COMMONWEALTH OF AUSTRALIA
MINISTRY OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1951 No. 69

GRAVITY RECONNAISSANCE (1950) NORTH WEST BASIN, WESTERN AUSTRALIA

by

R. F. Thyer

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R. F. THYER.

C O N T E N T S

LIST OF PLATES

GRAVITY RECONNAISSANCE (1950) - NORTH-WEST BASIN, WESTERN AUSTRALIA.

This report presents the results of a gravity reconnaissance survey which was carried out under the writer's supervision during the last quarter of 1950.

The area covered by the reconnaissance comprises part of the North-West district of Western Australia and lies between the Gascoyne River in the south and the town of Onslow in the north. It is otherwise bounded in the east by the 116th meridian and in the west by the coast between Carnarvon and Onslow. Ampol Petroleum Ltd. holds an authority to prospect for oil over the area and the survey was part of an extensive investigation being carried out by the Bureau of Mineral Resources, Geology and Geophysics, to assist in the search for oil.

The report describes in some detail the methods adopted in carrying out the field work and the errors to which the results are subject. The results are discussed only briefly and the interpretation given must be regarded as a preliminary one subject to modification as further data are accumulated in extending or otherwise adding to the reconnaissance.

The writer gratefully acknowledges the assistance given by Ampol Petroleum Ltd. in making available a vehicle and a mechanic and otherwise assisting by providing accommodation when the party was working near Learmonth. The help given by station owners and managers is also gratefully acknowledged.

Operations :

Two geophysicists from the Bureau left Perth in mid-October, accompanied by a cook and a mechanic, who was on loan from Ampol Petroleum Ltd., and field work commenced at Carnarvon on October 14th.

The party was equipped with two vehicles, an Army ambulance on a 4-wheel drive chassis and a Land Rover (English equivalent of the Jeep). A third 4-wheel drive vehicle (Command car) was attached to the party during the latter half of the work by the Ampol Company.

Gravity observations were made with a Norgaard Gravimeter along roads and tracks in an area bounded in the south by the Gascoyne River and extending north to Onslow, a distance of 200 miles, and from the west coast inland for a distance of approximately 100 miles. This area is intersected by the Minilya and Lyndon Rivers, and the North-West Cape and Exmouth Gulf occupy most of its north-west sector.

Owing to the approach of the summer season (the summer months are too hot for field work), it was decided to speed-up the work by the addition of a second shift of instrument reading, and consequently two additional geophysicists and a field assistant were added to the party early in November. As a result, the reconnaissance was completed by December 11th.

Observations were made at 260 stations which were spread along 1,100 miles of roads and tracks, i.e., at an average density of one station per 4 miles. Levels were obtained by barometers and station positions were fixed from air photographs. These surveying methods are relatively crude and consequently the corrections for latitude and elevation, particularly the latter, are subject to relatively large errors. It is doubtful whether

the reduced gravity readings are more accurate than ± 2 milligals, but for a reconnaissance of this nature, especially where such large anomalies are present, such errors can be tolerated and they certainly do not vitiate the general interpretation.

The gravity readings were tied to pendulum stations at Carnarvon and Onslow, i.e., at the southern and northern extremities of the area respectively and anomalies are expressed relative to the theoretical values on the International Ellipsoid.

Various corrections have been applied to the raw data and maps showing Bouguer, Free-Air and Isostatic anomalies were produced. In general, the maps all show the same pattern of broad troughs and ridges which it is believed correspond to troughs and ridges within the pre-Palaeozoic basement.

It seemed likely that the gravity reconnaissance would add considerably to the geological knowledge of the area and further work was programmed. In July, 1951, a gravity reconnaissance party resumed work in this same general area in order to fill some of the gaps in the previous pattern and to do some detailed traverses at selected places. It is believed that the detailed work might prove useful in mapping the course of some of the faults which are only partly exposed. A total of 1,500 miles of reconnaissance traversing was programmed for this year (1951) in addition to the detailed work mentioned already.

At a later date it is proposed to extend the reconnaissance to the area south of the Gascoyne River. At present there is no suitable air photo coverage of the North-West basin south of the Gascoyne River but the R.A.A.F. Photographic Unit proposes to fly the area early next year.

Geology of the Area :

The geology of the area has not been completely investigated and is still the subject of field mapping by officers of the Bureau. No report on their work is available to date and the following brief account is based on discussions with the Bureau's geologists and by reference to a report by H. G. Raggatt (1936).

The area is a semi-arid one with rainfall of less than 10" per year. It is mostly flat and covered with stunted bushes and scrub. It is divided into several large sheep stations with boundary and intermediate fences which are readily visible on the air photographs. The intersection of some of these with other fences, roads or tracks proved useful markers in locating station sites.

Near the coast the surface is occupied by salt lakes, one of which is of immense size. Further inland the surface is mostly covered by sandhills but there are also a few areas of rough hilly country. The hills at most rise 300 or 400 feet above the level of the surrounding country, and from the coast inland there is a general rise in elevation of approximately 7' per mile.

The area covered by the reconnaissance is portion of a large sedimentary basin containing sediments ranging in age from Devonian to recent. They do not represent a continuous succession, as Lower Mesozoic rocks appear to be absent. The sediments have been laid down mainly under marine conditions, and except where disturbed by faults the dips are gentle and mostly towards the west.

The basement of the basin is composed of pre-Cambrian metamorphic rock mostly schist and granitised schist, intruded by granite. The existing geological maps of the basement complex on the fringe of the basin do not show any basic metamorphic or intrusive rocks of high density. This fact may signify a basement of uniform density and consequently a gravity pattern free from major disturbances due to difference in basement density.

Palaeozoic rocks comprising Devonian, Carboniferous and Permian sediments outcrop in the eastern half of the area, and where present in the western half are overlapped successively by Cretaceous, Tertiary and Quaternary deposits. Near the eastern margin of the basim the Palaeozoic rocks are riven by extensive faults which strike roughly north and south. It is possible that similar faults are obscured by deposits of younger sediments on the western portions of the basin. It was believed that the gravity work would be able to locate these faults.

Gentle folding is a notable feature in the Cretaceous and Tertiary sediments in some places, for example, Cape Range, Rough Range, the Giralia structure and smaller structures near the head of Salt Lake. These are anticlinal structures with their axes striking roughly north-north-east and exhibiting some closure. It is not known if similar structures extend downward into the underlying Palaeozoic sediments.

The area is considered to have reasonable prospects for development of oilfields but the distribution and structure of the Palaeozoic sediments beneath Mesozoic and Tertiary sediments in the western portions of the basin could have an important bearing on the prospects. There are few deep bores on the western portion where the knowledge of the distribution of the Palaeozoic sedimentsis consequently very meagre.

Geophysical Problem :

The object of the gravity reconnaissance was to obtain a picture of the distribution of the sediments within the basin. As mentioned above, the distribution of the Palaeozoic sediments remains mostly unknown in the western portion of the basin because of the cover of younger sediments. Sediments are generally less dense than the basement rocks and consequently where there are accumulations of sediments there are generally negative gravity anomalies due to their mass deficiency. No direct measurement of the density of the rocks was made but an average figure was arrived at by allotting an appropriate density to each member of the stratigraphical succession and calculating a weighted-mean density. This average was 2.50. The density of the basement rocks (mostly granitic types) was taken as 2.70 and the density difference of 0.20 would result in a gravity anomaly equal to - 1.0 milligals for every 400^{t} of sediments.

As mentioned earlier, the reconnaissance was confined to traversing along existing roads and tracks. Although these were not numerous, they were sufficient to provide a satisfactory coverage. From a consideration of the general position and dimensions of the basin as known it was considered that the gravity contours would be elongated in a north-south direction, and consequently the density of the stations on east-west traverses (that is, across the pattern) was greater than for traverses in the north-south direction.

The area was crossed by four main east-west traverses, one from Carnarvon along the Gascoyne River via Gascoyne Junction to Dairy Creek, one from Minilya Homestead through Wandagee H.S.,

Middalya H.S., Williambury H.S. to Lyndon H.S., another section from Point Maud through Winning Pool H.S. along the Lyndon River to Lyndon H.S., and the fourth from Point Cloates via Exmouth Gulf H.S., Giralia H.S. to Yanrey H.S. These traverses were connected by north-south traverses. The most westerly one was from Carnarvon via Minilya H.S., Point Maud, Point Cloates to Exmouth Gulf with an easterly branch from Minilya H.S. via Winning Pool to Onslow. The easterly extremities of the east-west traverses were joined by a traverse from Gascoyne Junction to Minnie Creek H.S., Lyndon to Wogoola H.S. A traverse was also run around the North-West Cape.

The existing maps covering the area are as follow :-

(a) Australian Military Survey, 8-mile Series :

Onslow
Point Cloates
Exmouth Gulf
Carnarvon
Gascoyne River

(b) Australian Military Survey, 4-mile Series :

Glenroy
Yanrey
Minilya
Quobba
Kennedy Range
Shark Bay
Wooramel

(c) Australian Military Survey, 1-mile Series :

Carnarvon

(d) Western Australian Lands Department, 10-mile Topographical Series :

Sheet 13 (Onslow)
Sheet 10 (Carnarvon)

(e) Australian Aeronautical Map :

F.3 - Onslow
G.3 - Carnarvon.

With the exception of the 1-mile to the inch map of Carnarvon, none of these is sufficiently accurate to provide a satisfactory basis for plotting the gravity data or calculating the station latitudes. Some of them show gross errors in plotting such prominent land marks as station homesteads and road locations. Giralia Homestead, for example, is plotted on the W.A.L.D. 10-mile Topographical Map approximately 6 miles from its correct geographical position, and the main northern highway is shown 4 miles from its true place in one area. The only height information on any of the above plans is a few heights on trig stations, some of which may have been obtained by barometric methods. This paucity of accurate topographical information is stressed because a proper appreciation of it is necessary to understand the difficulties facing a reconnaissance gravity survey of the nature of that described in these notes.

The positions of the stations were fixed from air photographs. A complete coverage of the area at a scale of 1 in 50,000 and of part of the area at a scale of 1 in 32,000 was available. Maps prepared from the air photographs were available only for the

North-West Cape and a small area immediately adjoining it to the south and portion of the Minilya River area. For the remainder, strip maps covering routes to be followed were prepared by tracing features from the air photographs, and these, together with the photographs themselves, enabled station distribution to be planned and the stations to be located in the field with little difficulty. Station locations were given geographical co-ordinates based on existing trig stations and astronomical fixes, and the co-ordinates served a twofold purpose of plotting the stations on the final plan and making latitude corrections. Station latitudes obtained in this way are probably correct to ± ¼ mile.

Daily operations were planned to radiate from a mobile camp site where a base barometer was stationed. This was an aircraft altimeter reading to ± 2 feet and was read at 15 minute intervals. A bank of three similar altimeters was carried in the operating vehicle and these were read at each gravity station and the time noted. The stations were read in groups of 5 or 6 over distances ranging up to 30 miles. The barometers were read at each station on the way out and the readings were repeated on the return journey. The altimeter readings were corrected for diurnal change and drift as determined by the repeat readings of each station. All the readings were made in closed loops and closure errors were distributed during final computing. The individual elevations are probably accurate to ± 20', but the relative error between adjacent stations would be substantially less than this. For example, precise levelling recently carried out between Giralia and Bullara shows that the barometer levels of stations 21/5 and 21/10 are within ± 8 feet of the correct values. The gravimeter was read at the same time as the altimeter and about every third gravity observation was repeated to provide data for correcting them for instrument zero drift. The gravity observations, like the barometer readings, were made in closed loops and errors in loop closure adjusted. The individual gravity readings after this adjustment are probably correct to ± 0.1 milligals.

The Reduction of Raw Data :

In determining the Bouguer anomalies, an elevation correction factor of 0.067 milligals per foot, corresponding to a mean surface density of 2.30 was used. Isostatic corrections were not determined for every station owing to the immense amount of work entailed. With such a flat continental area, however, the isostatic corrections change only very gradually from place to place. The major part of the correction is that due to the topography, the outstanding feature of which is the edge of the continental shelf. In the absence of any contour plans of the area it is difficult to appreciate the relative importance of this continental edge. Plate 1 has been prepared to help overcome this difficulty. It shows rough contour lines based on the barometric elevations drawn at 100' intervals and these have been extended to the area covered by the Indian Ocean on the western border of the area by means of data taken from hydrographic charts. These contour lines should not be accepted too literally but they do indicate the gentle westward slope which the land surface has of approximately 7' to the mile right to the edge of the continental shelf. The isostatic corrections are based on the Hayford theory of compensation assuming a depth of compensation of 113.7 kilometres. They were determined at 16 places, distributed more or less evenly throughout the area and contour lines of equal correction drawn. These are also shown on Plate 1. They have been drawn parallel to the edge of the continental shelf for reasons mentioned above. The isostatic correction applied to the individual stations was obtained by interpolating between these contour lines. While it is realized that this method of correcting the observed data is subject to relatively large errors, it was believed that the

method suited the relative inaccuracy of the raw data.

Results :

The results are shown in the form of gravity anomaly contour plans. Plate 4 shows isostatic anomalies based on the corrections and elevations shown on Plate 1. Plates 2 and 3 show respectively the Bouguer and Free-Air anomalies. Because of the immense size of the area it is believed that the isostatic correction is essential, and for this reason the discussion of the results is confined to a discussion of the isostatic anomaly contour plan. An examination of the distribution of the stations shows that the reconnaissance left many gaps where the trend of the contour lines has been sketched in. Current field work is correcting this omission by additional traversing and the new data may appreciably affect the distribution of some of the contour lines. The broad features, however, will probably not be altered substantially. The only place where a reasonable comparison can be made between the gravity anomaly and the thickness of the sedimentary column is in the broad trough which lies between Middalya and Lyons River Homesteads. The gravity anomaly is approximately - 40 milligals and the total thickness of the sediments is probably of the order of 15,000'. If it is assumed that the anomalies are entirely due to density deficiency in the sediments, a density differential between sediments and basement of approximately 0.2 must be assumed. This is a reasonable figure and, as shown earlier, is consistent with the known lithology. On this rather slender evidence it is tentatively assumed that the gravity pattern as a whole represents the distribution of relatively light sediments overlying denser basement rocks. Previous experience, however, has shown that on an area as large as this, gravity anomalies are sometimes due to differences of density within the basement rocks. The nature of the basement rocks underlying the sediments is unknown but where they outcrop on the eastern margin of the area and for some hundreds of miles to the east, they appear to be comprised mainly of granite and acid types of metamorphic rocks which probably do not differ much in density from the granites. The existing geological maps do not show any areas of relatively dense basement rocks (greenstones) which form a significant part of the basement outcrops in the Western Australian goldfields further south. However, at present there is no gravity data on the area occupied by the basement rocks on which a reliable opinion can be based as to the size of anomalies likely from variations of density in the basement rocks. Current field work, however, has been extended for a distance of approximately 100 miles over the outcropping basement rocks in order to obtain such data.

On the western side of the area use has been made of two observations by Vening Meinesz (1949) to extend the isostatic anomaly pattern. These observations were made with pendulums in a submarine during a cruise between Fremantle and the East Indies.

All three anomaly maps exhibit the same major features, but the absolute values of the contour lines differ due to the different correction factors applied. The most striking feature in all of them is a broad negative anomaly approximately 120 miles long by 40 miles wide which strikes approximately north-west. Its axis passes through Middalya Homestead in the north and Lyons River Homestead in the south. In the north it terminates near the Lyndon River and in the south just south of the Gascoyne River. Its eastern margin coincides with the eastern edge of the Palaeozoic basin and its western edge with a zone of major

faulting along which the Palaeozoic sediments are dipping steeply to the east (see Raggatt, 1936). In the isostatic contour plan (Plate 4) the area enclosed by the - 20 milligal contour line almost exactly coincides with the known outcrops of Palaeozoic rocks, mostly Permian. As mentioned earlier, the maximum anomaly of - 40 milligal is of the order of magnitude to be expected to the known thickness of Palaeozoic sediments assuming a reasonable density contrast (0.20) from the basement rocks, and this fact, together with the coincidence of the gravity anomaly with the area of outcrop and its eastern margin with the margin of the basin, makes it highly probably that the gravity anomaly is directly related to the configuration of a Palaeozoic basin, the gravity contours, with appropriate scale factors, representing closely the basement contours. Such an interpretation would conclude that the basement is relatively shallow under the zone of faulting with steep easterly dips along the western edge of the Kennedy Range.

Further north a similar but smaller gravity trough is developed immediately to the west of the pre-Cambrian shield. Its axis strikes slightly east of north in the direction of Onslow. The maximum anomaly is only - 20 milligal which suggests that the sediments are only 7,000 to 8,000' thick in the centre of this trough.

Parallel to the coast and extending some 50 to 60 miles inland is another broad depression in the gravity field. Its axis passes about 12 miles east of Carnarvon and strikes slightly east of north through the east side of Salt Lake and appears to die out at the bottom of Exmouth Gulf. It is separated from the main eastern trough (described above) by a relatively narrow ridge of high values which appears to continue with minor interruptions to the north coast on the eastern side of Exmouth Gulf. The area occupied by the broad coastal depression contains practically no outcrops of Palaeozoic rocks. On its eastern half the surface is occupied mainly by Cretaceous rocks and the western or coastal side by Tertiary and Quaternary deposits. Most of the major anticlinal structures which are developed in the Cretaceous and Tertiary rocks lie within the area covered by this trough. Its axis is parallel to but lies about 8 miles to the west of the axis of the Cardabia anticline and there is a slight broading of the gravity contour pattern in the apical area just south of Remarkable Hill. The maximum anomaly is - 50 milligals in the vicinity of Carnarvon which would correspond to a considerable thickness of sediments. An east-west geological section shown by Raggatt (1936), p.165, through Carnarvon shows that the bores on Brickhouse Station terminate in Permian sediments at depths ranging from 2,000' to 3,000' after penetrating more than 1,000' of such sediments. If the gravity defect is due entirely to sediments, it seems likely that there is a very thick Palaeozoic section beneath the bores which might total more than 15,000' in thickness. Immediately to the west of the Cardabia structure, the anomaly is approximately - 30 milligals which would correspond to a thickness of sediments to the order of 12,000'.

In the vicinity of Exmouth Gulf and the North-West Cape the gravity pattern is more complex with alternating troughs and ridges. The axis of the Rough Range anticline lies about 2 miles to the east of a gravity minimum, a relationship which is similar to that which exists between the Cardabia structure and the gravity minimum. Over the North-West Cape gravity increases in a northerly direction as the edge of the continental shelf is approached. This may mean that the basement is approaching the surface in this direction but positive anomalies close to continental edges are a common feature of continental margins and the increase is not necessarily related to a decrease in the thickness of light sediments.

The similarity in trend of the axes of the gravity lows and the surface structures is striking and one cannot escape the conviction that the two are closely related, even though that relationship is at present obscure. Perhaps the surface structures are due to lateral pressure from the west which has buckled the relatively thin layer of Mesozoic and Tertiary sediments against a buttress of rising basement immediately to their east. These trends are quite dissimilar to the known trend of the pre-Cambrian schists which form part of the basement complex and which strike mostly north-west.

Conclusions :

The gravity reconnaissance has revealed an interesting pattern of gravity lows which for various reasons are believed to be due to accumulations of sediments in three major troughs. No opinion can be expressed as to whether these are to be regarded as three separate geosynclines which have developed independently or whether they are to be regarded as part of a much larger single geosyncline divided by later deformation of the earth's crust.

A striking parallelism is revealed between the axes of the gravity troughs and surface structures but the reason for this is obscure.

It is believed that the gravity reconnaissance has made an important contribution to the knowledge of the area and further important results might be expected to accrue from additional work done during 1951 and planned for the future.

(R. F. Thyer)
Geophysicist.

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Vening Meinesz, F.A., 1949, "Gravity Expeditions at Sea, 1923-1936," Vol. IV, Publ. of Neth. Geod. Comm.

Melbourne.
December, 1951.

Distribution :
1. Under Secretary for Mines, Western Australia.
2. General Manager, Ampol Petroleum Ltd.
3. " " " " "
4. Chief Geologist.
5. Australian Mining & Smelting Co. Ltd.
6. Geophysical Library.
7. " "

PLATE I

North West Cape
EXMOUTH GULF
MT. KING
EX. 22
POTSHOT
TREALLA
EX. 45
EX. 1
LEFROY
EX. 75
CENTIPEDE
FRASER I.
PT. CLOATES L.H.
BULLARA H.S.
GIRALIA H.S.
WHALEBACK
ASTRO
W.B.I
Pt. Maud
WINNING POOL H.S.
ASHBURTON BRIDGE
YANREY H.S.
ASHBURTON RIVER
WOGOOLA H.S.
TOWERA H.S
KANNARIE R.
LYNDON RIVER
LYNDON H.S.
A.B. 19
OPT. A (ECC.)
K61
MINILYA
WANDAGEE H.S.
WANDAGEE
BARRA BIDDY CREEK
MIDDALYA H.S.
WILLIAMBURY H.S.
MANGAROON H.S.
MT. THOMSON
MT. AGAMENNON
MINNIE CREEK H.S.
K 45
K 54O
1/6O
2/6
2/4O
C. Cuvier
AB 6 (ECC.)
SALT MARSH
BOOLOGOORO H.S.
COORALA H.S.
LYONS RIVER H.S.
LYONS RIVER
GASCOYNE RIVER
CARNARVON
BERNIER I.
DORRE I.

SCALE IN MILES

8 0 8 16 24 32 40 48

NOTE: Elevations by barometer accuracy ±20 feet.
Surface contours approximate only but show general trend.
Isostatic corrections based on Hayford method using depth of compensation of 113·7 kilometers.

Geophysicist
December, 1951

LEGEND

4·7 Gravity Station Number
·25 Gravity Station Value
4/7 Survey Control Point Astro Fix or Trig
200′ Surface contour in feet
+5 Isostatic correction in milligals
-5 Points where isostatic correction computed
Road
Track

LOCALITY MAP

Area covered by Geophysical Survey
WESTERN AUSTRALIA
PERTH

GEOPHYSICAL SURVEY. NORTH WEST BASIN. W.A.

GRAVITY RECONNAISSANCE

SURFACE CONTOURS AND ISOSTATIC CORRECTIONS

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics. G98-9

PLATE 2

North West Cape
EX 22
MT. KING
EXMOUTH GULF
POTSHOT
TREALLA
EX. 45
EX 1
LEFROY
EX 75
FRASER I.
PT. CLOATES L.H.
BULLARA H.S.
CENTIPEDE
GIRALIA H.S.
ONSLOW
ASHBURTON BRIDGE
YANREY H.S.
ASHBURTON RIVER
WHALEBACK
ASTRO
W.B. 1
Pt. Maud
WINNING POOL H.S.
TOWERA H.S.
WOGOOLA H.S.
YANNARIE RIVER
LYNDON
LYNDON H.S.
WANDAGEE H.S.
WANDAGEE
MINILYA
K61
AB 19
PT. A (ECC)
4/7
2/7
BARRAMBYDDY CK.
MIDDALYA H.S.
WILLIAMBURY H.S.
K45
MANGAROON H.S.
MINNIE CREEK H.S.
K54
1/6
2/6
4/3
5/5
3/5
4/5
2/8
2/40
MARSH
C. Cuvier
AB 6 (ECC)
SALT
BOOLOGOORO H.S.
COORALA H.S.
CARNARVON
CASCOYNE RIVER
LYONS RIVER H.S.
LYONS
BERNIER I.
DORRE I.

SCALE IN MILES

8 0 8 16 24 32 40 48

LEGEND

13-10 Gravity Station Number
-25 Gravity Station Value
4/7 Survey Control Point (Astro. Fix. or Trig.)
Road
Track

NOTE: Gravity observations tied to pendulum stations at Carnarvon and Onslow and anomalies expressed relative to theoretical values on International Ellipsoid. Latitudes from air photos, accuracy ±0·25 miles Elevations by barometer, accuracy ± 20 feet.

Geophysicist
December, 1951

GEOPHYSICAL SURVEY, NORTH WEST BASIN, W.A.

GRAVITY RECONNAISSANCE

BOUGUER ANOMALIES

CONTOUR INTERVAL 5 MILLIGALS
APPROX. ACCURACY ± 1·5 MILLIGALS
ELEVATION CORRECTION FACTOR 0·067 MGAL./FT.

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics.

G98-10

PLATE 3

North West Cape
ONSLOW
ASHBURTON BRIDGE
ASHBURTON
RIVER
EX. 22
MT. KING
TREALLA
POTSHOT
EX. 45
E.X. 1
LEEFROY
EX. 75
FRASER I.
PT. CLOATES L.H.
BULLARA H.S.
CENTIPEDE
GIRALIA H.S.
YANREY H.S.
WHALEBACK
ASTRO
W.B. 1
WOGOOLA H.S.
TOWERA H.S.
YANNARIE R.
Pt. Maud
WINNING POOL H.S.
LYNDON
RIVER
LYNDON H.S.
A.B. 19
WANDAGEE
WANDAGEE H.S.
MINILYA
WILLIAMBURY H.S.
K 45
MANGAROON H.S.
MT. THOMSON
MT. AGAMEMNON
MINNIE CREEK H.S.
PT. A. (ECC.)
BARRABIDDY
CREEK
K 54
K 61
C. Cuvier
A.B. 6
(ECC.)
MARSH
SALT
BOOLOGOORO H.S.
COORALA H.S.
LYONS RIVER H.S.
LYONS
GASCOYNE
RIVER
CARNARVON
BERNIER I.
DORRE I.
DIRK HARTOG I.
PERON PENINSULAR

SCALE IN MILES

8 0 8 16 24 32 40 48

LEGEND

4-2 Gravity Station Number
-25 Gravity Station Value
4/7 ○ Survey Control Point (Astro. Fix. or Trig.)
—— Road
- - - - Track

NOTE: Gravity observations tied to pendulum stations at Carnarvon and Onslow and anomalies expressed relative to theoretical values on International Ellipsoid. Latitudes from air photos, accuracy ± 0·25 miles Elevations by barometer, accuracy ± 20 feet.

P.J. Shuyer
Geophysicist
December, 1951

GEOPHYSICAL SURVEY, NORTH WEST BASIN, W.A.

GRAVITY RECONNAISSANCE

FREE AIR ANOMALIES

CONTOUR INTERVAL 5 MILLIGALS

APPROX. ACCURACY ± 1·5 MILLIGALS

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics.

G98 - 11

North West Cape
EX. 22
MT. KING
EXMOUTH GULF
POTSHOT
TREALLA
EX. 45
EX. 10
LEFROY
EX. 75
FRASER I.
PT. CLOATES L.H.
BULLARA H.S.
CENTIPEDE
GIRALIA H.S.
WHALEBACK
ASTRO
Pt. Maud
W.B. 1
ONSLOW
ASHBURTON BRIDGE
YANREY H.S.
ASHBURTON RIVER
YANNARIE
WOGOOLA H.S.
WINNING POOL H.S.
TOWERA H.S.
LYNDON
LYNDON H.S.
RIVER
WANDAGEE H.S.
WANDAGEE
MILALYA H.S.
WILLIAMBURY H.S.
K 45
MANGAROON H.S.
MT. THOMSON
MT. AGAMEMNON
MINNIE CREEK H.S.
MINILYA
BARRABIDDY
CREEK
K 54
K 61
PT. A. (ECC.)
AB. 19
C. Cuvier
AB 6 (ECC.)
MARSH
SALT
BOOLOGOORO H.S.
COORALA H.S.
GASCOYNE
CARNARVON
LYONS RIVER H.S.
BERNIER I.
DORRE I.
DIRK HARTOG I.
PERON PENINSULA
FAURE I.
Vening Meinesz Submarine Pendulum Station

SCALE IN MILES

8 0 8 16 24 32 40 48

LEGEND

- 4-2 Gravity Station Number
- -25 Gravity Station Value
- 4/7 Survey Control Point (Astro. Fix. or Trig.)
- Major Troughs
- Major Ridges
- Road
- Track

NOTE: Gravity observations tied to pendulum stations at Carnarvon and Onslow and anomalies expressed relative to theoretical values on international Ellipsoid.
Latitudes from air photos, accuracy ±0·25 miles.
Elevations by barometer, accuracy ±20 feet.
Isostatic corrections based on Hayford method using depth of compensation of 113·7 kilometers.

Geophysicist
December, 1951

GEOPHYSICAL SURVEY, NORTH WEST BASIN, W.A.

GRAVITY RECONNAISSANCE

ISOSTATIC ANOMALIES

CONTOUR INTERVAL 5 MILLIGALS

APPROX. RELATIVE ACCURACY ± 2 MILLIGALS

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics

PLATE 4