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RECORDS 1951 No. 68

DETAILED GRAVITY TRAVERSE, NORTHERN END GIRALIA STRUCTURE, N.W. BASIN, WESTERN AUSTRALIA.

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CANBERRA, A.C.T.

by

R. F. Thyer

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by

R. F. Thyer

DETAILED GRAVITY TRAVERSE, NORTHERN END GIRALIA STRUCTURE, NORTH-WEST BASIN, WESTERN AUSTRALIA.

Gravity observations were made at quarter-mile intervals along the road that joins Bullara and Giralia homesteads. This road crosses the northern end of the Giralia anticline normal to its axis. A seismic reflection profile, which is described in B.M.R. Record 1951 No.62, has also been run along this road and it is possible to compare the gravity results with the seismic.

Gravity station elevations were determined with an accuracy of ± 1/10 of a foot and the gravity observations have been reduced to Bouguer anomalies using an elevation correction factor of 0.062 milligals. per foot. The results are shown in the form of a profile on the accompanying plate (G98-7). The surface profile is also plotted and the positions of some of the seismic shot points are shown alongside the gravity station numbers.

Discussion of Results.

The gravity observations which were made with a Norgaard gravimeter are believed to be accurate to ± 0.05 milligals. The profile is for the most part smooth with minor discontinuities near gravity stations 5 to 7, 13 to 14, 40 to 44 and 54. The outstanding feature, however, is the broad minimum centred at station 22. To the east of station 22 the Bouguer anomaly increases by 14 milligals. in the first six miles and a further 3 milligals. over the next four miles to Giralia homestead. The regional gravity pattern shows that it increases still further east and reaches a maximum of about eight miles to the east of the homestead. To the west of station 22 the increase is 14 milligals. over the eleven miles to Bullara homestead and the increase is remarkably linear.

It is considered that the gravity anomaly is due to the presence of light sediments in a trough of pre-Cambrian basement rocks, although some part is probably due to a deeper mass deficiency associated with the depression of the basement floor. The density of the sediments is likely to range between rather wide limits and some of the massive limestones which occur in the Palaeozoic system may be as dense as the basement rocks. On the whole, however, it is expected that Mesozoic and younger sediments will have a mean density of about 2.35 to 2.4 and the Palaeozoic sediments, which are separated from the above by an unconformity, from 2.50 to 2.55. Because of their bigger contrast with basement density it might be expected that the Mesozoic and younger sediments would contribute most to the gravity anomaly. However, the seismic section indicates that the rocks above the unconformity, which are assumed to be Mesozoic and Tertiary, change by only a few hundred feet in thickness across the section and thus could contribute little to the anomaly. It seems likely therefore that the Palaeozoic rocks must be largely responsible for the anomaly.

In the seismic section the general structure of the reflecting horizons beneath the unconformity, i.e., in the section which is believed to consist of Palaeozoic sediments, is a broad syncline with its axis through shot point 16. The gravity minimum, however, is about 8,000' further west. The reflection data from below the unconformity in the region between shot points 14 and 26 provide some evidence of a migration of the axis of the syncline to the west, i.e., towards the gravity minimum and this may be significant.

One possible explanation for the Giralia and other anticlines developed in the Tertiary and Mesozoic rocks is that these structures are due to block faulting in the underlying Permian-Devonian rocks which are known to be block faulted in the eastern part of the basin where they outcrop. The gravity results do not indicate any major fault in the vicinity of shot point 7 where steep dips are mapped on the surface and where block faulting of the deeper Palaeozoic sediments might be expected. The gravity profile shows only a minor dislocation, the value at station 5 being about 1 milligal. higher than if the profile were smooth. The profile shows a minor dislocation between stations 13 and 14 of less than 1 milligal. and this could be due to a fault with east side down. The minor dislocations in the gravity profile in the vicinity of station 40 to 44 and at station 54 may also be associated with minor faulting.

(R. F. Thyer)
Geophysicist.

Melbourne,
December, 1951.

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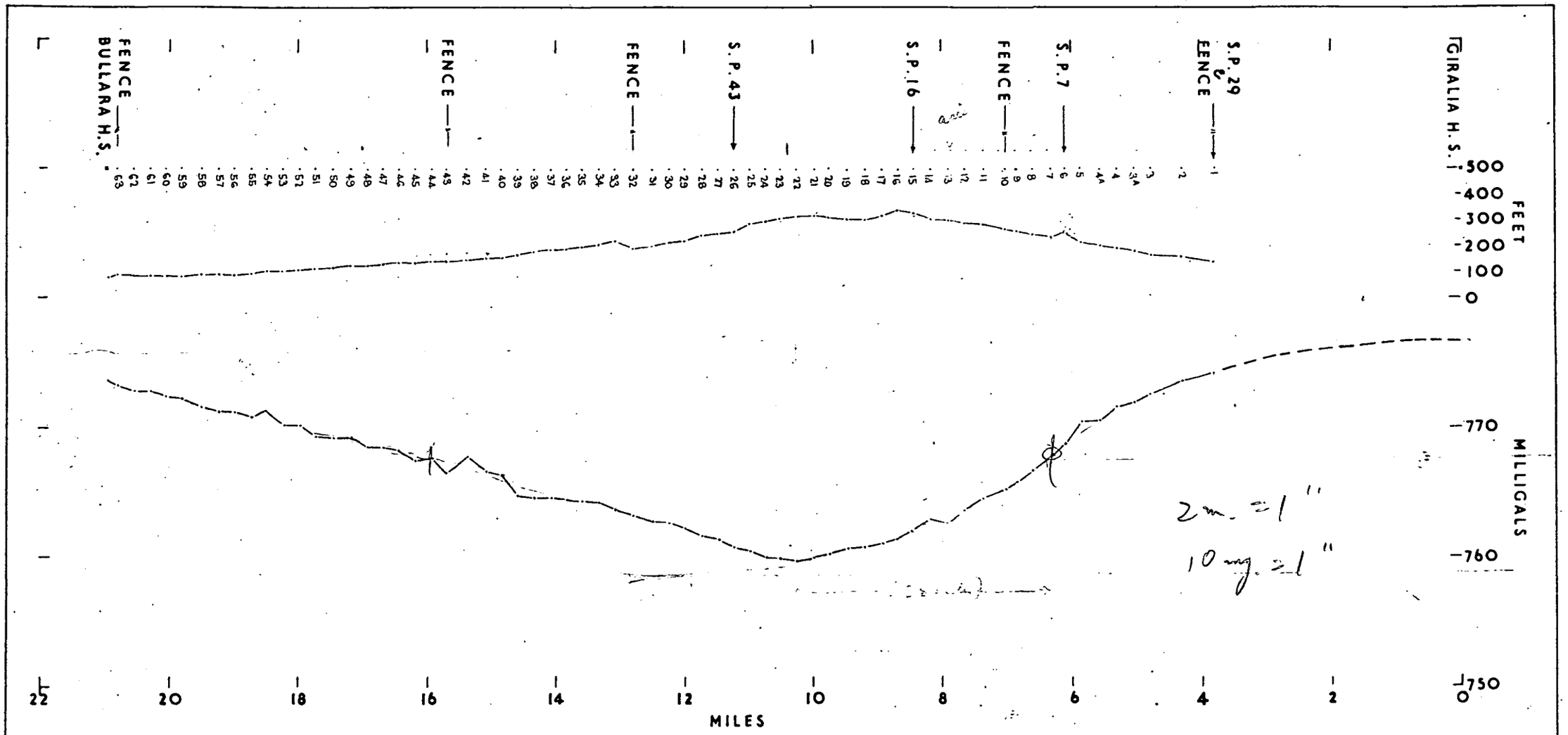

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R Y Thyer GEOPHYSICIST

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