gravity gradients, which are mainly evident between the +5 and +10 milligal contours and extend from the area near Station No.122

in a north-north west direction over a distance of approximately 23 miles into the area immediately south of the Wimmera River.

The above-mentioned zone of strong gradients terminates to the east a relatively narrow gravity "high", which was found during the course of the 1958 survey as parallel to and mainly east of, the Mackenzie River between Zumstein and Norton Creek (see Neumann and Van Son, 1958).

Relatively steepest gravity gradients are evident along the northern section of the anomaly trend immediately south of the Wimmera River, extending south-south east over a distance of approximately six miles into the area of Donny Brook Quarry.

4. INTERPRETATION OF RESULTS

Outcrops of greyish-white medium to coarse sandstone of the Grampian Group, regarded as being Upper-Devonian to Lower Carboniferous in age, occur approximately six miles south of Horsham near McKenzie Creek Settlement. These sandstones have been recently described by D.Spencer-Jones (see D.Spencer-Jones 1957/58) in connection with the occurence of thin veins of a brownish-black vitreous substance ("Humicite") in the quarry of the McKenzie Creek Quarrying Company near the banks of the Mackenzie River.

The sandstone outcrops, which extend with north-north west strike over a distance of approximately one and a half miles are shown as shaded areas superimposed on the gravity contours on Plan 1.

To further investigate the nature of the gravity anomaly, which in the McKenzie Creek Quarry area is evidently closely related to the occurrence at relatively shallow depth of the Grampian Sandstone, density determinations were carried out on a number of specimens of the sandstone, purposely selected with varying porosity and varying grain size.

A mean density of the samples collected from the Palaeozoic sandstone formations of the McKenzie Creek and Donny Brook Quarries was found to be 2.45 grammes per ccm.

A density gravity-meter profile - on the other hand - was run south of Horsham and approximately eight miles south east of the McKenzie Creek Quarry during the course of the 1958 gravity survey over an area of younger sediments (Recent and Tertiary in age) and a density of 2.0 grammes per ccm. was found for these younger beds.

Assuming a displacement of the Palaeozoic sandstone along a near-vertical fault of north-north west strike and a corresponding thickening of the younger beds east of this fault, would account for a density difference of 0.4 as being the most likely from available information on rock densities. A throw of approximately 2,400 feet would sufficiently explain the gravity anomaly of roughly twelve milligals, which was established in the McKenzie Creek Quarry area.

The approximate track of the assumed fault plane is shown on the gravity contour plan following the +5 and +6 milligals contours from the Wimmera River to the north to Donny Brook Quarry to the south.

5. REFERENCES

NEUMANN,F.J.G. and VAN SON, J.R.H., 1958 - Preliminary Report on a Reconnaissance Gravity Survey at Oil Prospecting Permit No.14 Area, near Horsham,Vic. Australian Bur.Mineral Res.Geol. and Geophysics. Records 1958, No.84.

SPENCER-JONES,D., 1957/58 - Humicite in the Grampians Sandstone at McKenzie Creek, Western Victoria. Vic.Mining and Geol.Journal, Vol.6, No.2, p.42-45, 1957/58.


HORSHAM
VECTIS
NORADJUHA
WONWONDAH
TOOLONDO
Wimmera River
Mount William Creek
Dock Lake
Pine Lake (salt)
Drung Drung Lake
Mackenzie River
Burnt Creek
Nortons Creek
Bungalally Creek
Potters Creek
Briggs Creek
Mt. Zero
SEMI-DETAILED GRAVITY SURVEY (1959)
MACKENZIE RIVER AREA, W-VIC.
BOUGUER ANOMALIES
SCALE IN MILES
G329-2