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PROGRESS OF THE RECONNAISSANCE GRAVITY SURVEY OF AUSTRALIA

by

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ILLUSTRATIONS

Plate 1. Gravity surveys as at 1st July 1965.

Plate 2. Australian mainland Bouguer anomalies.

Plate 3. Australian mainland Bouguer anomaly features.

Note

The maps available on separate issue mentioned in Chapter 3 may be purchased from the following sources:

40 miles to 1 inch transparent overlay

Government Printing Office, Wentworth Avenue, Kingston, CANBERRA ACT.

200 miles to 1 inch colour print with feature overlay

Melbourne Photo and Graphic Services Pty Ltd, 622 Burwood Road, AUBURN, VICTORIA.

SUMMARY

Reconnaissance gravity coverage of Australia is currently being extended at a rate of between 40 and 60 one-degree squares per year, and a start has been made to cover the continental shelf. The bulk of this is being done by the Bureau of Mineral Resources, and the station density on the mainland is around one per 50 square miles (about 90 stations per degree square).

Significant contributions are also being made by private companies, which generally cover smaller areas per survey with a higher density of stations.

The tectonic pattern of Australia as reflected in Bouguer anomaly is being unfolded. Of particular significance for oil search is the definition of basin boundaries and provinces. New concepts later confirmed by aeromagnetics, seismic work, or drilling have been postulated, and established concepts have been clarified and extended. Outstanding examples include:

- (1) The postulation of thick sediments in the Perth and Kidson Basins.
- (2) The illustration of the extent and dimensions of overthrusting on the northern edge of the Amadeus Basin.
- (3) The definition of a south-eastern extension of the Toko syncline in the Georgina Basin.
- (4) Guidance to areas of Palaeozoic sediments and associated structure underlying, and entirely hidden by, the Mesozoic cover of the Great Artesian Basin.

The reconnaissance gravity survey does reflect the larger anticlinal features; surveys for spotting drilling targets should be more accurate and detailed. The reconnaissance gravity survey is not considered to be a substitute for aeromagnetic survey which, of course, is also a reconnaissance tool. The coverage of the continent by aeromagnetics is well advanced. The two methods supplement each other and narrow down the ambiguities of interpretation that are inherent in each. The gravity, in general, provides better continuity of outline of features, but aeromagnetics provide valuable control data in the form of local estimates of depth to magnetic basement and indicated changes in type of magnetic basement.

1. INTRODUCTION

A method of reconnaissance gravity surveying with the ultimate aim of covering all Australia has been described by Vale (1962). The station density described was little better than one per 50 square miles (7 x 7 mile grid) or 90 per degree square. Helicopter transport was used, and Bouguer anomaly accuracy was estimated at somewhat better than 2 milligals. The same station density is still being maintained, but generally an accuracy of better than 1 milligal is now achieved.

There is now a body of experienced helicopter pilots in Australia for this class of work, and some helicopter operators have tended to become specialists in it. The result has been a very substantial reduction in helicopter unserviceability, and a consequent reduction in total costs. The work is now largely let out to contract, and the cost, including computing and production of final maps, is around £15 per station occupied. As these stations include ties to other surveys and between traverses, and repeat readings for drift control, the actual cost per new station added is nearer £24.

As field procedures have become more standardised it has been possible to employ navigators and gravity meter operators with lower qualifications. Quick field reduction techniques have been developed to monitor the performance of the meter operators; these permit a preliminary assessment of results, and indicate if and where additional stations are desirable. Final computing is now done by electronic computers, resulting in much greater speed and accuracy and in cross checking of the field readings.

2. GRAVITY COVERAGE OF AUSTRALIA

Plate 1 shows the current state of gravity coverage of Australia. Reconnaissance coverage extends over more than half the continent and is being extended at a current rate of between 40 and 60 one-degree squares per year. Complete land coverage in the early nineteen-seventies is expected. Work has now begun also on the continental shelf, but complete coverage will take many years. The area of the present continental shelf survey is shown in Plate 1; it extends from the Bonaparte Gulf northward past Bathurst Island in the Timor Sea. It is a surface-shipborne gravity meter survey controlled by a number of underwater gravity meter stations. A seismic sub-bottom profiler ("Sparkarray") survey is run in conjunction with it. Traverses are east-west at nine-minute intervals

with some north-south tie lines. Coverage of an area of some 15 one-degree squares is proposed.

Accurate control of both topographic and gravity datums is maintained between all surveys. This is achieved through a network of accurate base stations. In the case of gravity, the initial base network was put in by pendulum measurements, and gravity meter ties between the pendulum stations have since been made with a bank of gravity meters transported by aircraft. Many additional base stations were added in the process, and each large reconnaissance survey will include ties to several base stations. In the case of topographic surveying, a network of third order levelled traverses is run throughout each survey area in advance of the survey. Topographic ties are made to bench marks established by the third order survey. Position control is maintained by photo identification of stations. The photos in turn are related to astronomical control. For the offshore work a radio location system is used, and this in turn is related to a first order position network on shore.

3. THE GRAVITY MAP OF AUSTRALIA

Plate 2 shows a 10-milligal Bouguer anomaly contour map of mainland Australia, and gives a suggested division into areas (or provinces) of distinctive Bouguer anomaly pattern (or "features"). This same map is available on separate issue in colour with a transparent overlay of the feature boundaries. Also available on separate issue is a transparent 5-milligal contour map at a scale of 1:2,534,400 (40 miles to 1 inch); this is in four sheets to match the Tectonic Map of Australia, and it may be assembled as an overlay over the tectonic map. Plate 3 is a map of feature boundaries without Bouguer anomalies. In this case the provinces are further divided into units.

This set of maps displays striking correlations between the gravity features and known geology, and shows how the geological or tectonic concepts may be extended beyond their directly observed limits. As we all know, there is seldom a simple interpretation of the cause of a Bouguer anomaly feature; intrabasement and subcrustal effects are invariably present. In some places unaltered sediments overlie crystalline basement of lower density than the sediments; here the correlation between gravity and geology is the reverse of what one may conventionally expect. Further striking correlations, not illustrated here, may be observed with total magnetic intensity maps and maps showing estimated depths to magnetic basement. Correlating with these maps one may see where magnetic basement topographic features or changes in type of basement are probable causes of features in the Bouguer anomaly pattern.

In the following table the gravity features are classified into "provinces" and "units" corresponding to Plate 3. Although the detail of the maps is adequate for a further division into sub-units consisting of local "highs", "lows", "gradients", and so on, that would be beyond the scope of this paper. Provinces and units have, as far as practicable, been copied from the work of previous authors who have dealt with the results of individual surveys or discrete areas. Generally their work has been done without regard to the context of surrounding areas, and this has made some of their proposed divisions inappropriate. Also, an interpreter studying a small area will think in terms of "platforms" and "depressions" which, in the context of an area the size of the Bowen Basin or the Australian continent, shrink to local "highs" and "lows". The present author therefore apologises for any distortions of the boundaries and names proposed by earlier authors, and trusts that the distortions will be accepted as fair.

Included within the table are an indication of some of the geology with which the features may be correlated and a possible interpretation of the feature. Both are necessarily very brief and rough.

4. ACKNOWLEDGEMENTS

It would not be practicable to give individual acknowledgement to all the persons who contributed to compiling the present Bouguer anomaly map of Australia. Many of them will receive partial acknowledgement in the listed references. However, special mention must be made of the recent efforts of Mr J. Shirley in assembling and revising the available map of data for uniform presentation and the untiring cooperation of the Gravity Drafting Group of the Bureau of Mineral Resources in preparing the maps for presentation.

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BOUGUER ANOMALY FEATURE	KNOWN CORRELATION WITH PROBABLE CAUSATIVE GEOLOGY	POSTULATED CORRELATION WITH POSSIBLE CAUSATIVE GEOLOGY
PROVINCE 1		
Fitzroy Regional	Fitzroy Basin, a major Palaeozoic	The southern extension of the Basin
Gravity Complex	basin within the more extensive	on longitude 126° is postulated.
	Canning Basin. Generally, relative	However, the division between the
	high and low Bouguer anomaly areas	Palaeozoic Fitzroy Basin and the
	correspond with known tectonic high	Upper Proterozoic sediments ex-
·	and low areas except towards the	tending to the east and correl-
	coast where thick sediments extend	ating with a gravity trough, the
	into the area of the Yeeda Gravity	Bannerman Gravity Trough is
	Platform.	obscure.
<u>Unite</u>		•
A. Napier Gravity	An area of outcropping Devonian	It is postulated as an area con-
Depression	limestones lying within the Lennard	taining relatively thick Lower
	Shelf.	Palaeozoic sediments.
B. Oscar Gravity	Also an area generally within the	It is postulated as a relatively
Ridge	Lennard Shelf. Upper Proterozoic	high-standing basement ridge.
	and Archaean exposed at the south- eastern end.	
C. Noonkanbah	A deep sedimentary trough (20,000	The continuation of the sedimentary
Gravity Trough	feet) within the Basin. The trough	trough to the south around the
	is often referred to as the Fitzroy	south-eastern end of the Broome
	Trough as a narrower concept than	Gravity Ridge is tentatively
•	the Fitzroy Basin. The western	postulated.
	end of the gravity trough corres-	•
	ponds with the Jurgurra Terrace.	
• •	The sedimentary trough continues	
•	under the Yeeda Gravity Platform.	
D. Yeeda Gravity	The continuation of the Fitzroy	It is postulated that the igneous
Platform	Trough, but with additional thick	sequence is thick and extensive,
	Carboniferous, including a basic	and that there is an added effect
	igneous sequence observed in	of crustal thinning under the
	bores.	continental shelf.
E. Broome Gravity	A high basement ridge well estab-	The extension of the ridge south-
Ridge	lished by bores and seismic at its	east to at least 125_k^{10} longitude
	western end.	is postulated.
PROVINCE 2		
Munro Regional	Basement (granitic) is known at	It is postulated that the area has
a wa .a .	relatively shallow depth (5000	Abduman anddmaudu Abau Aba 1944
Gravity Platform	Letatively sustion debru (2000	thinner sediments than the Fitzroy

Units

- A. Lagrange Gravity
 Plateau
- B. Casis Gravity
 Depression
- C. Joanna Gravity Ridge

Areas of poor outcrop with little guidance to underlying section or structure. It is postulated that the Bouguer anomaly variations in part represent areas of relative difference in thickness of sediments and otherwise represent intrabasement density variations.

PROVINCE 3

South Canning Regional Gravity Low Until recently an essentially unknown region with poor outcrop. Includes the recently discovered Kidson Basin, named following an aeromagnetic survey and confirmed by seismic. It was postulated as an area that would contain thick sediments. Gravity stations are too sparse to define boundaries. The Kidson Basin discovery confirms the postulate.

PROVINCE 4

Anketell Regional Gravity High Area with relatively shallow (granitio) basement struck in bores. Also has a shallow magnetic basement.

Sparse gravity data suggest that high Bouguer anomalies run south-eastwards continuously from the Anketell Regional Gravity High to the Blackstone Regional Gravity High and may correlate with a ridge that separates the Canning Basin from the Officer Basin and the Officer Basin from the Amadeus Basin.

PROVINCE 5

Pilbara Regional Gravity Complex Basement outcrops of the Pilbara Block and southern onlap of the Canning Basin. It is postulated that Bouguer anomaly features with strong gradients and relief will characterize the entire area of the Pilbara Block and may be used to distinguish between areas of acid and basic rocks.

PROVINCE 6

Vlaming Regional Gravity High PROVINCE 7

Carnaryon Regional Gravity Low Marks off an area of rapidly thickening Jurassic sediments.

Corresponds with the Carnarvon
Basin. Bouguer anomaly values are
not clearly distinguished from those
of basement areas to the east.
Station coverage is too sparse for
good definition of feature boundaries.

Subsequent seismic and drilling indicate that unit boundaries correlate well with structural boundaries.

Unite

A. Merlinleigh Gravity Depression Palaeozoic outcrops on the eastern side of the Carmarvon Basin.
Subsequent drilling and seismic justify definition of a Merlinleigh Basin.

B. Wandagee Gravity
Ridge

A high-standing basement ridge, the Wandagee Ridge separates the Merlinleigh Basin from the Gascoyne Basin.

C. Gascoyne Gravity
Depression

Corresponds with the Gascoyne Basin. Generally, an area of Tertiary and Mesozoic cover. Except in the far north, drilling indicates that this cover rests on Silurian and Ordovician.

D. Meedo Gravity
Platform

Largely corresponds with Tertiary cover with some Archean outcrops in north-east. Some seismic evidence of more general correlation with high basement.

PROVINCE 8

Ajana Regional Gravity High Corresponds in part with Lower Palaeozoic and Archean basement outcrop, both of which dip under Tertiary or Kesozoic cover. Where checked there is good correlation between the western margin of the basin and the corresponding gravity gradient. Gravity coverage is too sparse for extensive production.

The Wandagee Ridge was predicted largely as a result of gravity interpretation. Subsequent seismic and drilling have confirmed its existence. The extension of the ridge by way of the Meedo Gravity Platform to connect with the Ajana Block is predicted. There is some recent seismic confirmation of this.

Bouguer anomaly variations are of little help in defining sub-units. It does, however, give definition of the eastern margin of the basin against the Wandagee Ridge and high basement under the Meedo Gravity Platform. Gravity station coverage is too sparse for good definition.

It is postulated that it outlines a high-standing basement area linking the Wandagee Ridge with the Ajana Block, and separating the Byro and Coolcalalaya Basins from the Gascoyne Basin.

It is postulated that high-standing Archean basement extends north, south, and west from outcrop. To the north it connects with the Wandagee Ridge by way of the Leedo Gravity Platform.

Perth Regional Gravity Low

Corresponds with the Perth Eagin. The Tertiary and Mesozoic cover over most of this Basin gave little indication of a deep basin, and the concept of a shallow basin was held until the end of the 1940's.

The first gravity readings indicated that the concept of a shallow basin needed revision; some 30,000 feet of sediments was predicted. Subsequent seismic and drilling tend to confirm this prediction.

Units

A. Byro Gravity Low

B. Coolcalalaya Gravity Low

Corresponds with the Byro Basin. Gravity coverage is too sparse for good definition of the feature. Corresponds with the Coolcalalaya

Basin. Gravity coverage is sparse.

C. Watheroo Gravity Deprocation \

D. Beagle Gravity High

E. Mandurah Gravity Rise

Undoubtedly corresponds with very thick sediments. Corresponds with the Beagle Ridge

discovered by aeromagnetics and confirmed by drilling.

Seismic indicates that this area also contains thick sediments.

F. Bunbury Gravity Depression

Seismic indicates thick sediments.

PROVINCE 10

Naturaliste Regional Gravity High

Corresponds with outcropping Archean basement. At present there is lack of gravity control to give definition of seaward extent of feature.

PROVINCE 11

Gibson Regional Gravity Low

An area mostly covered with Tertiary, Cretacecus or Permian veneer. In north-east some Upper Proterozoic salt domes occur. Upper Proterozoic occurs to west and south-west. The gravity province boundary is defined only to the north-east.

The concept of the Byro and Coolcalalaya Basins, as an extension of the Perth Basin rather than the Carnarvon Basin is substantially based on gravity interpretation. Seismic evidence is now tending to confirm the appropriateness of the concept. May deserve being named a Basin in its own right. The extent of the gravity high is unknown. Its eventual definition seaward may be very important. Although thick sediments are observed, the area may be structurally higher and have shallower basement than the areas of the Watheroo and Bunbury Gravity Depressions. May deserve being named a basin in its own right.

It is postulated as region of thick sediments and as possible extension of Officer Basin. Rocks observed in salt domes suggest a connection with Amadeus Basin. May also have connection with Canning Basin. Proportion of section that may lie within the Palaeozoic is speculative.

Blackston Regional Gravity High An area with outcropping Archean rocks in its southern and eastern parts.

It is postulated that relative high and low Bouguer anomalies will respectively indicate relatively more basic and acid rocks.

Unit

Charles Gravity Ridge An area of few outcrops indistinguishable from Province 11. It is postulated that a shallow basement ridge will form the north-eastern border to the Officer Basin. It probably extends north-west to form the southern margin of the Canning Basin.

PROVINCE 13

Cobb Regional Gravity Low Area contains outcropping Archean and metamorphosed Lower Proterozoic rocks in the east. The north-west is covered by alluvium with Cretaceous and Permian veneer, but there is some evidence of dispirio folding.

The area of the gravity low is very extensive, and there is a highly negative Bouguer anomaly. The low must be part caused by an intrabasement crustal or sub-crustal mass deficiency, but it is postulated that there may be thick sediments in the north-west. These could be mostly Upper Proterozoic.

PROVINCE 14

Ayers Rock Regional Gravity Low Area contains Archean rocks to the south and a veneer of alluvium or Mesozoic to the north, with some Upper Proterozoic sedimentary outcrops.

It is postulated as an area of thick sediments with a large overthrust from the south.

PROVINCE 15

Olga Regional Gravity Ridge Includes some Upper Proterozoic and Ordovician outcrops

It is postulated as representing a high basement ridge marking the southern edge of the major deposition of the Amadeus Basin.

Units

A. Bloods Range Gravity Ridge

B. Angas Downs Gravity Ridge The western part of the Olga Regional Gravity Ridge. It lies largely outside the Amadeus Basin.

The eastern part of the Olga Regional Gravity Ridge. The Amadeus Basin sediments lap over the postulated basement ridge.

Amadeus Regional Gravity Low

Corresponds with the greater portion of the Amadeus Basin. Includes Archean rocks on its northern edge.

A major basement overthrust from the north is postulated. However, this does not appear to offer sufficient explanation and intrabasement density variations are also postulated.

Units

A. MacDonald Gravity Shelf

B. Hermannsburg

Depression

Gravity

An area largely covered with alluvium that may extend beyond the western extremity of the Amadeus Basin. Apart from the Archean rocks mentioned above, this corresponds with the area where great thickness of sediments may be expected. Seismic evidence also gives support to this. There is seismic evidence for thick sediments in the south.

It is postulated that this may be a shelf area with significant though relatively thin sediments.

C. Maryvale Gravity Shelf

It is postulated that a substantial portion of the Amadeus Basin sediments will be missing, even where there is a considerable thickness of sediments.

D. Todd Gravity Terrace

An area of Archean outcrop overlain to the south by Upper Proterozoio.

PROVINCE 17

Papunya Regional Gravity Ridge .

Corresponds with Archean outcrops separating the Ngalia and Amadeus Basins.

PROVINCE 18

Finke Regional Gravity Ridge

These high gravity values provide a distinct boundary to the southeast of the Ayers Rock and Amadeus Regional Gravity Lows. Archean rocks crop out to the south-west.

It is postulated that the gravity ridge represents a basement ridge that marks the eastern limit of the Amadeus Basin even though there is probably some overlap of Amadeus Basin sediments.

PROVINCE 19

Illogwa Regional Cravity High

Archean crops out to the northwest, and Mesozoic underlies sand of the Simpson Desert to the southeast.

It is postulated as generally an area of shallow basement. Generally, the relatively high and low Bouguer anomalies reflect varying acidity in the basement rocks.

Units

A. Hay Gravity Low

B. Caroline Gravity

C. Hale Gravity Platform

The general comments above may be repeated for each of these units.

Georgina Regional Gravity Shelf So far as it is at present defined this gravity province corresponds with Lower Palaeozoic of the Georgina Basin. In general, with the exception of the Toko Syncline there appears to be so little density contrast between the basement and sediments that we cannot predict areas of different sedimentary development.

<u>Units</u>

A. Ammaroo Gravity Depression Corresponds with the Ammaroo Basin.

Bouguer anomaly may be of limited use in defining probable developments within the basin, but it is adjacent to the Hay Gravity Low, which appears to be controlled by acid basement rocks.

The general comment for the gravity province appears to be particularly

applicable.

- B. Ooratippra Gravity High
- C. Sandover Gravity
 Low
- D. Tobermorey
 Gravity Shelf
- E. Toko Gravity
 Trough

Corresponds at its north-western end with outcropping rocks of the Toko Syncline. Farther north-west, older and denser rocks of the Syncline crop out, and the gravity feature disappears. Sand and Mesozoic rocks cover the area to the south-east.

It was postulated that the Toko Syncline with its younger sediments continued to plunge to the south-east under the Mesozoic sediments. This has been clearly demonstrated by seismic as correct.

PROVINCE 21

Cloncurry Regional Gravity High Corresponds in part with the exposed Cloncurry Fold Belt, an area of metamorphosed Lower Proterozoic sediments including numerous granite intrusions. Lower Palaeozoic dolomites etc. of the Georgina Basin crop out to the south and extensively to the west. Mesozoic rocks of the Great Artesian Basin cover the area to the south and east.

The sub-surface extension of the Cloncurry Fold Belt at relatively shallow depth to correspond with the extent of the gravity province is predicted. Seismic, aeromagnetic, and bore data give general support to this hypothesis. A striking feature is the pattern of Bouguer anomaly highs and lows trending north-north-west. The lows exhibit close correlation with particular granite intrusions, whose continuance beyond outcrop may be predicted.

Units

A. Field Gravity
Spur

Upper Proterozoic sediments to the north-west and Mesozoic to the south-east.

B. Bedourie Gravity
Ridge

Characterized by Mesozoic sediments thickening gently to the south

C. Glenormiston Gravity Shelf Georgina Basin sediments onlap on to the Cloncurry Fold Belt in this area.

- D. Boulia Gravity Ridge
- E. Kalkadoon
 Gravity Low
- F. Burke River
 Gravity Complex
- G. Mackunda Gravity
 Platform
- H. Julia Creek

Gravity

PROVINCE 22
Flinders Regional

Gravity Low

These areas are closely identified with basement variations and structure in the north. Some Georgina Basin and Great Artesian Basin sediments cover their southward extension.

This area also has basement cropping out to the north. The major part of this area is covered with Mesozoic sediments thickening gently to the south-east, reaching a thickness of some 4000 feet.

Covered with Mesozoic sediments,

with generally shallow basement shown by water bores. Basement appears to be deepening on northeastern margin.

Mesozoic rocks of the Great Artesian Basin. The area is not, to the extent that is known, distinct from other areas of the Basin. It is postulated that more basic metamorphic or igneous rocks occur at no great depth.

Bouguer anomaly does not obviously reflect the thickening Mesozoic sediments. It is postulated that the area is underlain by relatively dense basement with a general absence of granite intrusions.

Although there appears to be a sufficient combination of sediment thickness and density contrast to shift the general level of Bouguer anomaly, intra-basement effects are still too strong to permit any predictions of variation in sedimentary thickness.

It is predicted that the basement features of the north continue generally at shallow depth to the south, to correspond with the gravity features.

In spite of the thickening Mesozoic, which is of relatively lcw density, it is believed that intra-basement structure and rock types are predominant in determing the Bouguer anomaly.

Generally believed that intrabasement effects control the Bouguer anomaly features.

Where relatively small Bouguer anomaly features with relatively steep gradients are observed, then shallow basement is expected. In other areas the relatively low Bouguer anomalies may indicate thick sediments. This is particularly likely on the eastern side, where the Artesian Basin overlaps the Palaeozoic sediments of the Drummond Basin.

Units

- A. Richmond Gravity
 Shelf
- B. Nonda Gravity
 Depression
- C. Tangorin Gravity
 Depression

PROVINCE 23

Muttaburra Regional Gravity Ridge Generally not distinguishable at the surface from Province 22. There is bore evidence suggesting that basement is generally around 4000 feet deep.

Units

- A. Manuka Gravity Embayment
- B. Winton Gravity
 Platform
- C. Longreach Gravity Spur
- D. Aramac Gravity
 Platform

PROVINCE 24

Thomson Regional Gravity Low units.

The general comment on the Province

may be applied to each of these

Mesozoic sediments of the Great Artesian Basin cover the entire area. There is substantial evidence that Bouguer anomaly features may frequently correlate with sedimentary development and structure, but this is not consistently so. The most important known development is the Palaeozoic Adavale Basin. It is postulated that this area is underlain at relatively shallow depth by metamorphics of the Charters Towers area.

Because of the proximity to the Julia Creek Gravity Shelf, relatively low-density basement may have an effect, but generally it is postulated that relatively thick sediments are present.

It is postulated that relatively thick sediments are associated with this gravity depression.

It is postulated that this is an area of relatively shallow basement and that extensive Bouguer anomaly features probably represent changes in basement type. Local Bouguer anomaly features may represent local structure. This, in fact, has been confirmed.

A. Vergemont Gravity Depression

Ridge

B. Warbreccan Gravity Major anticlines occur at the south western end.

C. Barrolka Gravity Depression

- D. Jundah Gravity Depression
- E. Blackall Gravity Platform
- F. Quilpie Gravity Depression

This area includes the known Adavale Basin and Cooladdi Trough which correspond with low Bouguer anomaly features.

G. Tobermorey Gravity Terrace

H. Charleville Gravity Platform

There is no known significant development of pre-Mesozoic in this area.

PROVINCE 25

Nebine Regional Gravity High

Has outcropping granite basement of the Eulo Shelf to the south and includes the Nebine Ridge, a basement ridge considered to devide the Great Artesian Basin into the Surat Basin in the east and the Eromanga Basin in the west.

Units

A. Eulo Gravity Platform

Corresponds with the Eulo Shelf.

B. Morven Gravity Ridge

Corresponds with the Nebine Ridge.

It was first postulated that this may represent thick sediments. However, recent drilling suggests that basement density rather than basement depth is the controlling factor in defining the feature. The gravity ridge defines a structural ridge which fades out to the north-east.

It is postulated that these features outline an area of relatively thick sediments including Palaeozoic.

Postulated as an area of relatively shallow basement.

It is postulated that the more negative Bouguer anomalies may be used to outline areas of significant pre-liesozoic sedimentary thickness, and that Bouguer anomaly may be used as a first guide to predicting structure.

It is postulated as an intermediate zone with basement type playing an increasing part from west to east in causing the relatively low Bouguer anomalies.

It may be that the relatively low Bouguer anomaly features contain thicker sediments. However, intrabasement density changes are considered to be more likely.

The feature connects to the Anakie Regional Gravity High in the north, and it is postulated that the Nebine Ridge is continuous between the Eulo Shelf in the south and the Anakie Block in the north.

Anakie Regional Gravity High Area includes outcropping Tasman Geosyncline metamorphics as basement rocks of the Anakie Block; they dip under the Middle and Upper Palaeozoic Drummond Basin on the west, the Upper Palaeozoic Bowen Basin on the east, and Mesozoic of the Great Artesian Basin to the south.

It is postulated that to the east and south, relatively high Bouguer anomalies outlining the Province indicate the extent of the Anakie Block at relatively shallow depth. To the west, however, the substantial thickness of sediments in the Drummond Basin has only minor effect in shifting the mean level of Bouguer anomaly.

Units

- A. Drummond Gravity Shelf
- B. Clermont Gravity
 Ridge

Corresponds in large part with outcropping Drummond Basin sediments. Most of the outcropping Anakie Block occurs within this area.

It is postulated that this provides definition of the Anakie Block beyord outcrop, and shows the connection with the Nebine Ridge.

PROVINCE 27

Bowen Regional Gravity Low This area includes most of the outcrop of Bowen Basin sediments.

Though additional outcrops do occur to the east in the Coastal Regional Gravity Complex, they have been subject to more severe tectonic activity and igneous intrusion.

Bouguer anomaly features have been shown to relate to structure in a number of locations. Mesozoic sediments of the Surat Basin overlap the Bowen Basin sediments in the south.

It is postulated that Bouguer anomaly can be used as a valuable guide for following structural trends. Around the margins, the presence of granite in the basement rocks may upset predictions.

Units

- A. Emerald Gravity
 Shelf
- B. Springsure
 Gravity Shelf

The Comet Platform, a structurally high area known from observed surface structure, drilling, and seismic, occurs in the south-east of the area.

It is postulated as an area of east-ward deepening basement except for the Comet Platform area, whose probable extent is clearly outlined by a local Bouguer anomaly high.

It is postulated that this may be an area of relatively shallow basement with granite being the cause of relatively low Bouguer anomalies.

- C. Shotover Gravity
 Depression
- D. Devlin Gravity Terrace

In places this includes granite outcrops and also includes an area of strong folding.

PROVINCE 28

Surat Regional Gravity Low

To the extent that this gravity province has been mapped, it coincides fairly closely with the Mesozoic Surat Basin. The Bowen Basin is known to continue southward under the Surat Basin. The thickest sediments lie under the Meandarra Cravity Rise, and relatively shallow granitic basement occurs in the area of the Roma Gravity Depression. This then is an area of reverse correlation. Much of the thickening of the sediments in the Meandarra Trough is due to one formation, the Cabawin Formation.

It is postulated as outlining the deepest part of the basin except in the north, where it clearly relates to granite outcrop.

Postulated as an area which, in terms of present day shape of the basin, has a sedimentary thickness reducing rapidly towards the east.

It is postulated that the Cabawin Formation has a higher bulk density than the basement, and is responsible for the reverse correlation between Bouguer anomaly and structure.

Units

- A. Roma Gravity
 Depression
- B. Meandarra Gravity Rise
- C. Tara Gravity
 Depression

The eastern side of the Gravity Depression apparently co-incides with the eastern side of the Bowen-Surat Basin complex, but within the feature the high-standing Cabawin basement feature co-incides with relatively low Bouguer anomaly on the flank of the Lieandarra Gravity Rige.

It is postulated that the entire gravity unit of low Bouguer anomaly is a result of acid basement rocks rather than pre-Mesozoic sediments, although the latter may be present. See comment for the Gravity Province.

This feature straddles a zone where relative Bouguer anomaly value swings from reverse to direct correlation with basin structure. Provided the gravity survey is linked with seismic and drilling control, Bouguer anomaly can still be a useful guide to structure.

Coastal Regional Gravity Complex

This covers the area of outcropping metamorphic and igneous rocks of that part of the Tasman Geosyncline east of the Bowen and Surat Basins. Included within this area are a number of sedimentary basins including such substantial ones as the Middle Palaeozoic Yarrol Basin,

Except perhaps in the Moreton-Clarence Basin, Bouguer anomaly on the reconnaissance scale offers little assistance as a guide to sedimentary thickness. Bouguer anomaly features do, however, bear a close relation to igneous and tectonic features, and may frequently be used to predict the continuation of those features beyond observed outcrop. The Maryborough Basin does contain basic igneous intrusives in its section and this may explain its Lack of expression in Bouguer anomaly.

Units

- Ridge
- B. Repulse Gravity Depression
- C. Llewellyn Gravity Platform
- D. Marlborough Gravity Ridge
- E. Baffle Gravity High
- F. Gympie Gravity Platform
- G. Brisbane Gravity Plateau
- H. Kingaroy Gravity Embayment
- I. Clarence Gravity Shelf

A. Eungella Gravity) See general comments for the gravity province

> The Moreton-Clarence Basin coincides with this area.

The present gravity station density is too sparse to give good definition of the unit or to use for structural prediction.

New England Regional Gravity Low

Corresponds closely with the New England Geosyncline. A unit within the Tasman Geosyncline containing extensive granite intrusions.

There is not sufficient gravity coverage to clearly define the gravity province or units within it. All that can be said is that it is an area distinctly different and with a substantial mass deficiency when compared to the area of the Coastal Regional Gravity Complex to the north.

PROVINCE

East from Province 18 19 and 21 West and South from Province 24

At the time of writing there is not sufficient data available to be able South from Provinces to divide this area into gravity provinces, but some units may be defined. The area is covered with Mesozoic of the Great Artesian Basin. Unaltered sediments ranging from Permian to Upper Proterozoic extend into the area. Basement types overlap this age range and include highly indurated and metamorphosed rocks ranging from the Lower Palaeozoic to Archean. Seismic, drilling, and aeromagnetics confirm that in some instances a relative Bouguer anomaly low relates to increase in sediment thickness while in other instances it would appear to be caused by relatively lowdensity basement. Where there is known sedimentary or basement structure, there is frequently an observed Bouguer anomaly feature.

Units

A. McDills Gravity Platform

Minor features appear to reflect sedimentary structure where checked by seismic.

B. Abminga Gravity Depression

This gravity feature to extend into an area of Archean outcrop.

Rise

C. Hamilton Gravity Aeromagnetic and seismic data suggest that there is increasing sedimentary thickness from west to east.

It is postulated that the gravity feature outlines an area of intrabasement mass deficiency. It is postulated that the area is underlain by denser basement than Unit B but shallower basement than

Unit D.

- D. Dalhousie Gravity Depression
- E. Noolyeana Gravity Ridge
- F. Cowarie Gravity Depression
- G. Eyre Gravity Depression
- H. Cacoory Gravity Depression

evidence within this suggest that the relatively low Bouguer anomaly features relate to intra-basement density changes.

- I. Durham Gravity Ridge
- J. Tenappera Gravity Depression
- K. Naryiloo Gravity Terrace

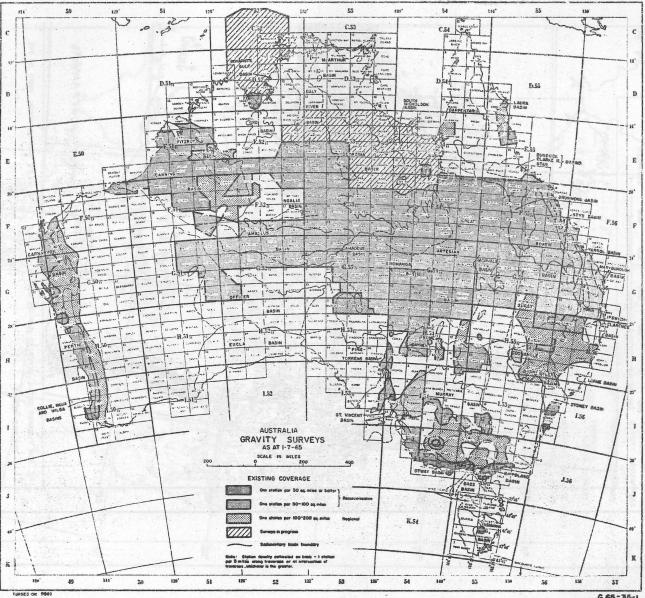
The limited seismic and drilling

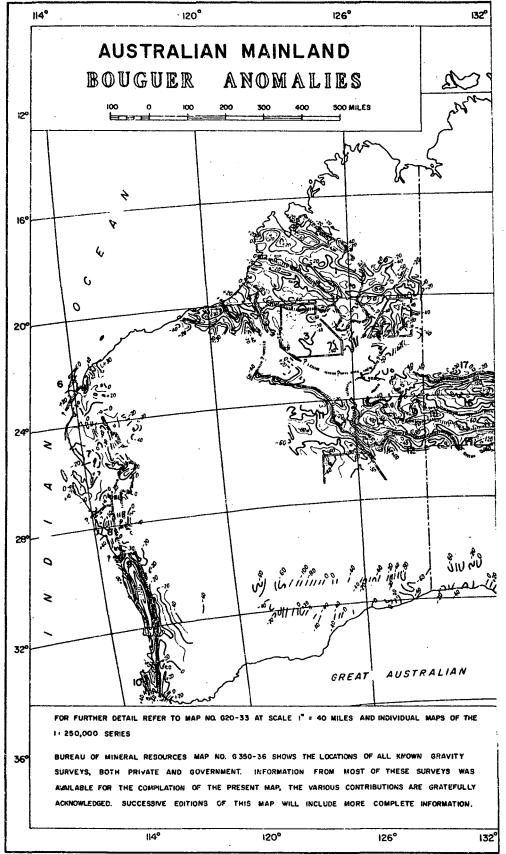
A correlation between relative Bouguer anomaly value and sedimentary thickness as revealed by seismic has been established in a number of places in the area of these units.

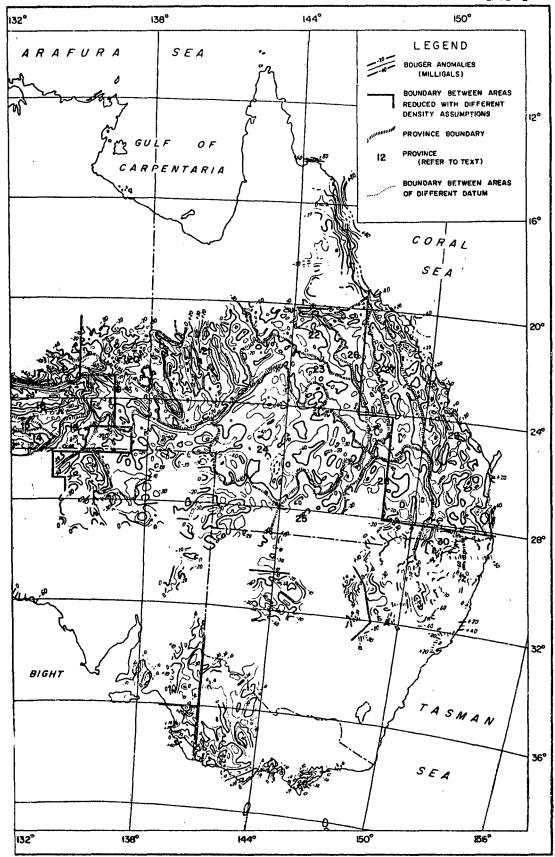
Postulated that this gravity unit relates mainly to relatively thick pre-Mesozoic sediments.

It is postulated that these units of relatively high and low Bouguer anomaly relate to relatively thin and thick sediments.

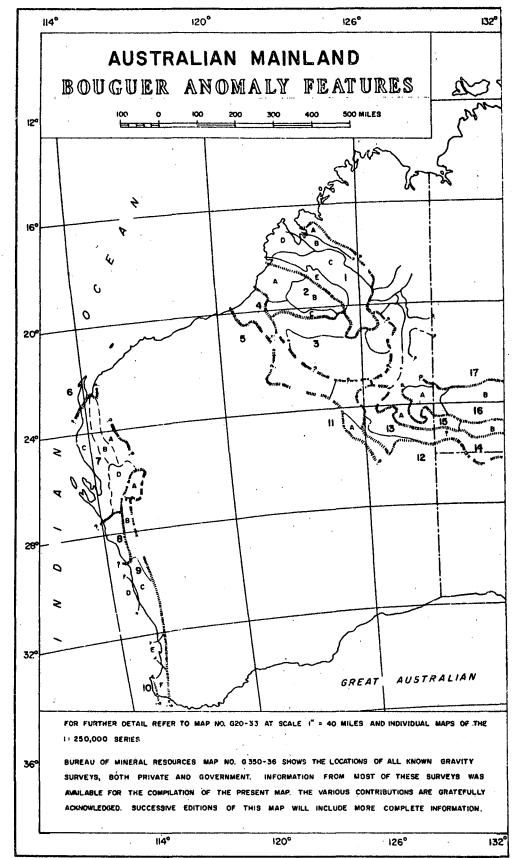
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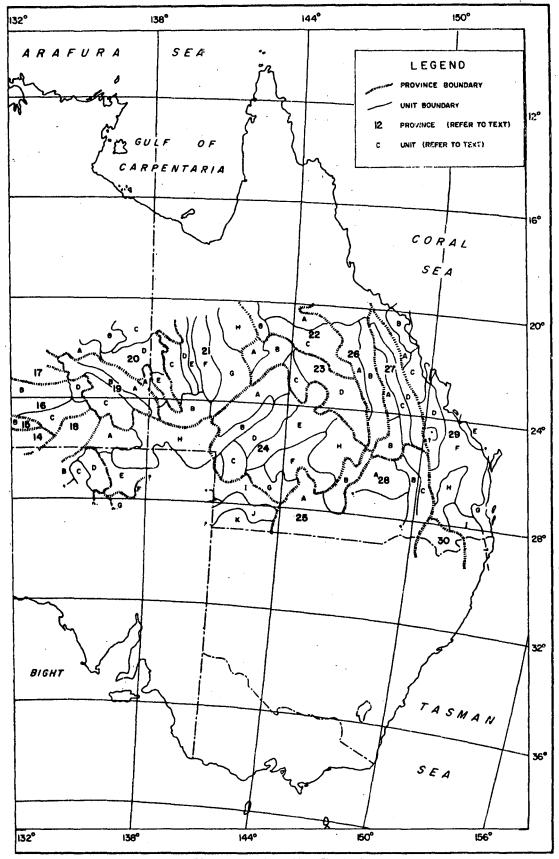






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