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The reconnaissance gravity survey of Australia : a qualitative analysis of results

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Figure 1*: Gravity features

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SUMMARY

As a first step towards analysing and interpreting contoured gravity data, it is a common practice to divide the contour pattern into discrete regions of different gravity characteristics. This helps to clarify the overall contour pattern and emphasise significant but less obvious features of the gravity field. It also simplifies the task of describing gravity features, their interrelationship, and their correlation with geological or tectonic elements.

The method has been used by the several authors who have contributed to the interpretation and reporting of the results of reconnaissance gravity surveys in Australia. In general, two classes of feature have been defined and named - gravity provinces and gravity units. A gravity province is a region where the gravity field is characterised by uniformity of at least one property, such as contour trend, gravity level, or degree of contour disturbance, which distinguishes it from neighbouring provinces. A gravity unit is a subdivision of a province. As for provinces, but on a smaller scale, neighbouring units are distinguished from each other by differences in contour trend, gravity level, or degree of contour disturbance.

Gravity provinces have been defined on a continuing basis by various authors, as parts of the reconnaissance gravity survey of Australia were completed. With the reconnaissance survey now virtually complete, this report is a summary and to some extent a rationalisation of the work of all of these authors. Ninety-six gravity provinces are defined over Australia and its northwest continental shelf, and are discussed in relation to known geology and geophysics.

A broad assessment of the causes of gravity features indicates that, in general, provinces of high Bouguer anomaly correspond to Proterozoic or early Palaeozoic metamorphic belts, provinces of low Bouguer anomaly to granitic batholiths or Phanerozoic sedimentary basins, and provinces of complex contour pattern to Precambrian or Palaeozoic orogenic domains.

INTRODUCTION

The Bureau of Mineral Resources (BMR) initiated a reconnaissance gravity survey program in 1959, with the aim of obtaining complete gravity coverage of Australia at a station grid spacing of 11 km or less. Previous authors have described the progress of this survey (Vale, 1965; Darby & Vale, 1969), the survey methods (Hastie & Walker, 1962), data reduction techniques (Langron, 1965; Bellamy and others, 1971), and the establishment of a national gravity base network to which various independent surveys could be tied (Dooley, 1965; Barlow, 1970; Wellman, 1974). Numerous reports have discussed the results of individual surveys over discrete areas which have contributed to the reconnaissance gravity coverage of Australia.

The reconnaissance gravity survey was completed in October 1974 with the completion of coverage of New South Wales, Victoria, and Tasmania. The results of the BMR survey, which covers about eighty-five percent of Australia, have been combined with the results of more intensive surveys by State Government organisations, notably the South Australia Department of Mines, academic institutions, and petroleum exploration companies to compile a Bouguer anomaly map of the whole of Australia.

This report describes ninety-six regional gravity provinces into which the Australian Bouguer anomaly field has been divided (Plate 1). Each gravity feature is named, briefly described, and discussed in terms of known geology. In general, the definitions and names of features are those proposed by Darby & Vale (1969) or authors who have interpreted the results of reconnaissance surveys since 1968. Revisions have been made where additional gravity coverage has shown the original name or definition of a gravity feature to be inappropriate.

The method of dividing the contour pattern into gravity features and correlating these with regional geological structures is only one of several approaches to the problem of analy-

sing and interpreting regional gravity data; other methods have been used by other BMR authors. For instance, Wellman (1976) has divided Australia into a number of discrete crustal blocks with differing gravity trends and attempted to infer their chronological relations, and Mathur (1974) and Anfiloff & Shaw (1973) have derived crustal cross-sections from regional gravity profiles.

MAP COMPILATION

The Bouguer anomaly map on which the gravity features are drawn, was prepared from the 1:5 000 000 Gravity Map of Australia (Bureau of Mineral Resources, 1976). The gravity map has been published at the same scale and projection as the Tectonic Map of Australia and New Guinea (Geological Society of Australia, 1971) to facilitate a direct comparison between gravity anomalies and regional geological structures. The map shows Bouguer anomalies on land, calculated assuming a rock density of 2.67 gm/cm^3, and free-air anomalies at sea.

DESCRIPTION AND INTERPRETATION OF GRAVITY FEATURES

Gravity features are classified into 'provinces' and 'units'. A gravity province is a region over which the Bouguer anomaly field is characterised by uniformity of at least one property - contour trend, mean anomaly level or degree of contour disturbance - which distinguishes it from neighbouring provinces. A gravity unit is a sub-division of a province, similar in definition to a province, but generally smaller. There are some inconsistencies in the way that gravity features have been defined because different authors have used slightly different criteria for drawing boundaries. However, faced with the impossibility of constructing a completely objective partition of the contour pattern into gravity provinces, the authors of this report have, in general, chosen to retain the boundaries proposed by previous authors who have studied the gravity patterns over particular areas in detail.

The gravity features are named after geographical features, towns, homesteads or railway stations; a descriptive term such as high, low, complex, ridge, trough, or shelf, is included in the name to describe the gravity feature.

Province 1 NATURALISTE REGIONAL GRAVITY HIGH

> A partly defined gravity province that is open in three directions towards the sea. On land the predominant contour trend is northerly. Bouguer anomaly values range from 0 to +40 mGal.

The Naturaliste Regional Gravity High corresponds to the Naturaliste Block, which is composed of late Proterozoic granulites and gneisses. The gradient defining its eastern boundary coincides with the Dunsborough Fault, which separates the Naturaliste Block from the Perth Basin. The province is associated with a pronounced magnetic feature, which swings sharply to the northwest at its northern end.

Province 2 PERTH REGIONAL GRAVITY LOW

> A narrow gravity trough extending for 800 km in a northerly direction along the west coastal region of southern Western Australia. The province is open to the sea between Dongara and Busselton; elsewhere it is bounded by steep gravity gradients to both east and west. Bouguer anomalies range from 0 to -130 mGal. The province has been divided into six units.

The Perth Regional Gravity Low coincides with the Phanerozoic Perth Basin; gradients forming the walls of the gravity trough correspond to faults separating the basin from Precambrian shield areas. The flat-lying Tertiary and Mesozoic cover over most of the basin gave little indication that the basin was deep, and it was believed to be shallow until a gravity survey in the early 1950s indicated the possible presence of thick sediments. Subsequent aeromagnetic, seismic, and drilling work has confirmed this. There

is indirect evidence, however, that the crustal column beneath the Perth Basin is mass deficient, so that low Bouguer anomalies may be only partly attributable to the light sedimentary pile.

Unit 2A Byro Gravity Low

A small Bouguer anomaly low at the northern end of the gravity province.

The Byro Gravity Low coincides with the Byro Basin of largely Permian sediments.

Unit 2B Coolcalalaya Gravity Low

A narrow gravity trough bounded by steep gradients, particularly in the east.

The Coolcalalaya Gravity Low coincides with the Coolcalalaya Basin. The concept of the Byro and Coolcalalaya Basins as an extension of the Perth Basin rather than the Carnarvon Basin is based substantially on gravity evidence, although the Byro Basin appears to have stratigraphic affinities with the Merlinleigh Basin, which is a sub-basin of the Carnarvon Basin.

Unit 2C Watheroo Gravity Depression

A well-defined Bouguer anomaly low bounded by steep gradients.

The Watheroo Gravity Depression corresponds to the Dandaragan Trough, an area of thick sediments in the Perth Basin.

Unit 2D Beagle Gravity High

A Bouguer anomaly high, open to the sea; west of the Watheroo Gravity Depression.

The Beagle Gravity High coincides with the Beagle Basement Ridge, the existence of which is confirmed by aeromagnetic, seismic, and drilling evidence.

Unit 2E Mandurah Gravity Rise

A slight Bouguer anomaly rise, open to the sea; south of the Watheroo Gravity Depression.

Although thick sediments have been indicated by seismic surveys and drilling, the sediments may be thinner than in the areas to the immediate north and south.

Unit 2F Bunbury Gravity Depression

An intense Bouguer anomaly low, bounded by steep gradients in the east and west, and open towards the sea in the north and south.

The Bunbury Gravity Depression corresponds with a graben of thick sediments which is separated by faults from shield areas to the east and west.

Province 3 CARNARVON REGIONAL GRAVITY COMPLEX

Characterised by the presence of gravity ridges and depressions which have an overall northerly trend. Bouguer anomalies range from +50 mGal in the south to -50 mGal in the eastern central part of the province. Seven units are defined.

The Carnarvon Regional Gravity Complex encompasses the Carnarvon Basin and part of the adjoining shield area. The concept of the Carnarvon Basin as consisting of a number of subsidiary basins separated by basement ridges was substantially derived from gravity interpretation. Later geophysical and drilling data have tended to confirm the original gravity interpretation. Over the basin area, gravity lows are interpreted as the expressions of sedimentary troughs, and gravity highs as basement ridges.

Unit 3A Ajana Gravity Spur

A northerly oriented gravity spur, bounded by a steep gradient along its eastern boundary and a gentler gradient to the west. The maximum Bouguer anomaly value is in excess of +50 mGal.

The Ajana Gravity Spur correlates with the Northampton Block of mid-Proterozoic granulites. The areal extent of the gravity spur suggests that the block extends to the north and west beneath the surface for some distance beyond its exposed part. The steep gradient along the eastern boundary of the feature coincides with a fault separating the Northampton Block from the Coolcalalaya Basin.

Unit 3B Wandagee Gravity Ridge

> A narrow sinuous gravity ridge which can be traced northwards from the Ajana Gravity Spur over the entire length of the Carnarvon Basin. A subsidiary ridge branches away from the main ridge in the south of the unit and follows the northern boundary of the Byro Gravity Low (Unit 2A).

The Wandagee Gravity Ridge corresponds to the Wandagee Ridge, a high-standing basement ridge which divides the Carnarvon Basin meridionally, and separates the Gascoyne Basin to the west from the Merlinleigh Basin to the east. The subsidiary gravity ridge passes through a Precambrian inlier north of the Byro Basin, and extends northeastwards to the shield area east of the Carnarvon Basin. Clearly, it represents a basement ridge separating the Byro and Merlinleigh Basins.

Unit 3C Gascoyne Gravity Depression

> A broad northerly oriented gravity low, open towards the sea, and characterized by smooth gravity relief and ill-defined contour trends. The unit becomes narrower towards the north.

The Gascoyne Gravity Depression corresponds to the Gascoyne Basin of mainly Palaeozoic and Mesozoic sediments. The eastern margin of the basin is the Wandagee Ridge.

Unit 3D Merlinleigh Gravity Depression

A well-defined north-northwest-trending Bouguer anomaly low, bounded by distinct gradients on all sides, except in the north where it terminates against a slight gravity saddle.

The Merlinleigh Gravity Depression extends over Permian outcrops in the eastern part of the Carnarvon Basin, and low Bouguer anomalies probably reflect the presence of a thick Permian and older sedimentary section. The basin is bounded to the west by the Wandagee Ridge, and the gravity saddle to the north may represent a basement ridge separating the Merlinleigh Basin from the Onslow Basin.

Unit 3E Onslow Gravity Low

A slight northerly trending Bouguer anomaly depression.

The Onslow Gravity Low corresponds to a known sedimentary embayment, the Onslow Sub-basin.

Unit 3F Exmouth Gravity High

A pronounced gravity high, covering most of the Northwest Cape. Maximum Bouguer anomaly values are in excess of +50 mGal. The unit is open towards the sea.

Seismic, drilling, and magnetic data have indicated that sediments are thick in this area. The high level of Bouguer anomaly therefore suggests that the basement beneath the sediments is composed of unusually dense rocks. Isostatic effects may contribute to the high Bouguer anomaly level.

Unit 3G Emund Gravity Shelf

An area of smooth gravity field in which Bouguer anomalies decrease from positive in the north to about -30 mGal in the south. Contour trends are northerly to northwesterly.

The Emund Gravity Shelf encompasses the western part of the Lower Proterozoic Gascoyne Block, which is mainly composed of medium to low-grade metasediments and granites. Although contour trends are generally parallel to structural trends, there are few instances where local gravity and geologic features can be correlated directly. The areas of lowest Bouguer anomaly roughly correspond to areas where granite is most abundant.

Province 4 AVON REGIONAL GRAVITY HIGH

> A regional Bouguer anomaly high, bounded on all three sides by gradients of various intensities. Bouguer anomalies decrease from positive in the west to about -20 mGal at the eastern province boundary.

The Avon Regional Gravity High occupies the southwest corner of the Archaean Yilgarn Block; granites and gneisses are the main rock types cropping out. Regionally high Bouguer anomalies have, on the basis of seismic refraction evidence, been attributed to the anomalously shallow depth of a dense low crustal layer (Everingham, 1965). The locus of the postulated crustal change from east to west is a zone of active seismicity, the Yandanooka/Cape Riche Lineament, which coincides with the eastern boundary of the province. Steep gradients along the western and southern province margins coincide with the Darling Fault and the northern boundary of a Proterozoic granitic outcrop respectively. Locally high Bouguer anomalies in the west of the province may be due to basic igneous outcrops or basic dyke swarms or both, which abound just east of the Darling Fault zone.

Province 5 ERABIDDY REGIONAL GRAVITY HIGH

> A Bouguer anomaly high characterised by gentle gravity gradients and northerly to northeasterly contour trends. It is bounded by a steep gradient in the west. Bouguer

anomaly values decrease from mainly positive in the west to about -30 mGal along the eastern province boundary.

The Erabiddy Regional Gravity High occupies the north-west corner of the Yilgarn Block. The province is comparable in size, general gravity pattern, and tectonic setting to the Avon Regional Gravity High (Province 4) and, by analogy, could reflect the relative shallowness of a dense lower crustal layer. High-grade metamorphic rocks and basic dyke swarms are comparatively abundant in this part of the Yilgarn Block, and may contribute to the high Bouguer anomaly level.

Province 6 NAREMBEEN REGIONAL GRAVITY SHELF

An area of fairly smooth gravity relief in which Bouguer anomalies are generally in the range -50 to -20 mGal. Local gravity highs are present in the vicinity of Southern Cross and Ravensthorpe.

The Narembeen Regional Gravity Shelf extends over a large part of the south-western Yilgarn Block. Broad gravity depressions of small amplitude are interpreted as the expression of granitic masses enclosed in slightly denser gneisses and migmatites. The local gravity highs can generally be correlated with outcrops of basic igneous rocks - the greenstone belts. The southern province boundary may correspond to the junction between the Archaean Yilgarn Block and the Proterozoic Albany-Fraser Province.

Province 7 AUSTIN REGIONAL GRAVITY COMPLEX

Characterised by discrete local gravity highs of amplitude 30 to 40 mGal, which are superimposed on a gravity surface of low mean Bouguer anomaly and smooth relief. The local highs are flanked by intense gradients, and are mostly aligned in a northerly direction.

The Austin Regional Gravity Complex covers a large area of the northwestern Yilgarn Block. The local gravity highs correspond to the greenstone belts of

basic igneous rocks, whereas the intervening areas of low Bouguer anomalies correspond to granitic or gneissic terrains. The predominant northerly trend of the local gravity highs is not clearly reflected in the outcrop pattern of the greenstone belts, which appear to be more north-northwesterly trending.

Province 8 CAREY REGIONAL GRAVITY COMPLEX

> Characterised by elongate local gravity features which have a predominant north-northwesterly trend. The local gravity highs are longer, less intense, and have a different overall trend from those in the adjoining Austin Regional Gravity Complex (Province 7) to the west, and it is on these criteria that the two provinces are distinguished.

The Carey Regional Gravity Complex encompasses the Eastern Goldfields region of the Yilgarn Block and includes part of the Nabberu Basin in the north. Local gravity highs and lows in the exposed Archaean area can be correlated with greenstone and granitic outcrops respectively. The contrast in contour pattern between the Austin and Carey Regional Gravity Complexes reflects a regional difference in the shape and distribution of the greenstone belts in the two areas. The boundary between the two provinces marks the westward limit of the main nickel province of the Yilgarn Block, and coincides in the north with a postulated unconformity in which a younger greenstone sequence (predominant to the east) appears to overlie a basement of older greenstone and granite (exposed to the west) (Durney, 1972). It is possible, therefore, that the two gravity provinces correspond to discrete tectonic units.

Province 9 YEO REGIONAL GRAVITY SHELF

> Characterised by a fairly smooth gravity field with Bouguer anomalies generally in the range -40 to -60 mGal. Contour trends are mainly north-north-westerly, although a gravity high near the centre of the province has an easterly trend.

The Yeo Regional Gravity Shelf extends over parts of the Yilgarn Block and the Nabberu and Officer Basins. There is no abrupt change in either contour pattern or Bouguer anomaly level associated with the shield margin, suggesting that the Yilgarn Block continues eastwards as basement under the sedimentary cover at least as far as the eastern boundary of the province. Seismic results give no indication of a supra-basement structural feature associated with the easterly trending gravity high, implying that it is caused by an intrabasement mass excess. The province as a whole may represent a tectonic subdivision of the Yilgarn Block.

Province 10 PORONGORUP REGIONAL GRAVITY LOW

> An elongate easterly trending gravity depression bounded to the north and south by gradients of at least 2 mGal/km. It is open towards the sea in the east.

The Porongorup Regional Gravity Low coincides with an extensive outcrop of Proterozoic granite which adjoins the southern part of the older Yilgarn Block. The granite is probably in the form of a steep-sided pluton extending to a depth of about 10 km. It is possibly the granitic core of a Proterozoic orogenic zone, marginal to the Yilgarn Block.

Province 11 RASON REGIONAL GRAVITY LOW

> An arcuate gravity trough of varying width and amplitude, in which Bouguer anomaly values generally range from -60 to -100 mGal. Two units have been defined.

The well-developed southern part of the province extends along the southeastern margin of the Yilgarn Block, and is clearly attributable to a regional mass deficiency within the crystalline Precambrian crust. It is, therefore, inferred that the northern part of the province, which extends across the western Officer Basin, is caused by a mass deficiency beneath the basin.

The geological significance of the mass deficiency is uncertain, but its parallelism with major gravity ridges corresponding to Proterozoic mobile belts, suggests that it is related to Proterozoic tectonic activity. Possibly, it corresponds to a zone extending along the southeast margin of the Yilgarn Block, where crustal thickening occurred as a result of severe compression associated with the formation of the Fraser Range metamorphics.

Unit 11A Dundas Gravity Trough

An intense northeast-trending gravity depression bounded by a steep gradient (up to 10 mGal/km) in the east and a less steep gradient in the west. The unit contains three separate minima of less than -90 mGal, separated from each other by gravity spurs extending southeastwards from the Carey Regional Gravity Complex (Province 8).

Although the Dundas Gravity Trough is believed to relate primarily to a regional and probably deep crustal mass deficiency, local gravity relief can be correlated with surface geological features. The southern two gravity minima roughly coincide with granitic outcrops near the southeastern margin of the Yilgarn Block, and the gravity spur separating them corresponds to the southern end of an Archaean greenstone belt. The steep gradient along the eastern margin of the trough correlates with the inferred Fraser Fault separating the Yilgarn Block from the Fraser Range metamorphics.

Unit 11B Lennis Gravity Trough

A broad arcuate belt of depressed Bouguer anomalies bounded by gentle gradients along its margins; less intense than the Dundas Gravity Trough.

The Lennis Gravity Trough extends across the western Officer Basin. Known thick sedimentary sections may contribute to the depressed Bouguer anomaly field, but consideration of the unit in its regional context

suggests that it corresponds to a mass deficient zone within the basement or the deep crust.

Province 12 FRASER REGIONAL GRAVITY RIDGE

A narrow sinuous gravity ridge of various amplitudes and intensities extending north-eastwards from near Esperance, in the south, to the western part of the Musgrave Block. It has been divided into four units.

The Fraser Regional Gravity Ridge evidently corresponds to a Proterozoic metamorphic belt bordering the Yilgarn Block to the southeast. The most intense part of the ridge encompasses the Fraser Range metamorphics, composed largely of garnet gneisses, pyroxene granulites, and gabbros, and bounded to the west by the Fraser Fault. In the north of the province, Precambrian basement is obscured by sediments of the Officer Basin.

Unit 12A Muncalinup Gravity High

A broad high, bordered by gentle gradients along its landward margins, and open towards the sea.

High Bouguer anomalies can be attributed to dense Proterozoic metamorphic rocks, which crop out in the unit.

Unit 12B Mount Andrew Gravity Platform

A northeasterly trending elongate belt of high Bouguer anomalies, bounded to the east and west by gentle gradients. The unit includes an intense local high of amplitude 30 mGal in the south.

The gentle gravity gradients along the margins of the unit could reflect either gradual density changes near the surface or sharper changes at depth. The local high in the south of the unit lies on the southerly projection of the intense gravity ridge associated with the Fraser Range metamorphic belt, and is probably

the expression of a near-surface body of dense basic metamorphic rock. Cainozoic sediments obscure most of the Proterozoic basement in the area and prevent positive correlation of the feature with its source.

Unit 12C Kitchener Gravity Ridge

> An intense rectilinear gravity ridge, bounded to the east and west by gradients of up to 10 mGal/km. There are three closed maxima of positive Bouguer anomaly, the southernmost of which culminates in a peak Bouguer anomaly value of more than +40 mGal at Fraser Range.

Anomalously high Bouguer anomaly values are attributable to dense pyroxene granulites, which form prominent outcrops in the Fraser Range area. The granulite body may extend to a depth of about 10 km, assuming that its mean density is 0.3 gm/cm^3 greater than that of granites to the northwest. The steep gradients along the margins of the unit correspond to inferred faults, which must have had significant vertical throw. The Fraser Fault in the west appears to be southeast dipping and, from the spatial relation between the gravity gradient and surface geological changes, reverse. Locally high Bouguer anomalies at Fraser Range may be associated with a flat-lying olivine gabbro sheet cutting across the granulites.

Unit 12D Neale Gravity Ridge

> An elongate sinuous zone in which Bouguer anomalies are generally 20 to 40 mGal higher than in surrounding areas. It is bounded along its margins by gentle gradients. In the central part of the unit there is an east-northeasterly trending local high of about 40 mGal amplitude.

High Bouguer anomaly values probably reflect the presence of dense Proterozoic metamorphic rocks within the basement of the Officer Basin, as evidenced by the colinearity of the unit with the Fraser Range metamorphic belt. The sedimentary section undoubtedly has an

attenuating effect on gravity relief. The intense local high near the centre of the unit is probably the expression of a body of dense granulites similar to those which crop out near Fraser Range.

Province 13 EYRE REGIONAL GRAVITY COMPLEX

A broad area of generally disturbed gravity contour pattern to the east of the Fraser Regional Gravity Ridge (Province 12). It is bounded on its landward margin by gravity gradients, and is open towards the sea. Four units are defined.

The Eyre Regional Gravity Complex covers the western part of the mainly Cretaceous to Tertiary Eucla Basin, but also includes Proterozoic outcrops in the south-west. High Bouguer anomaly gradients in the province support previous indications that the Eucla Basin sediments form only a thin layer over a crystalline basement. The general contour pattern is similar to that over the Yilgarn and Pilbara Blocks, suggesting that the province corresponds to a Precambrian craton consisting of crystalline rocks of various densities.

Unit 13A Gambanga Gravity Low

An elongate northeasterly trending low with a minimum Bouguer anomaly value of -60 mGal in the north of the unit.

The Gambanga Gravity Low extends over Proterozoic granites and gneisses in the west and sediments of the Eucla Basin in the east. Low Bouguer anomaly values are attributed to the presence of Proterozoic crystalline rocks of low density.

Unit 13B Seemore Gravity Low

Similar to the Gambanga Gravity Low, from which it is separated by a gravity ridge.

The Seemore Gravity Low is attributed to low density crystalline rocks in the Precambrian basement rather than to thick sediments.

Unit 13C Loongana Gravity Complex

> Characterised by intense local highs of 20 to 30 mGal amplitude. Contour trends swing from northerly in the south to north-northeasterly in the north.

The disturbed character of the contour pattern indicates sharp density contrasts at shallow depths beneath the Eucla Basin sediments. The local highs may be caused by basic igneous bodies enclosed within a mainly gneissic basement.

Unit 13D Madura Gravity High

> An irregular area of high Bouguer anomaly, extending from the coast to various distances inland. Its northwestern extremity is sharply truncated by the Fraser Regional Gravity Ridge. It is open towards the sea.

The Madura Gravity High corresponds to an area of dense and probably metamorphosed basement. The gravity rise towards the coast may be partly accounted for by the transition from continental to oceanic type crust.

Province 14 TEANO REGIONAL GRAVITY LOW

> A broad easterly trending gravity trough, bounded by steep gradients in the south and gentler gradients in the north. There are three separate minima in which the Bouguer anomaly value is less than -100 mGal.

The Teano Regional Gravity Low flanks the northern Yilgarn Block and correlates in part with Lower Proterozoic metamorphics of the Gascoyne Block and the northern Nabberu Basin. As metamorphic areas are normally associated with regional gravity highs, it is inferred that the source of the gravity depression is deep crustal or sub-crustal rather than near surface. It is possible that the province corresponds to a zone where crustal thickening occurred in Proterozoic times, as a result of severe tectonic activity in the region between the Yilgarn and Pilbara Blocks. The province

is one of several elongate gravity depressions which extend around the margin of the Yilgarn Block, and all may have some tectonic affinity.

Province 15 FORTESCUE REGIONAL GRAVITY COMPLEX

An oval-shaped province of generally disturbed gravity pattern and relatively low Bouguer anomaly level. The gravity field consists of intense disjointed local highs and lows which tend to be elongated in northeasterly or northwesterly directions. The average Bouguer anomaly level drops from close to zero in the north to about -60 mGal in the south of the province. Four units have been defined.

The Fortescue Regional Gravity Complex covers the Archaean Pilbara Block of granites, greenstones, and basic igneous intrusions, and most of the Lower Proterozoic Hamersley Basin to the south. The province encompasses a partly-buried Archaean craton, of which the Pilbara Block is only the exposed part. Local gravity variations are attributed to density variations within the Archaean basement.

Unit 15A Talga Gravity Complex

Characterised by intense local gravity highs and lows which tend to be elongate to either the northeast or the northwest. Bouguer anomalies, averaging about zero, are higher than in the other three units of the province.

The Talga Gravity Complex covers a large portion of the Archaean Pilbara Block. Local variations in gravity level correspond closely to variations in outcrop geology with intense gravity highs and lows associated with greenstone bodies and granitic intrusions respectively. Steep gradients in the gravity field reflect sharp density contrasts and steeply dipping contacts between the greenstone and granitic masses. The vertical extent of the larger greenstone bodies exceeds 4 km.

Unit 15B Pyramid Gravity Complex

Characterised by local highs and lows trending mainly northeast or northwest. Bouguer anomalies are mainly in the range 0 to -60 mGal.

Sediments of the Hamersley Basin cover most of the area of this unit, but local gravity relief is attributed to lateral density variations in the Archaean basement. This is inferred from the similarity in contour pattern between this unit and the Talga Gravity Complex, where Archaean basement is exposed.

Unit 15C Roy Hill Gravity Low

Characterised by regionally low Bouguer anomalies, generally ranging from -30 to -80 mGal. The contour pattern is less disturbed than in other parts of the province, although there are several local highs and lows of sharp intensity.

Regionally low Bouguer anomalies are evidently caused by the low density of basement rocks rather than sediments of the Hamersley Basin. Proterozoic sediments are absent in the north of the unit, where low Bouguer anomalies occur over Archaean granite, and local gravity lows are also associated with Archaean granitic inliers in the Hamersley Basin.

Unit 15D Balfour Downs Gravity Shelf

Bouguer anomalies average about 20 mGal higher than in the Roy Hill Gravity Low. The contours have a general north-northwesterly trend.

Basement over most of the unit is obscured by sediments of the Hamersley and Bangemall Basins. Local gravity features have no apparent correlation with surface geology, and are interpreted as the result of density variations in the Archaean basement. The eastern margin of the unit evidently corresponds to the Archaean/Proterozoic boundary, as it is close to and

parallel with an elongate outcrop of Proterozoic granite, the westernmost of a number of Proterozoic granites cropping out in the Paterson Province.

Province 16 ASHBURTON REGIONAL GRAVITY RIDGE

> A 60 to 100-km wide belt of comparatively high Bouguer anomalies extending arcuately round the southern margin of the Fortescue Regional Gravity Complex (Province 15). Gravity relief is smooth and regional contour trends are generally parallel to the province margins. The province is most clearly definable in the west; the eastern part is indistinct, but is interpreted to swing northwards to join the Anketell Regional Gravity Ridge (Province 17).

The Ashburton Regional Gravity Ridge corresponds to the partly exposed Ophthalmia-Gascoyne fold belt, which consists of low-grade metasediments and granites of early Proterozoic age, and overlying sediments of the mid-Proterozoic Bangemall Basin. The fold belt lies in the periphery of an Archaean craton and is, therefore, similar in tectonic setting to the Paterson Province and the Fraser Range metamorphic belt, both of which are associated with gravity ridges. High Bouguer anomalies may indicate the presence of relatively dense regionally metamorphosed rocks at depth.

Province 17 ANKETELL REGIONAL GRAVITY RIDGE

> A sinuous generally southeasterly trending gravity ridge, extending from the Northwest Continental Shelf to the western part of the Musgrave Block. Two units have been defined.

The high Bouguer anomalies are attributed in general, to dense metamorphosed rocks of a Proterozoic mobile zone. The northern part of the province encompasses Proterozoic metamorphics of the Paterson Province and the southern part presumably represents a subsurface continuation of the Proterozoic metamorphics beneath the Canning Basin. The postulated mobile zone appears to have tectonic affinities with both the Central and

West Australian Orogenic Provinces, as the gravity province is continuous with both the Fraser Regional Gravity Ridge (Province 12) along the southeast margin of the Yilgarn Block, and the Blackstone Regional Gravity Ridge (Province 55) over the Musgrave Block in central Australia. It is possible that metamorphism within the area of the province occurred during two periods - an earlier one associated with orogenic activity along the margin of the protocontinent comprising the Yilgarn and Pilbara Blocks, and a later one, probably in mid to late Proterozoic times, associated with the development of the Central Australian Orogenic Province.

Unit 17A Paterson Gravity Ridge

A broad rectilinear southeasterly trending gravity ridge, bounded to the east and west by strong gradients. The contour pattern is disturbed and contains several local features, which are mostly aligned parallel to the orientation of the province.

Although thin sediments of the Canning Basin extend across the northern and southern parts of this unit, major gravity relief is attributed to dense Proterozoic rocks within the basement. This is indicated by the approximate coextensiveness of the unit with the Paterson Province, which consists of mid-Proterozoic low to medium grade metamorphics and granite.

Unit 17B Warri Gravity Ridge

A sinuous south-easterly trending gravity ridge of varying width, containing several local highs and lows. This gravity ridge is narrower, of lower average amplitude, and of smoother contour pattern than the Paterson Gravity Ridge.

Sediments of the Canning and Officer Basins entirely obscure the Precambrian basement over the area of this unit. By virtue of its continuity with the Paterson

Gravity Ridge, which is clearly attributable to dense Proterozoic rocks, the unit is interpreted as representing a dense zone within the basement. Seismic and magnetic evidence indicate that the unit also corresponds to a high standing basement ridge, which may be the boundary between the Canning and Officer Basins.

Province 18 BARROW REGIONAL GRAVITY LOW

> A northeast-trending gravity depression, following the seaward margin of the Fortescue Regional Gravity Complex (Province 15). The province is fairly easily definable in the region of Barrow Island, but becomes less distinct towards the northeast. It contains several local gravity lows.

Mesozoic sediments are thick within the area of the province and these must contribute to the depressed Bouguer anomaly field. From west to east the province can be correlated with parts of the Barrow, Dampier and Bedout Sub-basins. However, density variations within the Precambrian basement probably have some influence on the contour pattern.

Province 19 MONTEBELLO REGIONAL GRAVITY RIDGE

> A prominent northeast-trending gravity ridge, extending parallel to the Barrow Regional Gravity Low, from which it is separated by a steep gradient.

The Montebello Regional Gravity Ridge borders the interpreted offshore extension of the Pilbara Block and is analogous to the Anketell and Ashburton Regional Gravity Ridges (Provinces 16 and 17), which border the Pilbara Block on land, and which have been correlated with Proterozoic mobile zones. It may therefore be inferred that the Montebello Regional Gravity Ridge is the expression of a zone of dense Proterozoic rocks in the basement. Geophysical and drilling evidence indicate that this inferred Proterozoic mobile zone is buried beneath thick Mesozoic sediments.

Province 20 MUNRO REGIONAL GRAVITY PLATFORM

A northwesterly elongated area of moderate Bouguer anomaly variation. Trends are mainly northwesterly onshore, but swing to a more westerly direction offshore. The province has been divided into three units.

The Munro Regional Gravity Platform corresponds broadly to the western central Canning Basin.

Unit 20A La Grange Gravity Platform

Onshore this unit consists of linear gravity highs trending northwest. Offshore it includes a westerly trending high of irregular shape and about 10 to 15 mGal amplitude. Bouguer anomalies range from +10 to -25 mGal.

The La Grange Gravity Platform corresponds to an area of flat-lying Mesozoic and Palaeozoic sediments with basement at an average depth of about 1500 m. The gravity features are probably due to intrabasement density variations. Strong magnetic features occur in the offshore part of the unit, and the westerly trending gravity high is flanked by a positive magnetic feature to the north and a negative feature to the south. It is likely that the gravity and magnetic features are caused by a basic intrusive body within the basement.

Unit 20B Oasis Gravity Depression

A shallow Bouguer anomaly depression with two local culminations near the southern margin. Gradients within the unit are small, but the northeastern boundary is a distinct linear gradient. Bouguer anomaly values range from -10 to -40 mGal.

Drilling results indicate the presence of at least 2500 m of mainly Palaeozoic sediments, which may partly be the cause of the low Bouguer anomalies.

Unit 20C Joanna Gravity Ridge

An easterly trending gravity ridge with several local culminations.

The Joanna Gravity Ridge corresponds with a zone of high magnetic intensity. Seismic results indicate an anticlinal closure coincident with part of the gravity ridge, suggesting that high Bouguer anomalies are at least caused by a basement ridge.

Province 21 SOUTH CANNING REGIONAL GRAVITY LOW

A broad area of low Bouguer anomaly level and smooth contour pattern, bounded by sinuous gravity ridges. It appears to be continuous into the Petermann Regional Gravity Low (Province 54) to the south. Contour trends range from northerly to north-westerly. Two units are defined.

The South Canning Regional Gravity Low extends over the southwestern part of the Canning Basin, including the Kidson and Joanna Springs Sub-basins. Geophysical and drilling data suggest variations in gravity level correspond to variations in depth to basement.

Unit 21A Sahara Gravity Shelf

Average Bouguer anomaly value about -30 mGal; several local depressions of 15 to 30 mGal relief.

Regionally low Bouguer anomalies within this unit are at least partly caused by thick sediments. Local gravity depressions can be correlated with the Joanna Springs Sub-basin and the western part of the Kidson Sub-basin.

Unit 21B Reeves Gravity Low

A broad gravity depression with Bouguer anomalies mainly in the range -40 to -70 mGal.

An examination of the gravity results in relation to seismic, magnetic, magnetotelluric and drilling data indicate that this unit corresponds to an area of thick sediments. Local gravity depressions in the south of the unit may be the expressions of local troughs.

Province 22 ANGAS REGIONAL GRAVITY HIGH

> An elongate northerly trending gravity high of about 50 mGal amplitude, which truncates the pronounced easterly trending gravity features of the central Australian region.

The Angas Regional Gravity High covers a portion of the South Canning Basin. Seismic, magnetic and magnetotelluric data indicate that basement becomes shallower as the gravity province is approached from the west, suggesting that high Bouguer anomalies are at least partly caused by a basement topographic rise. However, a basement inlier in the south of the province is not locally associated with high Bouguer anomalies, suggesting that the gravity high cannot be interpreted in terms of basement topography alone; part of the gravity relief may be due to an increase in basement density. The truncation of easterly gravity trends by the province suggests that the eastern boundary corresponds to the westward limit of the tectonic regime which predominates in central Australia.

Province 23 FITZROY REGIONAL GRAVITY COMPLEX

> A southeasterly elongated province in which many of the individual gravity features have the same trend. Bouguer anomaly values range from -40 to +40 mGal. Four units have been defined.

The Fitzroy Regional Gravity Complex correlates roughly with the Fitzroy Trough, a major Phanerozoic sub-basin within the more extensive Canning Basin. Geological and geophysical studies suggest that gravity relief is controlled partly by intrabasement density contrasts,

and partly by variations in thickness of post-Carboniferous sediments.

Unit 23A Napier Gravity Trough

A narrow gravity trough on the northeast margin of the province.

The Napier Gravity Trough coincides in part with Lower Proterozoic outcrops of the western limb of the Halls Creek Province. Low Bouguer anomaly values probably reflect an abundance of high-level granitic rocks.

Unit 23B Oscar Gravity Ridge

A northwesterly trending gravity ridge of varying width and amplitude. It includes several local culminations where Bouguer anomalies are positive.

The Oscar Gravity Ridge extends over metamorphic outcrops of the Halls Creek Province and sediments of the Lennard Shelf and Fitzroy Trough. The gravity feature as a whole probably relates to dense rocks within the Halls Creek Province, including its sub-surface extension to the southwest. However, the gradient along the southwest margin of the unit partly coincides with the Pinnacle Fault, and may reflect deepening of sediments into the Fitzroy Trough.

Unit 23C Noonkanbah Gravity Trough

An elongate northwesterly trending area of irregular shape, in which Bouguer anomaly values range from zero to -40 mGal.

The Noonkanbah Gravity Trough corresponds to the central part of the Fitzroy Trough in the east, and the Jurgurra Terrace in the west. Gradients along the southwest and northeast margins of the eastern part of the unit coincide with the Fenton and Pinnacle Faults respectively, and low Bouguer anomalies are attributed to thick Upper Palaeozoic sediments.

Unit 23D Broome Gravity Ridge

A well-defined Bouguer anomaly ridge along the southwestern margin of the province.

The northeast margin of the Broome Gravity Ridge is a prominent gradient which coincides with the Fenton Fault. The surface of a high basement ridge is well established by drilling and seismic results at the western end of the gravity ridge. The unit as a whole is thought to represent a basement ridge, the gravity results showing the composite effect of a basement uplift and density increase.

Province 24 ORD REGIONAL GRAVITY DEPRESSION

An arcuate gravity trough with an easterly trend in the south and a northeasterly trend in the north. Bouguer anomaly values range from -20 to -60 mGal with moderate gravity gradients predominating. The province has been divided into four units.

Unit 24A Rosewood Gravity Low; Unit 24B Hardman Gravity Low; Unit 24C Flora Gravity Low; Unit 24D Mount Bannerman Gravity Depression.

The Hardman Gravity Low coincides with the major development of the Ord Basin, although it is slightly offset. It has been estimated that the Ord Basin contains about 300 m of Cambrian sediments and volcanics, but the magnitude of the gravity depression indicates that up to 3000 m of sediments, probably of mainly Proterozoic age, could be present. The Mount Bannerman Gravity Depression extends into the Canning Basin at right angles. This is interpreted as reflecting the continuity of thick Proterozoic sediments between the southern Ord Basin and the Fitzroy Trough.

Province 25 SPRINGVALE REGIONAL GRAVITY RIDGE

A small but distinctive gravity ridge, trending in a north-northeasterly direction and bounded by steep gradients of up to 4 mGal/km.

Bouguer anomaly values range from -30 to +65 mGal.

The Springvale Regional Gravity Ridge correlates with a fault-bounded area of high grade metamorphics in the Halls Creek Province. Local peaks within the gravity ridge are probably caused by dense basic igneous intrusions.

Province 26 KIMBERLEY REGIONAL GRAVITY PLATFORM

No well-defined Bouguer anomaly trend, although the broader gravity features tend to be aligned with the nearest boundary of the province. The contour pattern is markedly smooth with Bouguer anomaly values averaging about zero. Five units are defined.

The Kimberley Regional Gravity Platform correlates closely with the Kimberley Basin of sub-horizontal Carpentarian sediments and volcanics. The exceptional smoothness of the gravity pattern indicates that lateral density variations within both the sedimentary section and the basement are negligible. Faulting has little effect on the contour pattern. The alignment of features parallel to the boundaries of the basins reflects post-depositional warping of a flat-lying basin.

Unit 26A Durak Gravity Low

A broad northeasterly trending low of small amplitude along the southeastern province margin.

The Durack Gravity Low is attributed to thickening of sediments in the southeastern part of the Kimberley Basin.

Unit 26B Glenroy Gravity Low

An elongate northwesterly trending low along the southwest province margin.

The sedimentary cover appears from geological evidence to be thinner in this unit than in the Durack Gravity Low, suggesting that low Bouguer anomalies are caused mainly by an intrabasement mass deficiency.

Unit 26C Hann Gravity Shelf

No well-defined trends are evident within this unit.

The Hann Gravity Shelf covers most of the western part of the Kimberley Basin, but there is no apparent correlation between gravity and regional geology.

Unit 26D Archipelago Gravity Rise; Unit 26E Berkeley Gravity Ridge

Broad gravity highs along the northwest and northeast margins of the province.

These features may be related to a structural high in the Archaean or Lower Proterozoic basement complex underlying the edges of the Kimberley Basin.

Province 27 BROWSE REGIONAL GRAVITY LOW

Two broad gravity depressions separated by an indistinct easterly trending gravity ridge.

The Browse Regional Gravity Low corresponds in part with the Browse Basin. Basement is shallow in the region of the Leveque Platform in the southern part of the province, and low Bouguer anomalies probably reflect low density basement rocks. The gravity low in the north roughly coincides with the deepest known part of the Browse Basin. It is suggested that the indistinct easterly trending gravity ridge corresponds to a basement ridge.

Province 28 BONAPARTE REGIONAL GRAVITY COMPLEX

The most distinctive feature of this province is the central zone of high Bouguer anomalies bordered by a V-shaped gravity low. Bouguer

anomaly values range from -20 to +75 mGal. Five units have been defined.

Unit 28A North Bonaparte Gravity Shelf; Unit 28B Wickham Gravity High; Unit 28C West Bonaparte Gravity Low Unit 28D South Bonaparte Gravity Low; Unit 28E East Bonaparte Gravity Low.

Magnetic, seismic and drilling data have established the presence of thick sediments of the Bonaparte Gulf Basin over the area of this province. Contrary to expectations, the sediments appear to be thickest over the central zone (Units A and B), which has the highest Bouguer anomaly level. The high Bouguer anomalies could thus relate to the presence of high-density material, such as limestone or basic igneous rocks, within the sedimentary section or to a dense zone within the basement. The regional setting of the province suggests that the latter explanation is more likely. The Wickham Gravity High is similar in shape, area and amplitude to the Springvale Regional Gravity Ridge (Province 32), which has been correlated with dense metamorphic and basic igneous rocks of the Halls Creek Province. As the Wickham Gravity High lies on the northerly projection of the Halls Creek Province, it can be inferred that high Bouguer anomaly values are due to dense rocks within the Proterozoic basement.

Province 29 CARTIER REGIONAL GRAVITY SHELF

An elongate northeasterly trending area with two gravity highs in the central and southern parts of the province and a gravity low in the north. Bouguer anomaly values range from +15 to +60 mGal.

The Cartier Regional Gravity Shelf encompasses the western part of the Bonaparte Gulf Basin and the north-eastern part of the Browse Basin. The gravity low lies on the axis of the Cartier Trough, where thick Triassic sediments are present. The two gravity highs cannot be correlated with known basin structures, and may

correspond to intrabasement mass excesses.

Province 30 TIMOR REGIONAL GRAVITY LOW

> Only a portion of this large gravity trough has been defined. The province has an east-northeasterly trend and is bounded by steep gradients. Bouguer anomaly values range from -50 to +60 mGal.

The axis of the Timor Regional Gravity Low is situated between the axis of the Timor Trough and the island of Timor. Low Bouguer anomalies probably reflect crustal thickening caused by overthrusting of the Timor plate on to the Australian plate. Seismic and drilling data indicate a major northwest-dipping thrust fault along the axis of the Timor Trough.

Province 31 SAHUL BANK REGIONAL GRAVITY RIDGE

> A prominent arcuate gravity ridge trending in an east-northeasterly direction. Individual Bouguer anomaly features are mainly aligned parallel to this trend, although there are subsidiary northerly trends in the east and west of the province. Bouguer anomaly values range from +50 to +80 mGal.

The Sahul Bank Regional Gravity Ridge correlates roughly with a regional structural high, the Sahul Ridge, although the gradient along the northern margin of the province may partly reflect an increase in crustal thickness to the north.

Province 32 WEST ARAFURA REGIONAL GRAVITY PLATFORM

> An easterly trending gravity province open towards the east. Bouguer anomaly values range from +30 to +60 mGal.

No correlation between gravity relief and geology is evident, but elongation of the province parallel to structure contours of the base of the Mesozoic section does indicate sediment thickening northwards.

Province 33 WANGITES REGIONAL GRAVITY RIDGE

A northerly trending gravity ridge with an average width of about 80 km. The maximum Bouguer anomaly values along the crest of the ridge decrease southward from +75 to +10 mGal.

The Wangites Regional Gravity Ridge correlates in part with the Litchfield Block of Precambrian metamorphics. The eastern province boundary in the south roughly coincides with the northern part of the Halls Creek Fault. There is no evidence in the gravity contour pattern for structural continuity of the Litchfield Block and the Halls Creek Province. However, the gravity ridges corresponding to the two orogenic domains are aligned, and both are partly flanked by the Halls Creek Fault, suggesting that the two areas have tectonic affinities.

Province 34 MARY REGIONAL GRAVITY SHELF

A wedge-shaped province bounded by well-defined gradients to the north and west. Bouguer anomaly values range from +15 to +40 mGal. Two units have been defined.

The Mary Regional Gravity Shelf correlates with the Pine Creek Geosyncline in the south and Mesozoic sediments of the eastern Bonaparte Gulf Basin in the north.

Unit 34A Marrakai Gravity Plateau

A broad gravity high in the southern part of the province.

The undisturbed character of the contour pattern suggests that the density contrasts are small within this part of the Pine Creek Geosyncline.

Unit 34B Van Diemen Gravity Low

A broad north-northeast-trending Bouguer anomaly low characterised by low gravity gradients.

The Van Diemen Gravity Low is postulated to reflect the presence of low density rocks in the Proterozoic basement. Mesozoic sediments are not known to attain a thickness of much more than 500 m and probably do not contribute greatly to the gravity low.

Province 35 OENPELLI REGIONAL GRAVITY COMPLEX

> Characterised by fairly intense local features which show no consistent trend. The province boundaries are rather arbitrarily defined. Bouguer anomaly values range from close to zero in the south to a maximum of +50 mGal in the north of the province.

The Oenpelli Regional Gravity Complex extends over the eastern part of the Pine Creek Geosyncline and the western margin of the McArthur Basin. High Bouguer anomalies in the north of the province reflect the presence of relatively high-grade metamorphic rocks, and local highs in the south correlate roughly with basic intrusive outcrops. Local gravity lows are attributed to granites.

Province 36 ARNHEM REGIONAL GRAVITY PLATFORM

> Average Bouguer anomaly value about zero and gradients low. No regional trends are obvious. Bouguer anomaly values range from -10 to +20 mGal.

The Arnhem Regional Gravity Platform covers the northern McArthur Basin, which consists of Carpentarian sediments and volcanics. There is little correlation between gravity relief and known structures within the basin, although gravity lows in the northeast may be related to granitic outcrops in the area and indicate a series of batholiths at depth. The regional gravity pattern is very similar to that of the Kimberley Regional Gravity Platform (Province 26), which correlates with a basin of early Carpentarian sediments and volcanics. It is suggested that the two regions have geological affinities with respect to both basement and

sedimentary cover.

Province 37 ELCHO REGIONAL GRAVITY HIGH

A distinctive gravity spur open towards the north. Bouguer anomaly values range from +20 to +70 mGal.

The Elcho Regional Gravity High correlates with the northern part of a faulted horst structure over which Archaean (?) metamorphic basement and Lower Proterozoic sediments and volcanics crop out. The faults bounding the horst have had a long history of recurrent movement, and it is inferred from geological studies that the fault-bounded area was a graben during the development of the McArthur Basin, but was later uplifted by up to 7 km to form a horst. The existence of the regional gravity high supports the view that the horst is the surface expression of a major zone of crustal uplift.

Province 38 TIPPERARY REGIONAL GRAVITY LOW

A small-amplitude gravity low with Bouguer anomaly values ranging from +25 mGal in the north of the province to -20 mGal in the south.

The Tipperary Regional Gravity Low extends over parts of the Pine Creek Geosyncline in the north and the Daly River Basin in the south. A regional decrease in Bouguer anomaly level southwards across the province is attributed to a gradual thickening of Palaeozoic and Upper Proterozoic sediments by more than 1000 m.

Province 39 VICTORIA REGIONAL GRAVITY SHELF

The boundary between this and adjacent provinces is somewhat arbitrary. Bouguer anomaly values range from zero to -30 mGal and no significant trends are evident.

The Victoria Regional Gravity Shelf corresponds geologically with the northern part of the Victoria River

Basin, which contains subhorizontal Upper Proterozoic sediments. The northwestern province boundary roughly coincides with the Halls Creek Fault. It is uncertain whether Bouguer anomaly features are caused by variations in thickness of the sediments or by intrabasement density variations.

Province 40 BUCHANAN REGIONAL GRAVITY PLATFORM

Characterised by small gravity gradients. The average Bouguer anomaly level is about -20 mGal, which is slightly higher than in neighbouring provinces. Three units have been defined.

Unit 40A Inverway Gravity Ridge; Unit 40B Canfield Gravity Complex; Unit 40C Murranji Gravity Shelf

The Buchanan Regional Gravity Platform encompasses parts of the Wiso and Victoria River Basins. The high Bouguer anomaly level of the province suggests that it corresponds to an area of relatively shallow Proterozoic basement. Local gravity features may be caused by basement density variations.

Province 41 DUNMARA REGIONAL GRAVITY LOW

A broad northwest-trending gravity depression of small amplitude, bounded by gradients to the north, east, and south. Bouguer anomaly values range from zero to -45 mGal. Two units have been defined.

The Dunmara Regional Gravity Low can be correlated with Lower Palaeozoic sediments of the Daly River Basin. Gravity relief is interpreted in terms of variation in thickness of the Palaeozoic and possibly the underlying Adelaidean sediments.

Unit 41A Elsey Gravity Low

A shallow gravity depression trending northwesterly to westerly.

Local thickening of Palaeozoic and/or underlying Proterozoic sediments is postulated.

Unit 41B Amungee Gravity Low

A northerly trending gravity depression of about 25 mGal relief.

Local thickening of Palaeozoic and/or Proterozoic sediments is postulated.

Province 42 McARTHUR REGIONAL GRAVITY HIGH

A regional high, open towards the sea, in which Bouguer anomalies range from -35 to +40 mGal. Five units have been defined.

The McArthur Regional Gravity High correlates with parts of the McArthur, Georgina and Carpentaria Basins. Lower Proterozoic basement crops out in the central southern portion of the province. Bouguer anomaly variations are mainly attributed to basement density contrasts rather than sedimentary thickness variations.

Units 42A Boorooloola Gravity High

An extensive high in the western part of the province.

The Boorooloola Gravity High correlates in the north with an uplifted zone in which Carpentarian sediments and volcanics of the Tawallah Group are exposed. The southern part of the unit may represent the subsurface continuation of the uplifted zone beneath Phanerozoic and Adelaidean sediments.

Unit 42B Creswell Gravity Low

An east-northeasterly trending gravity depression attaining a minimum Bouguer anomaly value of -35 mGal.

Granite crops out near the southern margin of the Creswell Gravity Low. Low Bouguer anomalies could be due to extensive buried granites or a thick accumulation of sediments of the McArthur Basin or both.

Unit 42C Murphy Gravity Ridge

A narrow east-northeasterly trending gravity ridge along the southern margin of the province.

The eastern part of the Murphy Gravity Ridge correlates partly with Lower Proterozoic rocks of the Murphy Tectonic Ridge. The western part of the unit may delineate the subsurface extension of this feature into the Georgina Basin.

Unit 42D Burketown Gravity Plateau

An area of relatively small gravity relief in which Bouguer anomalies range from 0 to +40 mGal.

Mesozoic sediments of the Carpentaria Basin cover most of the area of this unit, which lies immediately to the north of a regional gravity high corresponding to the Mount Isa Geosyncline. It is probable that high Bouguer anomalies reflect the northward subsurface continuation of dense rocks of the geosyncline.

Unit 42E Murgullah Gravity Depression

A small arcuate gravity depression in which Bouguer anomalies range from -20 to +10 mGal.

The relatively low Bouguer anomalies could be due either to granite or to a local sedimentary trough.

Province 43 PELLEW REGIONAL GRAVITY HIGH

A partly defined sub-circular high in which Bouguer anomaly values range from zero to +50 mGal.

No definite correlation with geology is observed. The feature could be caused by a basement rise or a dense body within the basement.

Province 44 GEORGINA REGIONAL GRAVITY SHELF

Contains a variety of local gravity features of different trends and Bouguer anomaly levels. Most features are aligned in either northeasterly or northwesterly directions. Bouguer anomalies range from -55 to +15 mGal. Nine units have been defined.

The Georgina Regional Gravity Shelf extends over most of the Georgina Basin, but also includes parts of the Tennant Creek Block in the west, and the Toko Syncline, the Mount Isa 'Geosyncline', and the South Nicholson Basin in the east. Except over the Toko Syncline, the gravity pattern does not in general appear to be related to variations in depth to basement, and most gravity features are attributed to basement density variations.

Unit 44A Renner Gravity Plateau

A northwesterly elongated area in which Bouguer anomalies range from 0 to -20 mGal.

Partly coincides with an area of deformed mid-Proterozoic sediments to the north of the Tennant Creek Block.

Unit 44B Ooratippra Gravity High

A unit of relatively high Bouguer anomalies which has a marked northwesterly trend. Bouguer anomaly values range from -40 to +15 mGal.

The extension of the Ooratippra Gravity High beyond the outcrops of metamorphics of the Tennant Creek Block may define the subsurface continuation of the metamorphics.

Unit 44C Frewena Gravity Shelf

Characterised by gentle gravity gradients and a generally northeasterly trend of individual gravity features. Bouguer anomalies range from -35 to -10 mGal.

Gravity features are probably due to density variations within the basement.

Unit 44D Wonarah Gravity Low

An elongate northeasterly trending gravity low with local minima in the north and south. Bouguer anomalies range from -10 to -55 mGal.

The area of the Wonarah Gravity Low includes parts of the Proterozoic South Nicholson Basin in the north and the Davenport Geosyncline in the south. Low Bouguer anomaly values are attributed to a mass deficiency within the presumed Lower Proterozoic basement.

Unit 44E Lingaree Gravity Ridge

A northeasterly trending gravity ridge. Bouguer anomalies range from -20 to +5 mGal.

The Lingaree Gravity Ridge coincides with mid-Proterozoic sediments in the north and Cambrian sediments in the south. The unit correlates roughly with the northwest margin of an inferred downwarp within the Adelaidean sequence underlying the Cambrian sediments. It is suggested that the unit corresponds to a zone of Lower Proterozoic basement which is denser than that of Unit D, but shallower than that of Unit E.

Unit 44F Ammaroo Gravity Depression

An easterly trending gravity low containing a number of local Bouguer anomaly features. Both northwesterly and northeasterly trends are apparent. Bouguer anomalies range from -20 to -50 mGal.

The Ammaroo Gravity Depression extends over Lower Palaeozoic sediments of the southern Georgina Basin. The presence of a granitic inlier in the area of the unit suggests that low Bouguer anomaly values are at least partly caused by an intrabasement mass deficiency. However, a small northwest-trending local low, centred over the axis of a syncline, may reflect thickening of Palaeozoic sediments.

Unit 44G Sandover Gravity Low

A broad northeasterly trending gravity depression in which the contour pattern becomes increasingly disturbed from north to south. Bouguer anomalies range from -10 to -35 mGal.

The Sandover Gravity Low extends over Cambrian sediments of the Georgina Basin. However, the Cambrian sediments are relatively dense, and it is postulated that low Bouguer anomaly values are caused by thick sediments of Upper Proterozoic age. The gradient which forms the eastern boundary of the unit may mark the eastern limit of thick Upper Proterozoic sedimentation.

Unit 44H Tobermory Gravity Shelf

A unit of generally indistinct Bouguer anomaly features. Bouguer anomalies range from +5 to -30 mGal.

There is no apparent correlation between gravity relief and sedimentary development.

Unit 44I Toko Gravity Trough

An intense southeasterly trending gravity trough in which Bouguer anomalies range from 0 to -35 mGal.

The Toko Gravity Trough corresponds at its northern end with Palaeozoic sediments of the Toko Syncline. Further north, older and denser rocks of the syncline crop out and the gravity feature disappears. Sand and Mesozoic rocks cover the area to the southeast. It was postulated on the basis of the gravity data that the Toko Syncline plunges southeast under the Mesozoic cover and this was later confirmed by seismic results.

Province 45 LANDER REGIONAL GRAVITY LOW

A west-northwesterly trending gravity trough bounded by a steep gradient in the south and a gentler gradient in the north. Bouguer anomalies range from -25 to -75 mGal.

The Lander Regional Gravity Low coincides with the Lander Trough, a deep sub-basin in the southern part of the Wiso Basin. Although thick sediments undoubtedly contribute to the depression of Bouguer anomaly values, a component of gravity relief is probably caused by crustal downwarping and/or a regional mass deficiency within the basement.

Province 46 TANAMI REGIONAL GRAVITY COMPLEX

A number of intense local gravity features with predominant northeasterly and northwesterly trends. Bouguer anomalies range from -40 to +10 mGal.

The Tanami Regional Gravity Complex correlates with The Granites-Tanami Block, composed of Archaean or Lower Proterozoic metamorphics, and granite. The regional gravity pattern gives some indication of the structural relations between The Granites-Tanami Block and neighbouring metamorphic complexes. Northeasterly gravity contour trends, which cut across known northwesterly metamorphic trends may indicate the influence of the Halls Creek Orogeny on geological development in the area, although there is no evidence for a direct structural link between the Halls Creek Province and The Granites-Tanami Block. The contour pattern over The Granites-Tanami Block is much less regular than that over the adjoining Arunta Block, implying that the two areas have dissimilar geological histories.

Province 47 PEDESTAL REGIONAL GRAVITY LOW

A T-shaped gravity depression bounded by steep gradients in the south. Three units are defined.

Low Bouguer anomaly values are attributed to an intrabasement or deep crustal mass deficiency in the east, and to thick sediments of the eastern Canning Basin in the south and west.

Unit 47A Yam Gravity Low

An easterly trending gravity depression of irregular outline.

The Yam Gravity Low encompasses outcrops of Palaeozoic, late and mid-Proterozoic sediments and Proterozoic granite. The sediments are not known to attain a significant thickness, suggesting that low Bouguer anomalies reflect an intrabasement or deep crustal mass deficiency. The parallelism of the unit with major gravity troughs and ridges in the central Australian region, which are attributed mainly to deep crustal effects, suggests that the gravity low has a deep crustal cause.

Unit 47B Moody Gravity Low

A southerly trending gravity depression bounded by steep gradients in its southern half.

The Moody Gravity Low extends over Permian sediments near the eastern margin of the Canning Basin. The eastern boundary of the unit coincides with an inferred fault, and seismic and drilling data indicate the presence of thick sediments over the area of the unit. Assuming that the basement density is uniform, the sediments may be as thick as 4000 m.

Unit 47C Thornton Gravity Low

A shallow easterly trending gravity depression to the west of the Moody Gravity Low.

The Thornton Gravity Low extends over faulted Permian sediments, and, like the Moody Gravity Low, may correspond to a basement depression.

Province 48 WILLOWRA REGIONAL GRAVITY RIDGE

An easterly trending gravity ridge bounded to the north and south by steep gradients that diminish in magnitude from east to west.

Bouguer anomaly values range from -40 to +5 mGal.

The Willowra Regional Gravity Ridge occupies the northern part of the Arunta Block. Gravity modelling studies indicate that high Bouguer anomalies are caused by a regional crustal upwarp and/or a body of dense granulites and basic igneous rocks within the upper crustal layer. The northern margin of the gravity ridge corresponds closely to the faulted northern margin of the Arunta Block.

Province 49 YUENDUMU REGIONAL GRAVITY LOW

A slightly arcuate easterly trending gravity trough bounded to the north and south by steep gradients that decrease gradually westwards. Bouguer anomaly values range from -30 to -100 mGal. Two units have been defined.

Unit 49A Trever Gravity Low; Unit 49B Napperby Gravity Low

There are separate low Bouguer anomaly closures within each of these units.

The Yuendumu Regional Gravity Low can be correlated with the Ngalia Basin in the south, and part of the Arunta Block in the north. Seismic evidence indicates large scale over-thrusting from the north across the Ngalia Basin, and it has been postulated that the gravity low is the expression of a deep sedimentary basin, partly obscured by a thrust sheet of metamorphic material. However, seismic and magnetic results suggest that the basin is not deep enough to be the sole cause of the gravity low; an intrabasement mass deficiency or crustal thickening must contribute to the depression of Bouguer anomaly values.

Province 50 PAPUNYA REGIONAL GRAVITY RIDGE

A narrow intense easterly trending gravity ridge bounded on its northern and southern flanks by steep gradients. The maximum

amplitude of the feature is more than 150 mGal. Bouguer anomalies within the province range from -60 to +50 mGal.

The Papunya Regional Gravity Ridge can be correlated with metamorphics of the southern Arunta Block (i.e. that part of the Arunta Block lying between the Amadeus and Ngalia Basins). Gravity modelling studies indicate that the gravity ridge could be caused by:

(1) A body of dense granulites and basic igneous rocks in the upper crust, or

(2) A major crustal upwarp over which the mantle and lower crustal layer are anomalously close to the surface.

Wavelength analysis of the gravity feature indicates that the top of any dense body cannot be deeper than 13 km, which suggests that dense rocks must be present in the upper crustal layer, whether or not the crust is warped at greater depth.

Province 51 ILLOGWA REGIONAL GRAVITY HIGH

Local gravity features within this province have a predominant north-westerly trend. Bouguer anomalies range from -40 to +15 mGal. Three units have been defined.

Unit 51A Hay Gravity Low; Unit 51B Caroline Gravity Ridge; Unit 51C Hale Gravity Platform

Proterozoic metamorphics of the Arunta Block crop out in the northwest of the province, and Mesozoic sediments in the southeast. Gravity relief is closely attributable to intrabasement density contrasts rather than to variations in sedimentary thickness. The Caroline Gravity Ridge appears to connect the Papunya Regional Gravity Ridge (Province 50) with the Bedourie Gravity Ridge (Unit 88J). This suggests a possible tectonic relation between the concealed southern margin of the Mount Isa Geosyncline and the Arunta Block.

Province 52 AMADEUS REGIONAL GRAVITY LOW

A pronounced easterly trending gravity depression bounded by a steep gradient to the north and a gentler gradient to the south. The maximum amplitude of the feature is more than 150 mGal and Bouguer anomaly values range from -20 to -145 mGal. Four units have been defined.

Unit 52A MacDonald Gravity Shelf; Unit 52B Hermannsburg Gravity Depression; Unit 52C Maryvale Gravity Shelf; Unit 52D Todd Gravity Terrace

The Amadeus Regional Gravity Low corresponds with the northern part of the Amadeus Basin, but also includes Proterozoic metamorphics of the Arunta Block along its northern margin. A major basement overthrust from the north has been postulated to account for the offset of the northern Amadeus Basin and the gravity depression. However, gravity modelling studies based on seismically determined basin parameters show that the amplitude of the gravity depression is much larger than could be caused by sedimentary section alone. An intrabasement mass deficiency or crustal thickening must contribute to the gravity depression.

Province 53 OLGA REGIONAL GRAVITY RIDGE

A narrow easterly trending gravity ridge. Although the province is a relative gravity high, Bouguer anomalies are strongly negative, ranging from -80 to -40 mGal. Two units have been defined.

Unit 53A Bloods Range Gravity Ridge; Unit 53B Angas Downs Gravity Ridge

The Olga Regional Gravity Ridge extends over thrust sheets of mid-Proterozoic metamorphics of the northern Musgrave Block in the west, and Palaeozoic sediments of the Amadeus Basin in the east. The province is postulated to be due to either a dense zone within the basement, or to a zone of thin crust where the mantle and lower crustal layer are anomalously shallow.

Magnetic data give no evidence for a basement ridge associated with the feature.

Province 54 PETERMANN REGIONAL GRAVITY LOW

A sinuous easterly trending gravity trough in which Bouguer anomalies range from -40 to -130 mGal. Two units have been defined that correspond to separate minima in the eastern and western parts of the province.

The Petermann Regional Gravity Low extends over parts of the Musgrave Block and the southern Amadeus Basin. Low Bouguer anomalies were previously interpreted as the expression of a deep sedimentary trough partly obscured by metamorphic rocks overthrust from the south. Gravity modelling studies, however, indicate that the amplitude of the gravity depression is much larger than could be caused by the sedimentary section alone. An intrabasement mass deficiency or crustal thickening must contribute to the gravity depression.

Unit 54A Cobb Gravity Low

A pronounced gravity [illegible]n bounded by steep gradients in th[illegible]d west. Contour trends vary f[illegible]rly in the east to north-westerly in the west. Bouguer anomaly values are mainly in the range -40 to -100 mGal.

The Cobb Gravity Low must be partly caused by an intrabasement or deep crustal mass deficiency, but thick sediments, probably of mainly Adelaidean and Palaeozoic age, may contribute to the gravity low in the west.

Unit 54B Ayers Rock Gravity Low

An intense easterly trending gravity low bounded by a steep gradient in the south and a gentler gradient in the north. Bouguer anomaly values range from -50 to -130 mGal.

The same comments apply to this unit as apply to the province as a whole.

Province 55 BLACKSTONE REGIONAL GRAVITY RIDGE

An easterly trending, slightly arcuate gravity ridge bounded by strong gravity gradients. The western half of the province contains a number of intense local highs of up to +60 mGal, whereas the eastern half is of much smoother contour pattern. Three units have been defined.

The Blackstone Regional Gravity Ridge correlates with the Musgrave Block, and is composed predominantly of Proterozoic granulites, gneisses, granites, and gabbroic intrusions (mainly in the west). However, the gravity ridge covers only the central core of the block and does not extend to its margins. The contour trend is parallel to the predominant strike direction of faults, but cuts across the main metamorphic trend which is northeasterly. The granulites are dense and must contribute to the high Bouguer anomaly level. Local highs in the west can be correlated with gabbroic intrusions, but it is considered probable that the gravity ridge is mainly the expression of a regional crustal upthrust in which dense rocks of the lower crust and upper mantle are anomalously close to the surface.

Unit 55A Tomkinson Gravity Ridge

An easterly trending gravity ridge, 400 km long and 50 to 100 km wide, with intense local highs up to 50 mGal amplitude.

Local gravity highs can be correlated with outcrops of gabbro, and extensions of the highs beyond the outcrops may indicate the presence of gabbro beneath the surface.

Unit 55B Crombie Gravity Low

A small gravity low of irregular shape separating the Tomkinson and Ernabella Gravity Ridges.

Relatively low Bouguer anomalies within this unit may be due to a preponderance of granitic rocks at the

expense of denser granulites, or to a thinning of the granulite layer.

Unit 55C Ernabella Gravity Ridge

An east-northeasterly trending gravity ridge bounded in the western part by strong gradients along its northern and southern margins. In contrast to the Tomkinson Gravity Ridge, the internal contour pattern is smooth, containing no local features of high intensity.

The western part of this unit covers the central zone of the eastern Musgrave Block. The eastern part presumably corresponds to a sub-surface continuation of the Musgrave Block which probably marks the south-eastern limit of the Amadeus Basin. The absence of short wavelength highs is attributed to the rarity of gabbroic intrusions, which are common in the western Musgrave Block.

Province 56 OFFICER REGIONAL GRAVITY LOW

A deep easterly trending gravity trough bounded by a steep gradient in the north and a gentler gradient in the south. Bouguer anomalies range from about -50 to -140 mGal. Two units have been defined.

The Officer Regional Gravity Low extends over the northern part of the eastern Officer Basin and the southern margin of the Musgrave Block. It is one of several pronounced easterly trending features which dominate the gravity pattern in central Australia. Gravity modelling studies based on seismically determined basin parameters show that the amplitude of the gravity depression is much larger than could be caused by the Officer Basin sediments alone. Light granitic basement rocks or crustal thickening probably contribute substantially to the gravity depression.

Unit 56A Birksgate Gravity Low

A broad west-northwesterly trending depress-

ion bounded by steep gradients to the north and gentle gradients to the south and west.

The Birksgate Gravity Low coincides in part with a deep trough of mainly Adelaidean sediments in the eastern Officer Basin. However, low Bouguer anomalies reflect a deep crustal mass deficiency as well as the presence of thick sediments.

Unit 56B Purndoo Gravity Low

A closed east-northeasterly trending Bouguer anomaly minimum of less than -140 mGal, bounded to the north and south by strong gradients. The unit is separated from the Birksgate Gravity Low to the west by a gravity saddle where Bouguer anomalies rise to -90 mGal.

The Purndoo Gravity Low coincides with the eastern end of the Officer Basin, which contains more than 400 m of Palaeozoic and Adelaidean sediments. The sediments are not the sole cause of low Bouguer anomaly values, as evidenced by the fact that the steep gradient forming the northern margin of the unit is centred to the north of the basin margin.

Province 57 WANNA REGIONAL GRAVITY LOW

An irregularly shaped region of low Bouguer anomalies and smooth contour pattern. The southern part is an elongate southerly trending gravity depression bounded by a steep gradient in the west. Bouguer anomaly values are mainly in the range -40 to -80 mGal.

The province extends over parts of the Eucla Basin in the south, and the Officer Basin in the north. Drilling evidence indicates that granitic basement is at a depth of only about 300 metres in the south of the province. The continuity of gravity pattern northwards from the drilling site suggests that the province as a whole corresponds to an area of low density basement. The Officer Basin sediments may have an attenuating effect on gravity relief in the north of the province.

Province 58 NULLARBOR REGIONAL GRAVITY SHELF

A northerly trending region of low to intermediate Bouguer anomaly level in which individual features have a variety of trends. Bouguer anomalies range from -70 to -15 mGal. Six units have been defined.

The Nullarbor Regional Gravity Shelf extends over parts of the Eucla Basin in the south and the Officer Basin in the north. Gravity relief appears to correlate mainly with basement topography in the south of the province but with intrabasement density variations in the north.

Unit 58A Serpentine Gravity Shelf

A small unit of low Bouguer anomaly level which includes two local highs of 10 to 15 mGal amplitude.

The local highs are attributed to dense bodies within the basement.

Unit 58B Nurrari Gravity Ridge

An elongate gravity spur of small relief extending in a north-northeasterly direction.

Seismic and magnetic results give no evidence for a basement ridge associated with the Nurrari Gravity Ridge, suggesting that high Bouguer anomalies reflect a dense zone within the basement rather than a basement topographic rise.

Unit 58C Midgening Gravity Low

Characterized by low Bouguer anomaly values and northeasterly contour trends.

Thickening of sediments may partly account for the Bouguer anomaly decrease westwards across the Midgening Gravity Low, but the western unit boundary probably relates to an intrabasement density contrast.

Unit 58D Cook Gravity Ridge

A sinuous, generally west-northwesterly trending zone of high Bouguer anomalies of about 10 mGal relief.

The Cook Gravity Ridge is probably the expression of a dense zone within the basement, as aeromagnetic survey results give no indication of a basement ridge associated with it.

Unit 58E Hughes Gravity Trough

A west-northwesterly trending area of depressed Bouguer anomaly.

The eastern part of the Hughes Gravity Trough corresponds to the Mallabie Depression, an infrabasin of mainly Palaeozoic sediments beneath a Tertiary and Mesozoic cover. Aeromagnetic results suggest basement depths of about 2500 m in the western part of the unit.

Unit 58F Coompana Gravity High

A sub-circular gravity high, open towards the sea.

Shallow bore hole, magnetic and seismic data suggest that the Coompana Gravity High represents a topographic rise in the basement of the Eucla Basin. The gradient along the northeastern margin of the unit roughly coincides with an inferred fault, and probably reflects rapid deepening of basement away from the topographic rise.

Province 59 WOORONG REGIONAL GRAVITY COMPLEX

Characterized by a series of narrow, arcuate gravity ridges and troughs, which are mainly northeasterly trending and convex to the northwest. Bouguer anomaly values range from -30 to +30 mGal. Six units have been defined.

The Woorong Regional Gravity Complex extends over the Permo-Triassic Arckaringa Basin and parts of the Officer Basin and the Gawler Block. The gravity ridges

and troughs are considered to represent zones of contrasting densi y within the Gawler Block which may correspond to areas of high-grade and low-grade metamorphic rocks respectively. Variations in thickness of the Arckaringa Basin sediments probably contribute to the gravity relief.

Unit 59A Christie Gravity Complex

> Consists of a number of discrete gravity highs and lows which, with the exception of a prominent northwesterly trending high, have a general northeasterly trend.

The Christie Gravity Complex occupies the western part of the Proterozoic Gawler Block and overlaps on to the Eucla Basin. Bouguer anomaly variations reflect density variations within the Gawler Block and its western sub-surface extension. Local gravity highs may indicate relative local abundances of gneiss and amphibolite in an otherwise mainly granitic basement.

Unit 59B Wallira Gravity Trough

> An intense arcuate gravity trough bounded by steep gradients in the west.

The Wallira Gravity Trough correlates with the inferred Wallira Trough in the west and the Phillipson Trough in the east. However, the Permo-Triassic sediments are not thick enough to be the sole cause of the gravity trough, indicating that the underlying basement rocks are of low density.

Unit 59C Wilkinson Gravity Ridge

> A distinctive, arcuate gravity ridge with a number of local culminations.

The Wilkinson Gravity Ridge corresponds to a shallowly buried zone of dense rocks within the Gawler Block.

Unit 59D Boorthanna Gravity Depression

An irregular gravity depression in which the main trend of local closures is north-northwesterly.

North-northwesterly trending local lows in the east of the Boorthanna Gravity Depression correspond closely in trend and position with the Boorthanna Trough, the deepest known part of the Arckaringa Basin.

Unit 59E Poutnoura Gravity Low

A northeasterly trending gravity trough in which individual Bouguer anomaly features are aligned parallel to the elongation of the unit.

The Poutnoura Gravity Low is attributed to a relative mass deficiency within the Proterozoic basement. Permo-Triassic sediments of the Arckaringa Basin may contribute to the gravity low, but are probably not thick enough to be its sole cause.

Unit 59F Talteroo Gravity Ridge

An intense slightly arcuate northeasterly trending gravity ridge bounded by steep gradients.

The Talteroo Gravity Ridge extends along the southeast flank of the Officer Basin in South Australia and includes a small inlier of Proterozoic rocks in the north. The ridge is almost certainly the gravity expression of a dense shallow basement zone, which may correspond to the northwest margin of the Gawler Block.

Province 60 WILGENA REGIONAL GRAVITY LOW

A broad gravity depression extending north-eastwards across the Gawler Block. It is divided into two by a indistinct gravity ridge. Three units have been defined.

The Wilgena Regional Gravity Low extends over a large portion of the Gawler Block. Regionally low Bouguer

anomalies could be caused by an abundance of low density rocks near the surface, or a deep crustal or subcrustal mass deficiency. It may be significant that seismic refraction evidence indicates relatively low refraction velocities in the upper mantle beneath the Gawler Block.

Unit 60A Ceduna Gravity Low

An area of regionally low Bouguer anomalies containing several minimum closures.

Local Bouguer anomaly lows are probably due to near-surface granites.

Unit 60B Jellabinna Gravity Ridge

A sinuous easterly trending gravity ridge of about 20 mGal amplitude.

The Jellabinna Gravity Ridge corresponds with a region of disturbed magnetic field and is interpreted as representing a zone of relatively high grade metamorphic rocks within the Gawler Block.

Unit 60C Malbooma Gravity Low

Contains numerous local gravity lows of 10 to 20 mGal amplitude.

Local gravity lows are attributed to granitic intrusions.

Province 61 WARRAMBOO REGIONAL GRAVITY COMPLEX

Occupies the Eyre Peninsula. Bouguer anomalies range from -40 to +40 mGal. Two units have been defined.

The Warramboo Regional Gravity Complex extends over Proterozoic metamorphics of the Gawler Block and the onshore portion of the Polda Trough.

Unit 61A Lincoln Gravity High

An area of smooth contour pattern and positive Bouguer anomaly level, occupying the southern part of the Eyre Peninsula.

High Bouguer anomalies reflect the presence of dense high-pressure granulites near the surface, but the proximity of the continental margin suggests that the high Bouguer anomaly level may be due at least partly to thinning of the continental crust.

Unit 61B Kimba Gravity Low

An area of regionally low Bouguer anomalies with numerous local closures. An easterly trending gravity depression occupies the southern part of the unit.

The easterly trending gravity depression in the south coincides in part with the Polda Trough. The low Bouguer anomaly level over the remainder of the unit is attributable to near surface granites of low density.

Province 62 GAIRDNER REGIONAL GRAVITY HIGH

A sub-circular province which includes a broad gravity high of irregular shape. Bouguer anomaly values range from -20 to +10 mGal.

The Gairdner Regional Gravity High coincides with a largely fault-bounded area in which acid extrusives and granites crop out. The average density of the acid volcanics is about 2.55 gm/cm^3, which is considerably lower than that of the surrounding metamorphics of the Gawler Block. The gravity high is different in shape and trend from other gravity highs over the Gawler Block, and is therefore considered unlikely to be caused by dense metamorphic basement. It is suggested that the acid volcanics are underlain by a substantial thickness of basic igneous rocks of greater average density than the surrounding metamorphic basement.

Province 63 ARCOONA REGIONAL GRAVITY COMPLEX

A northerly elongated region of smooth gravity pattern and intermediate Bouguer anomaly level, surrounded by more distinctive gravity provinces. The most pronounced feature is a northwest trending gravity depression in the northeastern corner of the province. Three units have been defined.

Unit 63A Farina Gravity Low; Unit 63B Torrens Gravity Shelf; Unit 63C Yorke Gravity High

The Arcoona Regional Gravity Complex largely coincides with the Sturt Shelf, a region of relatively undisturbed Adelaidean sediments. The smoothness of contour pattern over most of the province indicates that lateral density contrasts within the sediments and underlying basement are small. The low in the northeast has no correlation with known surface geology, and is interpreted as due to either low density basement rocks or to a relatively deep trough of Adelaidean sediments, which is indicated by aeromagnetic results.

Province 64 MULOORINNA REGIONAL GRAVITY RIDGE

A narrow west-northwesterly trending gravity ridge of about 20 mGal amplitude.

The Muloorinna Regional Gravity Ridge connects the Denison Block in the west with the Mount Painter Block in the east. Elsewhere it extends across thin Mesozoic sediments on the fringe of the Eromanga Basin. The Willyama and Wonaminta Blocks lie on the southeasterly prolongation of the gravity ridge. Regional considerations suggest that the gravity ridge corresponds to a shallow buried zone of dense Lower or mid-Proterozoic rocks which extends along the concealed northern margin of the Gawler Block.

Province 65 HAWKER REGIONAL GRAVITY COMPLEX

An elongate province consisting of several arcuate northerly trending highs and lows. Four units have been defined.

The Hawker Regional Gravity Complex correlates with the Adelaide Geosyncline, but also includes parts of the Arrowie Basin and the Willyama Block in the northeast. Most gravity features are of uncertain origin and could relate to density contrasts within either the Adelaidean sedimentary sequence or the pre-Adelaidean basement.

Unit 65A Quorn Gravity Trough

A northerly trending slightly arcuate gravity trough with an amplitude of about 30 mGal.

The western margin of the Quorn Gravity Trough coincides in part with the Torrens Lineament, which separates thick and strongly deformed Adelaidean sediments to the east from thin undisturbed Adelaidean sediments overlying the Gawler Block to the west. Low Bouguer anomalies could be due to thick Adelaidean sediments or to a low density block in the pre-Adelaidean basement.

Unit 65B Beltana Gravity High

An elongate northerly trending high with several local maxima and minima.

The Beltana Gravity High is attributed to either a regional density increase within the thick Adelaidean and Cambrian sedimentary section or to a dense body in the pre-Adelaidean basement. The first theory proposes a local abundance of Wooltana basic volcanics and/or carbonates in the Adelaidean and Cambrian sediments in the vicinity of the high. The second explanation requires a high density block in the basement. In the north of the unit, a small gravity low correlates with the mid-Proterozoic Mount Painter Block.

Unit 65C Frome Gravity Low

Includes an elongate northerly trending low with several local culminations.

The Frome Gravity Low correlates mainly with the Arrowie Basin, which contains at least 800 m of Phanerozoic sediments. However, a local minimum in the south extends over mid-Proterozoic granites of the Willyama Block, and this, together with magnetic evidence, suggests that the southern part of the province, at least, reflects a low density granitic intrusion beneath Adelaidean and Phanerozoic sediments.

Unit 65D Manunda Gravity Shelf

An area of mainly smooth contour pattern with an average Bouguer anomaly level of about zero. There is a prominent local gravity low in the east of the unit.

The mainly featureless nature of the contour pattern suggests uniformity of density within the Adelaidean sediments and the basement. Contour trends are roughly parallel to structural trends of the Adelaide Geosyncline, but the local low in the east coincides with the Lower Palaeozoic Anabama Granite. The gradient defining the eastern margin of the unit coincides in the south with the inferred Anabama-Redan Fault.

Province 66 BARRIER REGIONAL GRAVITY RIDGE

A north-northeasterly trending gravity ridge of varying width and amplitude. It is best developed in the north, where it consists of two distinct north-northwest-trending gravity highs, separated by a narrow gravity trough. Bouguer anomalies range from -30 to +30 mGal. Four units have been defined.

The Barrier Regional Gravity Ridge extends over the mid-Proterozoic Willyama and Wonaminta Blocks in the north, and Mesozoic sediments of the Murray Basin in the south. Although it is clear that high Bouguer anomalies in the north of the province are caused by dense Proterozoic metamorphics, the source of high Bouguer anomalies in the south is uncertain. The eastern province margin is a continuous linear gradient

with no break or displacement near the southern boundary of the Willyama Block. This suggests that the southern part of the province represents a sub-surface continuation of the Willyama Block beneath Adelaidean and Mesozoic sediments. If this is so, the province, viewed in its regional context, could be interpreted as delineating the eastern margin of an extensive Proterozoic craton, of which the Gawler, Denison, Mount Painter, Wonaminta, and Willyama Blocks are the exposed parts. An alternative interpretation is that the southern part of the province corresponds to the eugeosynclinal part of the Adelaide Geosyncline, containing abundant igneous and possibly metamorphosed rocks of probable Lower Palaeozoic age. In this case, the continuous gravity gradient defining the eastern province boundary would be interpreted as representing a regional lateral density contrast produced by major faulting which occurred after the formation of the eugeosyncline. Hence, the province as a whole would correspond to a relatively uplifted zone comprising dense rocks of both mid-Proterozoic and Lower Palaeozoic ages.

Unit 66A Waikerie Gravity Ridge

A sinuous gravity ridge of fairly low intensity.

The northern margin of the Waikerie Gravity Ridge coincides with the Anabama-Redan Fault, separating the Willyama Block from Mesozoic sediments of the Murray Basin, and the eastern margin coincides in part with an inferred fault within the Murray Basin. The interpretation of the gravity ridge is discussed in the comments for the province as a whole.

Unit 66B Willyama Gravity High

A pronounced gravity high, bounded by a strong gradient in the east and a gentler gradient

in the west. Bouguer anomaly values are mainly in the range 0 to +20 mGal.

The Willyama Gravity High correlates with the Proterozoic Willyama Block.

Unit 66B Bancannia Gravity Low

A prominent north-northwesterly trending gravity trough, bounded by steep gradients in the east and west. It is sharply truncated at its southern end by a narrow gravity ridge.

The Bancannia Gravity Low coincides closely with the Bancannia Trough, which consists of more than 3000 m of mainly terrigenous Lower Palaeozoic to Cretaceous sediments. The sediments comprise large thicknesses of sandstone, so it is probable that the relative mass deficiency associated with the sedimentary trough is large enough to cause the entire gravity depression.

Unit 66D Wonaminta Gravity High

An elongate north-northwesterly trending high with several local culminations, where Bouguer anomaly values exceed +20 mGal.

The Wonaminta Gravity High correlates in the south with the Proterozoic Wonaminta Block. The gravity pattern indicates that the Wonaminta Block continues northwards for about 100 km beyond its main outcrop.

Province 67 DARLING REGIONAL GRAVITY LOW

A broad elongate gravity trough, extending in a northeasterly direction. It contains a number of local gravity features, including numerous lows with various trends in the north, and northeasterly trending gravity lows in the central part. Bouguer anomaly values range from -50 to 0 mGal. Two units have been defined.

The north of the Darling Regional Gravity Low correlates in part with the Palaeozoic Darling Basin, and the remainder extends over Tertiary and Mesozoic sediments

of the western Murray Basin. Regionally low Bouguer anomaly values are considered to reflect the presence of thick Mesozoic and/or Palaeozoic sequence, but local gravity lows may be related to intrabasement density contrasts.

Unit 67A Poopelloe Gravity Low

A subcircular Bouguer anomaly depression, which contains several west-northwesterly trending local lows and a northwesterly trending gravity ridge.

Regionally low Bouguer anomalies are attributed to thick Palaeozoic sediments of the Darling Basin. Drilling and seismic data have indicated sedimentary thicknesses in excess of 3300 m in the area. The west-northwesterly trending local lows are probably caused by intrabasement mass deficiencies.

Unit 67B Milkengay Gravity Low

A northeasterly trending gravity depression, bounded by linear gradients to the northwest and southeast. The unit contains several elongate gravity lows and a gravity ridge.

Gravity relief may reflect variations in thickness of Permian and younger sediments. Elongate gravity lows along the western margin of the unit correlate with the Menindee, Tararra, and Renmark Troughs, which seismic data indicate contain about 3000, 2000 and 3000 m of sediments, respectively. The gravity trough close to the eastern margin of the unit is of uncertain origin, but probably relates to thickening of Permian and Mesozoic sediments. Basement is shallow in the south of the unit, and local gravity variations are attributed to intrabasement density contrasts.

Province 68 GAMBIER REGIONAL GRAVITY HIGH

Characterised by a high level of Bouguer anomaly with values ranging from -10 to +40

mGal. The predominant contour trend is northwesterly. Numerous local gravity features, both highs and lows, occur throughout the province.

The Gambier Regional Gravity High extends over parts of the Murray and Otway Basins, the Lachlan Geosyncline, and outcrops of Cainozoic alkali basalt. It is probable that contour trends reflect the main structural trends in the basement, and that the high Bouguer anomaly level indicates a high average basement density. Local gravity lows are attributed to granites within the Palaeozoic basement, except in the southwest, where a marked west-northwesterly trending gravity depression is associated with the Gawler Embayment, a sub-basin of the Otway Basin. The outcrops of Cainozoic basalt have no observable effect in the contour pattern.

Province 69 MELBOURNE REGIONAL GRAVITY HIGH

An area of regionally high Bouguer anomaly level and complex contour pattern. Trends are predominantly north-northwesterly in the east of the province, and north-northeasterly in the west. Bouguer anomaly values range from -30 to +30 mGal.

The Melbourne Regional Gravity High extends over parts of the Lachlan Geosyncline and the Otway and Gippsland Basins. Over the Lachlan Geosyncline the contour pattern closely reflects surface geological structures. Local gravity lows in the west of the province and over Port Phillip Bay correlate partly with sub-basins of the Otway Basin. However, the low over Port Phillip Bay is flanked on the west by a low which extends over granitic outcrop, suggesting that granitic basement rocks may be the part cause of low Bouguer anomalies over Port Phillip Bay.

Province 70 LA TROBE REGIONAL GRAVITY LOW

A pronounced easterly trending gravity depression open towards the sea.

The La Trobe Regional Gravity Low correlates with the onshore Gippsland Basin, and low Bouguer anomalies are attributed mainly to the presence of thick Mesozoic sediments. An east-north-easterly trending gravity spur is associated with a fault-bounded zone of uplift within the basin.

Province 71 ARTHUR REGIONAL GRAVITY HIGH

> An area of high Bouguer anomaly, occupying the northwestern corner of Tasmania. Contour trends vary from northerly to northeasterly, and the most pronounced local feature is a northeasterly elongated high of about 30 mGal amplitude. Bouguer anomaly values range from 0 to +35 mGal.

The Arthur Regional Gravity High encompasses most of the Upper Proterozoic Rocky Cape Geanticline. The northeasterly trending local high can be correlated with low grade Proterozoic metamorphics. Bouguer anomaly values in the high reach maximum values of more than +30 mGal in a region where ultrabasic igneous rocks crop out. A regional Bouguer anomaly rise towards the west coast probably reflects thinning of the continental crust.

Province 72 GORDON REGIONAL GRAVITY HIGH

> A north-northwesterly trending high, extending parallel to the coast and open towards the sea. The province is of greatest intensity and magnitude close to the coast in the north. Bouguer anomalies range from 0 to +65 mGal.

The Gordon Regional Gravity High correlates with parts of the Upper Proterozoic Tyenna Geanticline and the Palaeozoic Lachlan Geosyncline. Although thinning of the continental crust aprobably accounts for the regional Bouguer anomaly rise towards the coast, the intense culmination in the north of the province is partly due to a near-surface mass excess. It coincides with an elongate belt of high magnetic intensity

values, and extends over outcrops of ultrabasic rocks, suggesting that a large ultrabasic body is the probable cause of high Bouguer anomalies.

Province 73 MERSEY REGIONAL GRAVITY COMPLEX

> A large area of complex contour pattern in which Bouguer anomalies range from -40 to +10 mGal. No predominant contour trend is apparent.

The Mersey Regional Gravity Complex encompasses parts of the Tyenna Geanticline, the Lachlan Geosyncline, and the Tasmania Basin. The thin Tasmania Basin sediments have no appreciable effect on the contour pattern, and it is concluded that major gravity relief is the expression of density variations in the underlying basement, which for the most part is probably a subsurface continuation of the Lachlan Geosyncline. Slight gravity depressions are associated with postulated Tertiary grabens near Macquarie Harbour and along the northern part of the Tamar River. The regionally low Bouguer anomaly level of the province compared with surrounding provinces is almost certainly a consequence of thicker crust under the uplifted central part of Tasmania.

Province 74 DERWENT REGIONAL GRAVITY HIGH

> An area of high Bouguer anomaly, occupying the southern and eastern part of Tasmania, including Flinders Island. Bouguer anomalies range from -10 to +40 mGal.

The Derwent Regional Gravity High correlates in the south with the Tasmania Basin and in the north with the Lachlan Geosyncline. The province is roughly parallel to the coast, implying that thinning of the continental crust is at least partly the cause of high Bouguer anomalies. However, near-surface density increases within the Tasmania Basin or Lachlan Geosyncline are also indicated. The western province boundary in the

south roughly coincides with the junction between the Tyenna Geanticline and the Tasmania Basin. A broad high east of Hobart may be the expression of a large dolerite sill within the Tasmania Basin sequence.

Province 75 LISMORE-EDEN REGIONAL GRAVITY GRADIENT

A strong seaward gravity rise, extending the full length of the New South Wales coast. The gradient tends to mask local gravity features.

The Lismore-Eden Regional Gravity Gradient reflects the transition from continental to oceanic-type crust, and its strength and consistency are indicative of the relative narrowness of the continental shelf in this area. Local gravity features correspond mainly to density variations in the Palaeozoic rocks of the Tasman Geosyncline. The Sydney Basin appears to have no appreciable gravity expression.

Province 76 LACHLAN REGIONAL GRAVITY COMPLEX

A broad province of generally complex contour pattern in which contour trends are predominantly north-northwesterly. Bouguer anomalies range from -70 to +20 mGal. Five units have been defined.

The Lachlan Regional Gravity Complex extends over a large part of the Lachlan Geosyncline and parts of the Coonamble and Oxley Basins. Gravity contour trends closely reflect structural trends in the Lachlan Geosyncline. The units which have been defined show some correlation with structural divisions proposed by Scheibner (1973).

Unit 76A Macquarie Gravity Complex

An elongate north-northwesterly trending unit of complex contour pattern, in which most local gravity features are aligned in the direction of elongation of the province. Bouguer anomalies range from -50 to +5 mGal.

The Macquarie Gravity Complex extends over parts of the Lachlan Geosyncline in the south, the Coonamble and Oxley Basins in the north, and the Sydney Basin in the east. The contour trends reflect structural trends within the Lachlan Geosyncline, indicating that gravity relief in sediment-covered areas is caused by density contrasts in the geosynclinal basement. Over the exposed area of the Lachlan Geosyncline, there are a number of local correlations between gravity and geology. Gravity lows are mainly associated with granites, and gravity highs with metamorphic or basic igneous outcrops. In particular, the Bathurst Granite is represented by a distinct north-northwest-trending low, and basic volcanic rocks to its west by a gravity high. The Copperhannia Thrust coincides with a gravity gradient near Bathurst.

Unit 76B Monaro Gravity Low

An area of low Bouguer anomaly level, in which contour trends vary from northeasterly to northerly. Bouguer anomaly values range from -50 to 0 mGal.

The Monaro Gravity Low extends over Palaeozoic rocks of the Lachlan Geosyncline, and partly coincides with the Molong-South Coast Anticlinorial Zone of Scheibner (1973). Abundant granitic rocks within the area of the unit probably account for the low Bouguer anomaly values. The area is topographically high, suggesting that crustal thickening may also contribute to the gravity depression.

Unit 76C Bogan Gravity Ridge

A sinuous northerly trending gravity ridge, containing numerous local closures. Bouguer anomaly values vary from -50 to +20 mGal.

The Bogan Gravity Ridge correlates roughly with the Bogan Gate Synclinorial Zone (Scheibner, 1973). Regionally high Bouguer anomaly values may reflect an

abundance of metamorphic and basic igneous rocks and a deficiency of granites compared with adjacent areas. Geological studies have indicated that granites within the synclinorial zone are relatively small intrusions, in contrast to large batholiths which characterize surrounding areas. The narrow southern portion of the unit shows close correlation with topographically high areas in the Snowy Mountains, but the reason for this is not clear.

Unit 76D Hume Gravity Trough

A sinuous north-northwesterly trending gravity trough of varying width, extending adjacent and parallel to the Bogan Gravity Ridge. Bouguer anomalies range from -70 to 0 mGal.

The Hume Gravity Trough correlates roughly with the Girilambone-Wagga Anticlinorial Zone (Scheibner, 1973). Regionally low Bouguer anomalies probably reflect a relative abundance of granitic rocks at the expense of denser metamorphic and basic igneous rocks. The lowest Bouguer anomaly values occur in the south of the unit where crustal thickening under the Snowy Mountains may contribute to the depression of Bouguer anomalies on a regional scale.

Unit 76E Griffith Gravity Shelf

An elongate northerly trending area of intermediate Bouguer anomaly level, containing numerous local highs and lows of small amplitude. Bouguer anomalies are mainly in the range 0 to -20 mGal.

The Griffith Gravity Shelf extends over parts of the Lachlan Geosyncline, the Darling Basin and the Murray Basin. Gravity contour trends are parallel to the main structural trends of the Lachlan Geosyncline, indicating that the geosyncline is the basement to those parts of the Darling and Murray Basins within the area of the unit.

Province 77 MURRAY REGIONAL GRAVITY COMPLEX

A broad province of fairly small gravity relief, in which Bouguer anomalies range from -40 to +10 mGal. Local gravity features are elongate in various directions, ranging from predominantly north-northwesterly in the southwest to east-northeasterly in the east of the province. Three units have been defined.

The Murray Regional Gravity Complex extends over a large portion of the Murray Basin and adjacent parts of the Lachlan Geosyncline and the Darling Basin. The gravity pattern almost certainly reflects intrabasement density contrasts rather than variations in depth to basement, as there is no reliable drilling or geophysical evidence indicating sedimentary thickness greater than about 1500 m. The basement structural trends revealed by the gravity contour pattern contrast with, and are truncated by, the predominant north to northwesterly trends that characterise the Lachlan Geosyncline to the east. It can therefore be inferred that the province corresponds to an area of basement that is structurally distinct from, and probably older than, the main exposed part of the Lachlan Geosyncline.

Unit 77A Tyrell Gravity Shelf

An arcuate area, in which Bouguer anomalies range from -30 to +10 mGal. The trends of local gravity features vary from northwesterly in the north and are generally parallel to the boundaries of the unit.

The Tyrell Gravity Shelf covers parts of the Lachlan Geosyncline and the Darling Basin at its southern and northern extremities, but for the most part extends over the Murray Basin sediments. In the north of the unit, seismic results indicate a high velocity refractor at depths of less than 1000 m, and a local gravity low in the central part of the province correlates with a small granitic inlier. It is therefore probable that

gravity relief relates to density contrasts within the basement rather than to variations in thickness of the Murray Basin sediments.

Unit 77B Murrumbidgee Gravity Shelf

> An area of intermediate Bouguer anomaly level, in which the main contour trend is east-northeasterly. Bouguer anomaly values vary from -30 to +10 mGal.

The Murrumbidgee Gravity Shelf extends over sediments of the eastern Murray Basin. Drilling results indicate that local gravity features are caused by intrabasement density contrasts.

Unit 77C Goulburn Gravity Complex

> An area of complex contour pattern, in which there is no predominant regional trend. Bouguer anomalies range from -40 to +10 mGal.

The Goulburn Gravity Complex extends over parts of the Lachlan Geosyncline and the Murray Basin. There is little doubt that local gravity features correspond to density contrasts within the Palaeozoic basement. A northerly trending local high correlates with basic igneous outcrop close to a major fault, which downthrows to the east.

Province 78 BOURKE REGIONAL GRAVITY HIGH

> An arcuate province, in which easterly to northeasterly contour trends predominate. The Bouguer anomaly level is regionally high, but there is a string of gravity lows close to the central axis of the province. Bouguer anomaly values range from -30 to +10 mGal.

The Bourke Regional Gravity High extends across the southern part of the Great Australian Basin, including parts of the Bulloo Embayment in the west and the Surat Basin in the east; it also encompasses the northernmost outcrops of rocks of the Lachlan Geosyncline. Basement is shallow over most of the province, and

gravity relief is attributed to basement density variations. This is supported by the observed parallelism of aeromagnetic and Bouguer anomaly contour trends. The predominant easterly contour trend sharply truncates the north-northwesterly trend over the Lachlan Geosyncline, implying that the province corresponds to a zone in which Palaeozoic tectonic activity postdated the main Lachlan Orogeny.

Province 79 NAMOI REGIONAL GRAVITY RIDGE

An elongate northerly trending province, consisting of two narrow gravity ridges separated by a trough. Three units are defined.

The Namoi Regional Gravity Ridge extends over parts of the Palaeozoic New England Geosyncline, and the Bowen, Surat, and Oxley Basins. Correlation between gravity and geology is best over the exposed New England Geosyncline, and extensions of gravity features beyond this area indicate continuations of geosynclinal structures beneath the sedimentary cover. The three gravity units defined can be interpreted in terms of the types of structural divisions proposed by Scheibner (1973) and shown in the Tectonic Map of New South Wales (Geological Survey of New South Wales, 1974).

Unit 79A Tamworth Gravity Ridge

A narrow slightly arcuate gravity ridge of about 20 mGal amplitude.

The Tamworth Gravity Ridge coincides with the northern part of the Tamworth Synclinorial Zone, a concealed volcanic arc of late Silurian age.

Unit 79B Gwydir Gravity Trough

A narrow slightly arcuate gravity trough, which broadens considerably at its northern end.

Interpreted as the gravity expression of a basin that developed in a marginal sea between two volcanic arcs during Silurian times.

Unit 79C Meandarra Gravity Ridge

Similar in shape, area, and amplitude to the Tamworth Gravity Ridge.

The source of the Meandarra Gravity Ridge is concealed beneath late Palaeozoic and Mesozoic platform cover. However, the feature is similar and parallel to the Tamworth Gravity Ridge, suggesting that it is caused by a volcanic arc of probable Silurian age.

Province 80 NEW ENGLAND REGIONAL GRAVITY LOW

A northerly elongated area of low Bouguer anomaly level, bounded by distinct gradients in the east and west. There are numerous local closures within the province.

The New England Regional Gravity Low extends over Palaeozoic rocks of the New England Geosyncline. Low Bouguer anomaly values are mainly attributed to an abundance of late-stage orogenic granites of Permo-Triassic age. The area is topographically high compared with surrounding areas, suggesting that crustal thickening may also contribute to the depression of the Bouguer anomaly field.

Province 81 COASTAL REGIONAL GRAVITY COMPLEX

A complex arrangement of intense gravity highs and lows, most of which have a north-northwesterly trend. Bouguer anomalies range from -30 to +60 mGal. Nine units have been defined.

Unit 81A Eungella Gravity Ridge; Unit 81B Repulse Gravity Depression; Unit 81C Llewellyn Gravity Platform; Unit 81D Marlborough Gravity Ridge; Unit 81E Baffle Gravity High; Unit 81F Gympie Gravity Platform; Unit 81G Brisbane Gravity Plateau; Unit 81H Kingaroy

Gravity Embayment; Unit 81I Clarence Gravity Shelf

The Coastal Regional Gravity Complex covers the area of cropping out igneous and metamorphic rocks in that part of the Tasman Geosyncline lying east of the Bowen Basin. Within this area are a number of sedimentary basins, including the Palaeozoic Yarrol Basin, and the Mesozoic Maryborough and Clarence-Moreton Basins. The structural complexity of the region is reflected in the Bouguer anomaly contour pattern, but correlation between gravity features and known local structures is generally poor. It is considered that generally gravity lows correspond to granitic batholiths, and gravity highs to areas of abundant high-grade metamorphic and/or basic igneous rocks. There is evidence that slight residual gravity depressions are associated with the Clarence-Moreton and Maryborough Basins.

Province 82 BOWEN REGIONAL GRAVITY LOW

A north-northwesterly elongated area of low Bouguer anomalies, which becomes narrower from south to north. Local gravity features are mainly aligned parallel to the elongation of the province. Bouguer anomalies range from -25 to +15 mGal. Four units have been defined.

The Bowen Regional Gravity Low correlates closely with the northern Bowen Basin. Low Bouguer anomalies are attributed mainly to thick Palaeozoic and Mesozoic sediments, although the occurrence of granitic outcrops in the north of the province suggests that low density basement could be partly the cause of the gravity low.

Unit 82A Emerald Gravity Shelf

Generally small-amplitude Bouguer anomaly features, which exhibit both northerly and easterly trends.

The basement of Anakie Metamorphics is shallow over the Emerald Gravity Shelf and local gravity features probably correspond to intrabasement density variations.

Unit 82B Springsure Gravity Shelf

Broad low-amplitude Bouguer anomaly features with no major trends.

The Springsure Gravity Shelf is of uncertain geological significance. The Denison Trough, a sub-basin of the Bowen Basin, has no appreciable gravity expression.

Unit 82C Shotover Gravity Depression

A series of colinear north-northwesterly trending gravity lows, the intensity of which increases to the north.

The Shotover Gravity Depression coincides with the deepest part of the Bowen Basin, except in the extreme north, where it extends over granitic outcrop on the basin margin.

Unit 82D Devlin Gravity Terrace

Essentially a north-northwesterly trending gravity gradient, dislocated in places by local closures or spurs.

The Devlin Gravity Terrace is postulated to be the expression of a major hinge or fault that bounds the Bowen Basin in the east.

Province 83 ANAKIE REGIONAL GRAVITY RIDGE

A north-northwesterly trending regional gravity ridge, on which numerous small closures are superimposed. Bouguer anomaly values range from -20 to +25 mGal. The province is divided into two units.

Over most of its area, the Anakie Regional Gravity Ridge correlates with the Anakie Inlier of Lower Palaeozoic metamorphics and granite, and the Palaeozoic Drummond Basin adjoining the Anakie Inlier to the west. The areal extent of the province and its relation to the Nebine Regional Gravity High (Province 85) indicate that the Anakie Inlier plunges southwards beneath Mesozoic sediments of the Great Artesian Basin, and

connects to the Nebine and Eulo Ridges, which are areas of known shallow basement.

Unit 83A Drummond Gravity Shelf

An elongate north-northwesterly trending area of high Bouguer anomaly, covering the western part of the province.

The Drummond Gravity Shelf correlates with the Palaeozoic sediments of the Drummond Basin. High Bouguer anomalies probably relate to dense metamorphic basement, which is continuous with the Anakie Inlier.

Unit 83B Clermont Gravity Ridge

A north-northwesterly trending gravity ridge on which local highs and lows are superimposed.

The Clermont Gravity Ridge correlates closely with the Anakie Inlier. High Bouguer anomalies are caused by dense metamorphic rocks; local gravity lows are probably the expression of granitic intrusions.

Province 84 ROMA REGIONAL GRAVITY LOW

A northeasterly trending gravity depression in which gradients are generally low. Bouguer anomalies are mainly in the range -10 to -45 mGal.

The Roma Regional Gravity Low extends over parts of the Surat and Bowen Basins. Borehole data from the north of the province indicate that basement is shallow (generally in the range 1000 to 2000 m) and consists mainly of granite or Devonian Timbury Hills Formation. Mesozoic sediments are therefore too thin to cause the gravity depression, which must be the expression of a region of comparatively low density Palaeozoic basement rocks.

Province 85 NEBINE REGIONAL GRAVITY HIGH

A southwest-trending high of small Bouguer

anomaly relief and irregular outline. It is narrow in the north, but becomes broader southwards. The province contains numerous local gravity features, particularly in the south. Two units are defined.

Unit 85A Eulo Gravity Platform; Unit 85B Morvon Gravity Ridge

The southern part of the Nebine Regional Gravity High encompasses the Eulo Ridge, a structurally high area in which Palaeozoic basement crops out in a number of small inliers; the northern part corresponds to the Nebine Ridge, a structural high. The province is continuous with the Anakie Regional Gravity High (Province 83), which indicates that the Nebine Ridge is a continuous basement high, joining the Anakie Structural High in the north to the Eulo Ridge in the south, and separating the Eromanga and Surat Basins. The local gravity highs and lows are almost certainly caused by basement density contrasts.

Province 86 DIAMANTINA REGIONAL GRAVITY SHELF

Characterised by elongate predominantly easterly trending gravity depressions. Bouguer anomaly values range from zero to -40 mGal. Seven units have been defined.

The Diamantina Regional Gravity Shelf extends over a large portion of the Eromanga Basin. Bouguer anomaly features can variously be correlated with basin structures and intrabasement density contrasts. The province is bordered to the north and south by distinct gravity ridges, which are associated with Proterozoic metamorphic complexes.

Unit 86A McDills Gravity Platform

Main trends northwesterly with regional Bouguer anomaly values increasing towards the east.

Minor features appear to reflect basin structures, where checked by seismic survey.

Unit 86B Hamilton Gravity Shelf

A northerly trending region, in which Bouguer anomalies range from -20 to -40 mGal.

Magnetic basement is about 2000 m deep over most of the Hamilton Gravity Shelf.

Unit 86C Dalhousie Gravity Depression

A north-northwest-trending gravity depression with a large minimum closure in the north and a smaller closure in the south. Bouguer anomaly values range from -20 to -60 mGal.

Magnetic basement depths exceed 3000 m and seismic data indicate the presence of thick sediments in the north of the unit. It is postulated that the northern closure corresponds to a thick pre-Mesozoic sedimentary sequence; the southern closure could reflect either a local sedimentary trough or an intrabasement mass deficiency.

Unit 86D Noolyeana Gravity High

An irregular shaped high of small gravity relief.

The Noolyeana Gravity High is postulated to reflect shallow basement.

Unit 86E Cowarie Gravity Depression

An irregular-shaped low with three separate minimum closures.

The northernmost closure may reflect thick Permian or Mesozoic sediments; the southern ones, owing to their intensity and proximity to cropping out basement, are thought to represent granitic intrusions within the basement at shallow depth.

Unit 86F Cacoory Gravity Depression

A large unit containing a number of local gravity lows.

Seismic and drilling data suggest that local gravity lows in the north of the province relate to intrabasement mass deficiencies. Low Bouguer anomalies in the south may be caused by thick Mesozoic sediments.

Unit 86G Durham Gravity Ridge

A sinuous west-northwesterly trending gravity ridge.

Unit 86H Nappermerrie Gravity Low

Characterised by elongate east-northeasterly trending gravity lows.

A correlation between relative Bouguer anomaly values and sedimentary thickness, as revealed by seismic and drilling data, has been established in a number of places. The east-northeasterly trending lows in Unit 86H lie in the western part of the Cooper Basin.

Unit 86I Callabonna Gravity Low

The main feature is an intense subcircular Bouguer anomaly low.

The Callabonna Gravity Low is probably the expression of a shallow granitic intrusion. Proterozoic metamorphic and granitic rocks of the Mount Painter Block crop out just south of the feature.

Province 87 THOMPSON REGIONAL GRAVITY LOW

A broad Bouguer anomaly low, in which northeasterly contour trends predominate. Bouguer anomaly values range from -45 to 0 mGal. Eight units have been defined.

The Thompson Regional Gravity Low extends over all or part of the Mesozoic Eromanga Basin, the Permo-Triassic Cooper Basin, and the Devono-Carboniferous Adavale Basin. Bouguer anomaly features can be correlated with sedimentary basin structures in many areas, although the northwest province boundary clearly corresponds to a basement discontinuity. In particular, structures of

the Cooper and Adavale Basins have a close relation to the regional gravity contour pattern.

Unit 87A Vergemont Gravity Depression

> An elongate northeasterly trending Bouguer anomaly low, bordered on its northwestern side by a major gravity gradient. Bouguer anomaly values range from -10 to -35 mGal.

The northwestern boundary of the Vergemont Gravity Depression corresponds to the southern end of the postulated subsurface extension of the Mount Isa Geosyncline. Hence the low Bouguer anomaly level of this unit compared to that of the adjoining area to the northwest is due principally to a regional basement density decrease across the province boundary. There is no evidence for abrupt sedimentary thickening across this boundary.

Unit 87B Warbreccan Gravity Ridge

> A northeasterly trending zone of relatively high Bouguer anomalies.

Major anticlines are known to occur within the area of the Warbreccan Gravity Ridge.

Unit 87C Barrolka Gravity Depression; Unit 87D Jundah Gravity Depression

> These two units form a major northeasterly trending Bouguer anomaly in which the trends of local features range from northerly to northeasterly. Bouguer anomalies range from -20 to -45 mGal.

The northwestern boundaries of the Barrolka and Jundah Gravity Depressions roughly coincide with the northwest margin of the Cooper Basin. Low Bouguer anomaly values are probably caused by thick Permian and Mesozoic sediments.

Unit 87E Blackall Gravity Platform

A northeasterly elongated area containing several broad Bouguer anomaly highs. Bouguer anomalies range from -10 to -35 mGal.

The Blackall Gravity Platform corresponds roughly to an area of relatively thin Permian and Mesozoic sediments.

Unit 87F Adavale Gravity Depression

An irregularly shaped gravity depression in which Bouguer anomalies range from -20 to -45 mGal.

The Adavale Gravity Depression coincides in part with the Palaeozoic Adavale Basin. The more negative Bouguer anomaly features show correlation with areas of thick Devonian sedimentation.

Unit 87G Tobermory Gravity Terrace

A unit of small gravity relief, in which Bouguer anomalies range from -15 to -25 mGal.

Higher Bouguer anomalies in the Tobermory Gravity Terrace compared to Unit 87F, probably reflect a shallowing of the Lower Proterozoic basement. The unit coincides in part with the Thargomindah Shelf.

Unit 87H Charleville Gravity Platform

A series of northeasterly trending Bouguer anomaly highs and lows. Bouguer anomaly values range from -5 to -45 mGal.

There is no known significant thickness of Upper Palaeozoic and Mesozoic sediments in this area. Local gravity features are probably related to intra-basement density variations.

Province 88 CLONCURRY REGIONAL GRAVITY HIGH

A broad gravity high over which contours have a general north-northwesterly trend in the south, swinging to northerly in the north. There is an abrupt change in regional contour

pattern and Bouguer anomaly level across the southern boundary of the province. Ten units have been defined.

The Cloncurry Regional Gravity High corresponds mainly with the exposed Mount Isa Geosyncline, an area of Carpentarian sediments, volcanics, metamorphics, and granitic intrusions. Lower Palaeozoic sediments of the Georgina Basin crop out in the west, and Mesozoic sediments of the Eromanga and Carpentaria Basins, in the southeast and north. A subsurface extension of the Mount Isa Geosyncline at relatively shallow depth is predicted to correspond with the extent of the gravity province. Many Bouguer anomaly lows correlate closely with granite intrusions whose continuation beyond outcrop can be predicted. The southern province boundary corresponds to a major basement discontinuity separating Carpentarian geosynclinal rocks to the north from an area of probable Palaeozoic basement to the south.

Unit 88A Mount Oxide Gravity Shelf

Characterized by a general northerly trend of contours, and Bouguer anomaly values ranging from -10 to +20 mGal.

The Mount Oxide Gravity Shelf corresponds in the east with outcrops of Lower Proterozoic metamorphic and granitic rocks. The western margin of the unit is a gravity gradient, which roughly corresponds to the eastern boundary of the Georgina Basin.

Unit 88B Kajabbi Gravity Ridge

A northerly elongated area in which Bouguer anomalies range from 0 to +45 mGal. Most local features have a northerly trend.

The Kajabbi Gravity Ridge corresponds in the south to a zone of intense deformation and metamorphism. The northern part reflects the northern extension of the metamorphic zone under a thin Mesozoic sedimentary cover.

Unit 88C Julia Creek Gravity Shelf

Characterised by northeasterly trending local gravity features with Bouguer anomaly values ranging from 0 to -25 mGal.

The area of the Julia Creek Gravity Shelf is covered by thin Mesozoic sediments. Drilling data indicate that basement deepens towards the northeast. However, local gravity features are attributed to intrabasement density contrasts.

Unit 88D Glenormiston Gravity Shelf

Characterised by numerous local gravity features which have a general north-north-westerly trend. Bouguer anomaly values range from -15 to +20 mGal.

The Glenormiston Gravity Shelf is located near where the Georgina Basin sediments onlap on to the Mount Isa Geosyncline. Local gravity features probably reflect intrabasement density contrasts.

Unit 88E Boulia Gravity Ridge; Unit 88F Kalkadoon Gravity Low; Unit 88G Bourke River Gravity Complex

Characterised by elongate north to north-northwest trending gravity highs and lows. Bouguer anomaly values range from -25 to +30 mGal.

These units are closely identified with basement structures in their northern parts. The southward subsurface extension of these structures may be predicted from the gravity results.

Unit 88H Mackunda Gravity Platform

Contour trends swing from northeasterly in the south to north-northwesterly in the north. Bouguer anomaly values range from -15 to +20 mGal.

Carpentarian basement crops out in the north of the Mackunda Gravity Platform, but the major part of the area is covered by Mesozoic sediments, which thicken

gently to the south, reaching a maximum thickness of about 1200 m. Despite the presence of low density sediments, it is probable that intrabasement density contrasts are the causes of gravity features.

Unit 88I Field Gravity Spur

An elongate northwesterly trending gravity high in the southwestern part of the province. Bouguer anomalies range from zero to +15 mGal.

High Bouguer anomalies are attributed to the presence of dense basement rocks at shallow depth.

Unit 88J Bedourie Gravity Ridge

Small gravity features with trends ranging between northeasterly and northwesterly. The southern boundary is an arcuate gravity gradient. Bouguer anomalies range from +5 to +25 mGal.

Although Mesozoic sediments thicken gently from north to south, there is no corresponding reduction in Bouguer anomaly level. It is postulated that the area is underlain by dense rocks of the Mount Isa Geosyncline.

Province 89 MUTTABURRA REGIONAL GRAVITY RIDGE

An indistinct gravity ridge of about 20 mGal average amplitude. It is elongated in a northwesterly direction, but the trends of local gravity anomalies are not in general parallel to this regional trend. Four units have been defined.

Unit 89A Manuka Gravity Embayment; Unit 89B Winton Gravity Plateau; Unit 89C Longreach Gravity Spur; Unit 89D Aramac Gravity Platform

The Muttaburra Regional Gravity Ridge extends over a part of the Galilee Basin, but shows little correlation with known structures. Borehole data indicate a Mesozoic/Palaeozoic sedimentary thickness of greater

than 2000 m in places. There is some evidence for shallowing of basement towards the province from the northeast, so that high Bouguer anomalies may be at least partly attributable to the relative thinness of sedimentary section. The province may have considerable regional geological significance, as it marks the approximate northeastern limit of an extensive area in which regional contour trends are predominantly northeasterly.

Province 90 FLINDERS REGIONAL GRAVITY LOW

A broad gravity low, irregular in outline, with Bouguer anomalies ranging from 0 to -45 mGal. There are numerous local Bouguer anomaly closures in the north of the province, but the contour pattern becomes smoother from north to south. Three units have been defined.

Unit 90A Nonda Gravity Depression; Unit 90B Richmond Gravity Shelf; Unit 90C Tangorin Gravity Depression

The Flinders Regional Gravity Low extends over the northern Galilee Basin of mainly Permo-Triassic sediments, but it is uncertain whether low Bouguer anomalies and gentle gradients are indicative of thick sediments or uniformly low density basement. The basement is shallow in the north of the province and local gravity features almost certainly reflect intrabasement density contrasts. But in the south of the province, drilling results indicate more than 3000 m of Mesozoic and Upper Palaeozoic sediments, suggesting that the presence of light sediments is at least partly the cause of low Bouguer anomaly values. The approximate coincidence of the eastern province boundary with the eastern boundary of the Galilee Basin tends to support this interpretation.

Province 91 BURDEKIN REGIONAL GRAVITY SHELF

Bouguer anomaly values range from -35 to +30 mGal, and contour trends are generally

parallel to the nearest province boundary. Two units have been defined.

Unit 91A Townsville Gravity Shelf; Unit 91B Charters Towers Gravity Complex

Inspection of the Bouguer anomaly contours shows a considerable discontinuity across latitude 20°S. This is due to the different densities used in the Bouguer anomaly calculations on either side of this latitude and the relatively high elevations in the area. The province extends over part of the North Queensland Orogenic Domain; the trends of local gravity features are mainly parallel to observed structural trends within the geosyncline.

Province 92 ATHERTON REGIONAL GRAVITY LOW

A square-shaped province, consisting of numerous local gravity lows which are predominantly elongated in a northwesterly direction.

The Atherton Regional Gravity Low encompasses parts of the Georgetown Inlier, the Hodgkinson Basin, and the Carpentaria Basin. Proterozoic rocks of the Georgetown Inlier form the oldest outcrops, but the continuation of the province beyond these outcrops presumably indicates a sub-surface extension of the Georgetown Inlier beneath the Hodgkinson Basin. Some of the local gravity lows in the northeast of the province, however, correlate with granites intruding the Hodgkinson Basin sediments.

Province 93 CARPENTARIA REGIONAL GRAVITY PLATFORM

Gravity relief is smooth and no predominant contour trend is apparent. Bouguer anomalies range from -25 to +25 mGal.

The Carpentaria Regional Gravity Platform extends over part of the onshore Carpentaria Basin and the western part of the Georgetown Inlier of mid-Proterozoic metamorphic and igneous rocks. Gravity and seismic data do

not indicate the presence of thick sediments and most of the Bouguer anomaly features are probably related to density changes in the Precambrian basement. There is some suggestion in this province and eastern units of the Cloncurry Regional Gravity High (Province 88) of a gravity ridge associated with the Euroka Arch, the subsurface divide between the Eromanga and Carpentaria Basins.

Province 94 MITCHELL RIVER REGIONAL GRAVITY COMPLEX

A series of northerly trending gravity troughs and ridges. The general gravity pattern closely resembles that of the Cloncurry Regional Gravity High (Province 88). Bouguer anomalies range from -25 to +45 mGal. Six units have been defined.

Unit 94A Aurukun Gravity High; Unit 94B Archer River Gravity Low; Unit 94C Inkerman Gravity High; Unit 94D Strathmay Gravity Ridge; Unit 94E Koolatah Gravity High; Unit 94F Ebagoola Gravity Low

The Mitchell River Regional Gravity Complex encompasses parts of the onshore Carpentaria Basin in the west, and the Proterozoic Coen Inlier in the east. The Ebagoola Gravity Low (Unit 94F) can be correlated over most of its area with granitic outcrops of the Coen Inlier, and the adjoining Strathmay Gravity Ridge to the west (Unit 94D) coincides in part with metamorphics of the Coen Inlier. It is inferred that the other gravity highs and lows in the province, over which Mesozoic sediments crop out, correspond respectively to metamorphic and granitic zones within the basement, rather than to variations in thickness of the Mesozoic sediments. The similarity in gravity pattern between Provinces 88 and 94, suggests that the Mount Isa Geosyncline and the Coen Inlier are structurally similar.

Province 95 WEIPA REGIONAL GRAVITY SHELF

An area of relatively smooth contour pattern,

in which Bouguer anomalies range from -5 to +25 mGal. The predominant local feature in the province is a Bouguer anomaly high centred north of Weipa.

The Weipa Regional Gravity Shelf correlates with Mesozoic sediments of the Carpentaria Basin, except in the southeastern tip of the province, where the Coen Inlier is exposed. Bouguer anomaly variations are attributed to intrabasement density variations. The southwestern province boundary abruptly truncates the northerly gravity features of the Mitchell River Regional Gravity Complex, and probably corresponds to a major basement discontinuity.

Province 96 CAPE YORK REGIONAL GRAVITY HIGH

An area of high Bouguer anomaly, covering the eastern part of the Cape York Peninsula. The western and southern province boundaries are gravity gradients towards areas of lower Bouguer anomaly. The major contour trends are parallel to the coast. Five units have been defined.

Unit 96A Thursday Island Gravity High; Unit 96B Peninsula Gravity Trough; Unit 96C Weymouth Gravity High; Unit 96D Laura Gravity Plateau; Unit 96E Melville Gravity Gradient

The Cape York Regional Gravity High extends over parts of the Coen Inlier, the Hodgkinson Basin, the Carpentaria Basin and the Laura Basin. Proterozoic metamorphics and granites of the Coen Inlier are the oldest rocks cropping out within the province, so it can be inferred that regionally high Bouguer anomalies relate to the presence of these rocks at depth over all parts of the province, unless a mass excess occurs deep within the crust. Thinning of the continental crust probably accounts for an observed Bouguer anomaly rise towards the coast. Sedimentary thickness variations appear to have only a minor effect on the regional gravity pattern. A slight gravity depression is associated with

the Peninsula Trough in the north of the province and local gravity lows over the Laura Basin may correspond to areas of thickest Mesozoic sedimentation. Decreasing Bouguer anomalies towards the coast in the Weymouth Gravity High (Unit 96C) suggest a thickening of Mesozoic sediments.

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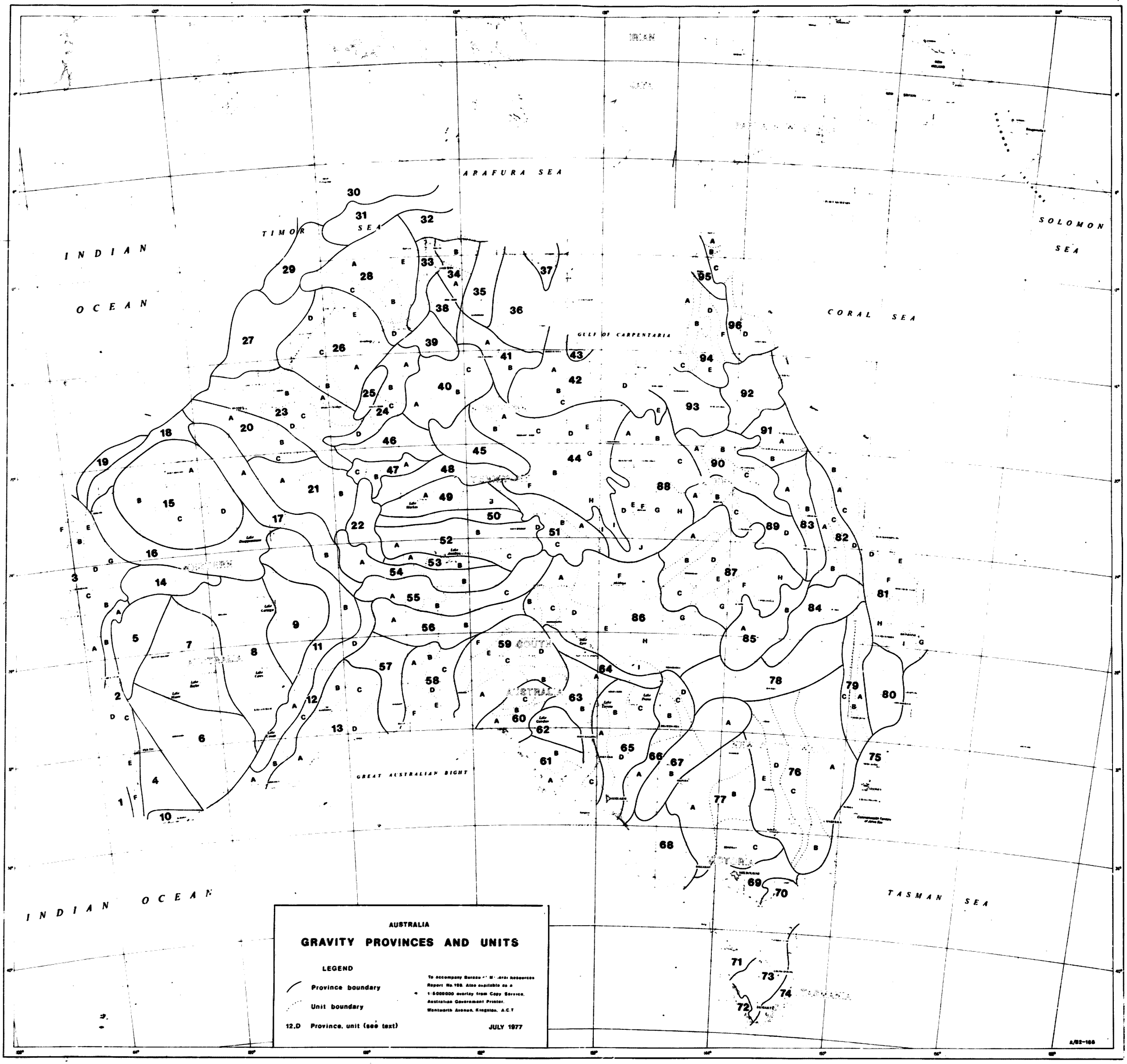
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