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1975/85

RECONNAISSANCE HELICOPTER GRAVITY SURVEY, NEW SOUTH WALES, VICTORIA, TASMANIA, & SOUTH AUSTRALIA 1973/74

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SUMMARY

A reconnaissance helicopter gravity survey of parts of New South Wales, Victoria, Tasmania and South Australia was carried out under contract to the Bureau of Mineral Resources, Geology and Geophysics (BMR) between November 1973 and June 1974, thereby completing the reconnaissance gravity coverage of Australia. Gravity stations were located on an 11-km grid over most of the survey area and on a 7-km grid in Tasmania, South Australia, and the BROKEN HILL and MENINDEE 1:250 000 Sheet areas in New South Wales. A number of earlier surveys carried out by BMR, the Tasmania Department of Mines, University of Tasmania, and private companies contributed to the overall gravity coverage of the survey area.

The survey area has been divided into thirteen gravity provinces, four of which were partly defined by previous surveys.

High Bouguer anomaly values in western New South Wales correlate with the Proterozoic rocks of the Willyama and Wonaminta Blocks and show that these rocks extend considerably farther than their mapped outcrops. An elongate gravity low between the two blocks is the expression of the Bancannia Trough. The eastern boundary of the area of high Bouguer anomaly correlating with the Willyama and Wonaminta Block is marked by a strong gravity gradient, indicating a major regional fault.

A large elongate region of low Bouguer anomaly, trending southwestwards, lies east of the Willyama and Wonaminta Blocks. The northern part of this low corresponds with the Darling Basin and the low gravity values here are largely attributed to thick Palaeozoic sediments. Along the western side gravity lows correlate with the Menindee, Tararra, and Renmark Troughs. However, in the southern part the low gravity values appear to be due to lower-density basement rocks.

A large area generally corresponding with the Murray Basin stands out because it is a region of little gravity relief and the anomalies within it have fairly weak trends. As no substantial thicknesses of sediments are known in the Murray Basin most of the anomalies are believed to be due to variations in density of basement rocks. In the southern part this interpretation is supported by the fact that a number of lows correspond with granite outcrops.

High gravity values in southwestern Victoria extending into South Australia are attributed to dense basement rocks, probably Ordovician gneisses and schists and Cambrian greenstones, scattered outcrops of which occur in the area. Areas of low gravity within this region are either due to granites or sedimentary troughs, in particular the sub-basins of the Otway Basin.

Low Bouguer anomaly values over much of the eastern part of the Lachlan Geosyncline may have two causes. Many of the strong individual lows can be correlated with granite batholiths, suggesting that the reason for the low gravity values in this region is a predominance of granitic rocks. As this region correlates with part of the Great Dividing Range, isostatic effects may also contribute to low values in some parts of the region. A high Bouguer anomaly zone which can be traced from the north of the survey area to the Victorian coast is believed to be caused by Silurian and Ordovician metamorphic rocks. A strong gradient to high Bouguer anomaly values down the east coast is attributed to rapid thinning of the continental crust. The onshore part of the Gippsland Basin stands out as a prominent gravity low on the Victorian coast.

High Bouguer anomaly values along the coast of Tasmania are also probably the result of thinning of the continental crust. Gravity lows in the centre of the island are generally correlated with granites, but one low is correlated with a trough in the Tamar region.

INTRODUCTION

The Bureau of Mineral Resources, Geology and Geophysics (BMR) completed the reconnaissance gravity coverage of Australia by conducting a helicopter gravity survey in parts of New South Wales, Victoria, South Australia, and Tasmania, including islands in Bass Strait (Plate 1), between November 1973 and October 1974. The survey was done by Wongela Geophysical Pty Ltd, using the cell method described by Hastie & Walker (1962) to establish stations on an 11-km grid over most of the area and a 7-km grid in Tasmania, South Australia and the BROKEN HILL* and MENINDEE 1:250 000 Sheet areas in New South Wales. Ties were made to stations from previous gravity surveys, within and adjacent to the survey area, which were considered to be of acceptable accuracy and density of coverage. The results of these surveys have been combined with the results of the BMR work to compile a complete Bouguer anomaly contour map of New South Wales, Victoria, Tasmania, and the eastern part of South Australia (Plate 2).

The survey area covers parts of the Central Australian and East Australian Orogenic Provinces (Geological Society of Australia, 1971), and the Eromanga, Sydney, Murray, Darling, Otway, Bass, Gippsland, and Tasmania Basins (Plate 5).

Topography, vegetation, and climatic conditions differ considerably over the survey area. The topography ranges from flat open plains to rugged mountainous terrain; the vegetation from sparse scrub growth to dense forests; the climate from hot, arid desert type to cold, wet alpine conditions; and the populated areas from remote pastoral districts to intensively farmed regions, towns, and large cities. Some of these areas gave operational problems in carrying out the survey as predicted in the presurvey report (Zadoroznyj, 1973).

This report summarizes the main features of the geology of the area and previous geophysical survey results, and presents a qualitative description and interpretation of major gravity features. A description of survey methods and lists of statistics are included as appendices.

GEOLOGY

The major geological provinces in the survey area are the Central Australian and East Australian Orogenic Provinces (Geological Society of Australia, 1971) and a number of basins containing undeformed sediments, viz. the Eromanga, Sydney, Murray, Darling, Otway, Bass, Gippsland, and Tasmania Basins (Plate 5). Subsidized boreholes in these basins are listed in Appendix 7 and their locations are shown in Plate 9.

Central Australian Orogenic Province

Willyama and Wonaminta Blocks. These rocks cropping out in the Broken Hill area of New South Wales represent the easternmost extent of the Central Australian Orogenic Province. They consist of schists, gneisses, granitic gneisses, aplites, amphibolites, and pegmatites of mid-Proterozoic age and Late Proterozoic or Early Cambrian tillites, shales, quartzites, and limestones. The Willyama Block is the zone of metamorphic and igneous rocks around Broken Hill. The Wonaminta Block is a small inlier of metasediments and volcanics to the northeast of the Willyama Block. The two blocks are separated by the Bancannia Trough, containing undeformed Middle to Lower Palaeozoic sediments. The Broken Hill lead-zinc-silver orebodies lie in the eastern part of the Willyama Block; the metamorphic rocks around the main lodes are altered arenaceous and argillaceous sediments.

East Australian Orogenic Province

Lachlan Geosyncline. The Lachlan Geosyncline is the largest part of the East Australian Orogenic Province ('Tasman Geosyncline'). It extends northward from Tasmania to northern New South Wales and westward from the east coast to near the Victoria/South Australia border. The folded Palaeozoic rocks of the geosyncline have been deformed by a number of tectonic events from the Cambrian to Middle Carboniferous. These have resulted in a series of elongate northerlytrending belts with the older rocks to the west and younger rocks to the east. Warren (1972) has divided the Lachlan Geosyncline into eleven elements of different geological histories (Plate 6).

The Ballarat Trough is an area of Cambrian and Ordovician sediments which have been strongly folded about northerly axes. The Cambrian succession is mainly a basic volcanic sequence with interbedded chert and black shale, and the Ordovician sediments are primarily greywacke with some interbedded pyritic shale. The tight often isoclinal folding has provided suitable lower-pressure sites for mineralization at the crests of folds (e.g. Bendigo reefs).

The Melbourne Trough consists of Silurian to mid-Devonian sediments overlying a relatively undeformed Ordovician sequence. The eastern edge of the trough was subjected to volcanic activity in the Middle Devonian, and granites were emplaced both along this edge and within the trough at about this time. Much of the mineralization of this area is associated with intrusions of Devonian basic dykes.

Most of the remaining mainland elements of the Lachlan Belt (Warren, op. cit.) are considered to have sufficiently similar histories to describe them together.

The rocks are Ordovician sequences of quartzose greywacke, acid to andesitic volcanics, black shale, and carbonates. They were folded during the Late Ordovician to Silurian Benambran Orogeny. Metamorphism occurred in a large belt, the Wagga Metamorphic Belt, extending from near Bairnsdale in Victoria to Cobar in New South Wales. Sedimentation continued through the Silurian, and widespread acid volcanics were deposited towards the end of this period. The Silurian rocks are typified by dacitic to rhyolitic volcanics, and limestone; other common rock types are slate, greywacke, and sandstone. Large granite and granodiorite masses were emplaced during the Late Silurian to Early Devonian Bowning Orogeny, and they preceded acid to intermediate lavas. Quartz sandstones, shales, and conglomerates were deposited in the Upper Devonian and folded during the Middle Carboniferous Kanimblan Orogeny.

The Hill End Trough consists of a basal Ordovician sequence of andesitic volcanics, with greywacke and some limestone, overlain by thick sequences of Silurian to Middle Devonian acid and andesitic volcanics. The trough was unaffected by the Bowning Orogeny and sedimentation was terminated by the Middle Devonian Tabberabberan Orogeny.

The Tasmanian rocks involved in major tectonic activity during the Palaeozoic form part of the Lachlan Belt. Cambrian sediments were laid down on a Late Proterozoic basement along the western edge of Tasmania. To the east there was considerable volcanic activity resulting in deposition of keratophyres, quartz porphyry, and quartz-feldspar porphyry with interbedded pyroclasts. Granite and ultrabasic intrusions were emplaced in the Late Cambrian and Early Ordovician. The Tabberabberan Orogeny impressed widespread folding and faulting on Tasmanian rocks, and was followed by a period of granitic intrusions until the Early Carboniferous.

Platform cover

The Eromanga Basin contains up to 3200 m of flat-lying to gently folded Jurassic and Cretaceous sediments extending over large areas of central Queensland, South Australia and northern New South Wales. Sedimentation began early in the Jurassic and continued into the Early Cretaceous; up to 600 m of sandstone and mudstone was deposited. A major marine transgression in the Early Cretaceous was followed by deposition of between 300 and 600 m of argillaceous sediments. Volcanic detritus deposited late in the Early Cretaceous was followed by deposition of up to 1500 m of sandstone and mudstone. The survey area covers parts of two sub-basins of the southern Eromanga Basin; the Lake Frome and Bulloo Embayments.

The Sydney Basin is a half-graben with the thickest section near a fault zone on the northeastern flank. The sediments include 1200 m of mainly non-marine Triassic clastics, and up to 4900 m of Permian marine and continental sediments. The continental sequence contains extensive coal measures. Extensive volcanic deposits occur in the lower part of the Permian succession in the southern part of the basin.

The Murray Basin is a large, roughly circular basin covering parts of southeastern South Australia, southwestern New South Wales, and northwestern Victoria. Permian and Cretaceous sedimentary sequences are overlain by about 300 m of Cainozoic sediments. A borehole near Jerilderie penetrated 1100 m of Permian coal measures and marine siltstones, and bottomed in Ordovician phyllite. The cretaceous sequence comprises sandstone and shale.

The Darling Basin is an easterly-orientated belt of Devonian to Lower Carboniferous sediments between the Great Artesian and Murray Basins. The sequences are predominantly continental, and are thickest in faulted downwarps.

The Otway Basin contains Mesozoic and Tertiary sediments in onshore and offshore western Victoria and eastern South Australia. Tertiary, Upper Cretaceous, and Lower Cretaceous to Jurassic sequences are separated by regional erosional unconformities. A large part of the basin has been covered by Tertiary basalts. The Tertiary sediments consist of limestone, marl, quartz sandstones with coal lenses, and conglomerates. The irregular distribution of Upper Cretaceous sediments suggest that block-faulting, forming horsts and grabens, took place during deposition of the sediments. The Lower Cretaceous to Jurassic sequence consists of subgreywacke, siltstone, mudstone, coal beds and lenses, and orthoquartzite.

The Bass Basin contains nearly 2000 m of marine Tertiary sediments made up of limestones, calcareous mudstones and shales, and minor sandstones. These are underlain by 800 m of Tertiary deltaic sediments comprising interbedded shales and siltstones. The basin is possibly a southerly extension of the Otway Basin.

The Gippsland Basin covers the south coastal region of eastern Victoria and the adjoining offshore area. The deepest and most prospective part of the basin is located in Bass Strait. The section is made up of Tertiary, Upper and Lower Cretaceous, and Palaeozoic sediments. The basin is wedged-shaped in plan and broadens eastwards from an apex near Yallourn. The granitic Bassian Rise and a series of down-to-the-north fault systems form the southern boundary of the basin. Commercial quantities of hydrocarbons have been obtained from the basal Tertiary and Mesozoic sediments since 1965.

The Tasmania Basin contains marine and continental sediments of Permian and Triassic age. Dolerite was extruded in the Middle Jurassic to form an extensive sheet cover over Permian and Triassic sediments.

Economic geology

The survey area covers regions of considerable mineral wealth ranging from the oil and natural-gas fields of the Gippsland Basin, to the many mineralized areas including the silver-leadzinc-producing area of Broken Hill (New South Wales) the former gold-producing areas of Ballarat and Bendigo (Victoria) and the copper-producing areas of Mount Lyell (Tasmania) and Cobar (New South Wales).

PREVIOUS GEOPHYSICAL SURVEYS

A considerable number of geophysical surveys have been made both in the sedimentary basins and the metalliferous regions of the survey area. Geophysical exploration for hydrocarbons has been concentrated in the Gippsland, Otway, and Sydney Basins, and exploration for minerals has largely been concentrated around the main mining centres such as Broken Hill, Bendigo, and Mount Lyell.

References to BMR and subsidized gravity, magnetic, and seismic surveys are listed in Appendices 4, 5, and 6 respectively and the results of regional surveys for which information is readily available are discussed briefly below.

Gravity Surveys

Gravity surveys (Plate 1, Appendix 4) providing an areal coverage have been carried out in the area by BMR, the University of Tasmania and Tasmania Department of Mines, and private companies. The BMR work and the work in Tasmania has generally been a reconnaissance nature to assist in regional geological mapping, though some smaller surveys have had more specific objectives.

Most of the surveys made by the private companies were subsidized under the Petroleum Search Subsidy Act, 1959-73. These surveys were generally successful in broadly defining the sedimentary basins and indicating major structures within some basins e.g. in the Otway and Darling Basins. Gravity anomalies in a number of areas were found to be caused by variations in basement lithology. A number of gravity lows were shown to be caused by granites in the basement, not by thick sediments.

Aeromagnetic surveys

BMR and subsidized aeromagnetic surveys have been made in the area (Plate 7, Appendix 5) to assist in interpreting the regional geology.

The subsidized surveys were aimed at locating areas of thick sediments to assist in exploration for petroleum. The Darnick Range Survey (North Australian Petroleum, 1963), for instance, outlined a northeast-striking sedimentary trough estimated to be 2000 to 3000 m deep in the Darling Basin. This interpretation is questionable, because of the presence of magnetized rocks at shallower depth. The Murray Basin Survey (Planet Exploration, 1962) covered a large part of the Murray Basin. The results of this survey suggest that the basin is an areally extensive, but generally shallow, depression containing a number of local troughs with about 1600 m of sediments. In the Darling Basin, the Darling Area Survey (Planet Exploration, 1963) delineated a number of troughs, each containing about 2000 m of sediments. The Mootwingee-Bancannia Survey (Geosurveys, 1964) outlined the Bancannia Trough, a graben structure with up to 4000 m of sediment. Magnetic basement depths of up to 6000 m were estimated from the results of the Echuca Survey (Seismic Analysis, 1962) in the southeast corner of the Murray Basin. Numerous probable granitic intrusions were also indicated in most of these areas and despite the possibility of substantial thicknesses of sediments the petroleum prospects are low.

Aeromagnetic surveys have been made by BMR at the request of the Mines Departments of New South Wales and Victoria. The surveys in New South Wales were to provide data to assist in the delineation of regional geological structure and also for detailed metalliferous prospecting. These surveys revealed strong magnetic anomalies parallelling the regional geological trends particularly in NARROMINE, FORBES, and BATHURST and indicating that magnetic data could be used for mapping of structures hidden by alluvium. Strong anomalies around the peripheries of several granitic outcrops may correspond to mineralized zones.

BMR has carried out surveys in Western Victoria, over the Gippsland Basin, and over BENDIGO, WANGARATTA, and TALLANGATTA. The work in western Victoria which attempted to locate 'gaps' in the Tertiary basalt which covers a large part of this side of Victoria met with only moderate success. The work over the Gippsland Basin (Quilty, 1965) was done to assist in petroleum exploration and indicated that the basin deepens offshore. The surveys over the 1:250 000 Sheet areas provided reconnaissance coverage of the area and good correlations were obtained with a number of geological features.

In 1966, BMR flew an airborne magnetic survey over Tasmania at an altitude of 3.3 km and a line spacing of 18.5 km to try to outline deep crustal features. It was difficult to define the deep-seated structures from interpreting these data because of the probelm of separating the magnetic effects of deep sources from those of shallow sources. Digital analysis of the data could possibly assist; this was done by Johnson (1972) for one of the survey lines. A comparison of the total magnetic intensity contours, obtained from the BMR survey, with Bouguer anomaly contours shows that, while the contours are usually parallel to each other, the magnetic and gravity features outlined generally do not correlate. An important exception occurs in the west and northwest of the island, where a belt of strong magnetic anomalies correlates with a pronounced zone of high gravity and strong gradients.

Magnetotelluric surveys

A magnetotelluric survey was made jointly by BMR and Macquarie University in the Murray Basin at a number of sites near Mildura and Broken Hill in 1973 (Vozoff et al., 1975). At two sites, a low resistivity layer, probably due to weakly compacted sediments, was indicated down to a depth of about 5 km. However, seismic work near one of the sites indicated a high-velocity refractor at a depth of a few hundred metres. The conflicting interpretations have yet to be resolved.

Seismic surveys

A large number of seismic surveys, both onshore and offshore, have been carried out in the sedimentary basins of the survey area (Plate 8, Appendix 6). The majority of these were private company surveys subsidized by the Australian Government. Many were reconnaissance surveys in search of, or to verify, substantial thicknesses of prospective sediments. More detailed surveys were carried out to locate suitable sites for exploratory drilling.

BMR also carried out deep crustal reflection seismic surveys near Mildura and Broken Hill in 1968 (Branson, Moss, & Taylor, 1972) and near Tidbinbilla, Australian Capital Territory and Braidwood, New South Wales in 1969 (Taylor, Moss, & Branson, 1972). Fair-quality events, considered to be from an intermediate layer, the Mohorovicic Discontinuity, and from a sub-Mohorovicic layer within the mantle were obtained at Mildura and Broken Hill. Poorer-quality deep crustal and upper mantle events were recorded at Tidbinbilla and Braidwood.

DISCUSSION OF GRAVITY RESULTS

Bouguer anomaly contours computed using a rock density of 2.2 gm/cm^3 are shown in Plate 2. Neither terrain nor isostatic corrections have been made to the Bouguer anomalies. Terrain effects would not significantly affect the regional contour pattern, although the correction for some individual stations would be as large as 20 mGal. Terrain corrections would certainly need to be applied in any detailed gravity interpretation in the highlands area. Isostatic corrections have not been made because of the need to make assumptions about the manner in which isostatic compensation is achieved. Isostatic effects over uplifted areas are considered qualitatively in the discussion.

The contoured areas have been divided into a number of regional gravity provinces to assist in discussion. Gravity provinces cover large areas of fairly simple shape in which the gravity field is characterized by uniformity with respect to contour trend, Bouguer anomaly level, or degree of contour disturbance. Where appropriate, provinces are subdivided into units, which are similar to provinces but generally occupy smaller areas.

Provinces are named after geographical features or towns. Some provinces had already been named as they extend from areas covered by previous gravity surveys. The names of all provinces wholly or partly in the survey area are listed in Table 1. Because only small parts of the Diamantina and Bourke Regional Gravity features lie within the survey area and are discussed in Fraser, Darby, & Vale (1976), no discussion of these features is included here.

TABLE 1. GRAVITY PROVINCES

Province Name	Origin of Name
Diamantina Regional Gravity Shelf	River
Bourke Regional Gravity High	Town
Barrier Regional Gravity Ridge	Range
Darling Regional Gravity Low	River
Murray Regional Gravity Complex	River
Gambier Regional Gravity High	Town
Melbourne Regional Gravity High	City
Lachlan Regional Gravity Complex	River
Gladstone-Eden Regional Gravity Ridge	Towns
Latrobe Regional Gravity Low	River
West Coast Regional Gravity High	Coast
Mersey Regional Gravity Complex	River
East Tasmanian Regional Gravity Ridge	River

Barrier Regional Gravity Ridge

This province is a sinuous generally south-southwesterly trending gravity ridge of varying width extending from the northwest corner of New South Wales to the South Australian coast at Meningie. It is bordered to the east by a pronounced linear gradient and to the west by a gentler irregular gradient. In the north, local gravity features are intense and predominantly north-northwest-trending whereas in the south, local features are of smaller amplitude and intensity and mainly north-northeast-trending. A prominent easterly-trending local gravity high cuts across the general northerly trend of contours near the centre of the province.

The province has been divided into four units for discussion purposes; Unit I, the Wonaminta Gravity Ridge which has strongly positive Bouguer anomalies and trends north-northwest; Unit II, the Bancannia Gravity Low, is an elongate gravity low with a strong north-northwest trend bounded by strong gradients on both sides; Unit III, the Willyama Gravity High a broad area of positive Bouguer anomaly in which contour trends vary from north-northwest in the north to east-northeast close to the southern margin; and Unit IV, the Waikerie Gravity Ridge, a zone of north-northeast-trending gravity highs of relatively small amplitude.

Most of Unit I can be correlated with exposures of the Precambrian rocks making up the Wonaminta Block. The gravity shows that the Proterozoic outcrops as far north of the Wonaminta Block as Tibooburra are part of the Wonaminta Orogenic Domain.

Unit II is the gravity expression of the Bancannia Trough which has been shown to contain over 3400 m of Palaeozoic sediments (Planet Exploration, 1967). The strong gravity gradients on its flanks support the hypothesis that the Bancannia trough is a graben structure.

Unit III is correlated with the dense Proterozoic rocks of the Willyama Block and the gravity contours are parallel to the major structural trends. The east-trending gravity high is close to and parallel to the Anabama Redan Fault, suggesting it may be caused by a igneous intrusion along the fault.

The interpretation of Unit IV is difficult because Cainozoic sediments conceal the basement rocks over the area. The continuity of gravity features, in particular the gradient along the eastern province boundary, south-westwards from the area of the exposed Willyama Block suggests that Unit IV corresponds to a subsurface continuation of the Willyama Block. However, the current geological thinking (K. Plumb, pers. comm.) is that the Willyama Block terminates against the Anabama-Redan

Fault and that the basement rocks south of it are the eugeosynclinal equivalents of miogeosynclinal facies in the Adelaide Geosyncline.

The strong gradient forming the eastern boundary of Unit IV indicates a large regional fault only parts of which have been mapped.

Darling Regional Gravity Low

This southwest-trending province lying east of the Barrier Regional Gravity Range is a region in which Bouguer anomalies are relatively low, ranging from -50 to -10 mGal. Two units have been defined. Unit I, the Poopelloe Gravity Low in the north, has a number of fairly intense lows with westerly to northwesterly trends; and Unit II, the Milkengay Gravity Low is characterized by elongate southwesterly-trending lows along its flanks separated in the northern part by a central gravity ridge.

The Poopelloe Gravity Low correlates with the Palaeozoic sediments of the Darling Basin, suggesting that thick sediments are causing the regionally low gravity values. This interpretation is supported by drilling and seismic evidence which has revealed more than 3300 m of sediments in the area. Although thick sediments may be the cause of regionally low Bouguer anomalies, it is probable that some of the local gravity lows reflect mass deficiencies within the basement, otherwise complex faulting involving substantial uplift and downthrust of small basement blocks would have to be proposed.

The three lows along the western flank of the Milkengay Gravity Low correspond to the Menindee, Tararra, and Renmark Troughs which seismic evidence indicates contain about 3000, 2000, and 3000 m of sediment respectively. The long narrow low along the eastern flank is difficult to interpret. It is reasonable to expect it to be caused by a trough of Palaeozoic sediments extending southwestwards from the Darling Basin; a view supported by a joint BMR-Macquarie University magnetotelluric survey (Vozoff et al., 1975) which indicated about 5 km of sediment near Pooncarie at the centre of the low. However, seismic data near Pooncarie indicate a high-velocity refractor, thought to be basement, at shallow depth. This conflict in interpretation has yet to be resolved.

Gravity relief in the southern part of the Milkengay Gravity Low is attributed to variations in basement lithology because drilling and seismic evidence has shown that the basement is shallow, reaching maximum depths of only about 1000 m in a few places, and because there does not appear to be any correlation between basement depths and Bouguer anomaly values.

Murray Regional Gravity Comple

This large province covers an area of little gravity relief in which local gravity features are oriented in various directions. It has been divided into three units: Unit I, the Tyrell Gravity Shelf, an arcuate unit of small gravity relief in which the contour trends are mainly parallel to the unit boundaries; Unit II, the Murrumbidgee Gravity Complex, in which the main contour trend is west-southwesterly; and Unit III, the Goulburn Gravity Complex, which has a relatively low Bouguer anomaly level and weak westerly contour trends. Apart from a small area in the south, which is over part of the Lachlan Geosyncline in Victoria, most of the province is over the Murray Basin.

Drilling and geophysical evidence in the Tyrell Gravity Shelf show that sediments are uniformly thin over most of the unit, indicating that gravity relief reflects basement density variations. This interpretation is supported by the observation that Bouguer anomaly minima of less than -20 mGal in the southern part of the unit can be correlated with the Wycheproof Granite, the Lake Boga Granite, and other granites. The lows in the northern part of the unit correlate in part with shallow sedimentary troughs interpreted from aeromagnetic data, suggesting that sedimentary troughs may be partly causing the gravity features.

The major anomalies within the Murrumbidgee Gravity Complex are a southwest-trending low and a broad high to its southwest. Bundy No. 1 well (Woodside Oil, 1962), drilled on the low, encountered granite at 408 m showing that a granitic body is the cause of the low Bouguer anomalies. The high is believed to be due to dense basement and the strong gradient between the features suggests a fault contact.

Low Bouguer anomalies in the southern and eastern parts of the Goulburn Gravity Complex are believed to be caused by granites of the Lachlan Geosyncline. Gravity lows in the north of the unit are attributed to granites in the Palaeozoic basement underlying the Murray Basin. This interpretation is supported by the correlation of the Pyramid Hill Granite with the low in northwest BENDIGO. Another significant feature is the north-trending high in central BENDIGO which coincides with outcrops of basic volcanics along the Heathcote Line.

Gambier Regional Gravity High

This province lying southwest of the Murray Regional Gravity Complex is characterized by high Bouguer anomaly values and general northwesterly-trending contours. The Bouguer anomaly pattern is disturbed, containing numerous local maximum and minimum closures ranging from +40 to -20 mGal. Of particular prominence are the highs exceeding +20 mGal in HAMILTON, the +40 mGal high in central PENOLA, and the -20 mGal low in northeast NARACOORTE.

The province extends over parts of the Murray Basin, Lachlan Geosyncline, and Otway Basin. Thin Quaternary sediments and basalt crop out in many parts of the province, particularly in the southeast. The high gravity values are attributed to dense basement rocks including ordovician schists and gneisses and Cambrian greenstones which occur in scattered outcrops. Areas of lower gravity may be due to granites or sedimentary troughs. The low which covers most of northern PENOLA is due to thick sediments in the Gambier Embayment , a sub-basin of the Otway Basin.

A prominent high with a peak Bouguer anomaly value of more than +40 mGal is centred over outcrop of Quaternary basalt in southeast HAMILTON. Cambrian greenstones crop out on the northeast flank of the high, suggesting that a thick greenstone body concealed beneath the basalt cover is the source of the high Bouguer anomalies. A north-northeast-trending gravity low to the north of the high can be correlated with granite outcrops.

Melbourne Regional Gravity High

This province, situated to the east of the Gambier Regional Gravity High, is characterized by high Bouguer anomaly values and general north-northeasterly-trending contours apart from the eastern third, where the contour trend is north-north-westerly. The major features are the gravity highs in southeast COLAC and eastern QUEENSCLIFF, a belt of gravity highs extending northwestwards across BAIRNSDALE, and gravity lows extending across COLAC, in QUEENSCLIFF, and in the central western part of BAIRNSDALE. The northern part of the province lies over part of the Lachlan Geosyncline while the southern part is over the eastern part of the Otway Basin.

The high in southeast COLAC correlates with a faulted zone of uplift in the Otway Basin, suggesting that shallow meta-morphic basement is the cause of relatively high gravity values in the area. The high in eastern QUEENSCLIFF is probably related to an anticline in the Palaeozoic basement as Lower Ordovician rocks in the core of the anticline crop out near the axis of the high. The zone of high gravity values extending northwestwards across BAIRNSDALE into TALLANGATTA may be caused by Ordovician gneisses and schists which have been mapped in the area but the correlation with gravity is poor. At the northern end of this belt is a pronounced high bounded to the northwest and east by strong gradients. A major fault is mapped on the northwest flank of the high corresponding with the gradient but not on the eastern flank. The rapid change in gravity level across this fault indicates a sharp change in geology which is not apparent from geological mapping. The shape and definitiveness of the high suggests that it is due to a basic igneous body.

The gravity lows extending across COLAC are caused by sediments in a sub-basin of the Otway Basin known as the Port Campbell Embayment. The gravity field over this embayment was considered to be such a good guide to basement depths that a depth to basement map was computed from gravity data (Shell Development, 1971). The low within Port Phillip Bay in QUEENSCLIFF correlated with a fault-bounded trough, and the low to the west of it is caused by the You Yang and associated granites (Zadoroznyj & Gunn, in prep.). The low in BAIRNSDALE is probably caused by granite which crops out nearby.

Lachlan Regional Gravity Complex

This large gravity province covering most of eastern New South Wales is characterized by strong north-northwesterly-trending contours and generally low Bouguer anomaly values, although a prominent ridge of high gravity values can be traced down the centre. The north-northwest-trending contours of this province are in contrast to the easterly to northeasterly-trending contours of the adjoining Murray Regional Gravity Complex to the west. The province has been divided into five units. Unit I, the Griffith Gravity Shelf has Bouguer anomaly values of a similar level to those in the adjacent Murray Regional Gravity Complex but a quite different north-northwesterly contour; Unit II, the Hume Gravity Trough is characterized by low Bouguer anomaly values, generally less than -20 mGal, and north-northwesterly contour trends. The major features in this unit are two extensive lows; one in NYMAGEE and the other in TALLANGATTA. In Unit III, the Bogan Gravity Ridge, Bouguer anomalies are 20 to 40 mGal higher than in adjacent areas. A noteworthy point is that the unit can be traced as a narrow sinuous ridge through the region of lowest Bouguer anomaly in east TALLANGATTA in the southern part of the province. Unit IV: the Macquarie Gravity Complex, lies to the east of Unit III and is broader and of lower Bouguer anomaly level. Unit V, the Monaro Gravity Low in the southeast of the province, is characterized by low gravity values in its northern and western parts. The major features are a large strong low in west CANBERRA and a smaller one centred in southeast TALLANGATTA.

The province covers most of the eastern part of the Lachlan Geosyncline and gravity contour trends are generally parallel to the overall north-northwesterly structural trend. The province also extends over parts of the Coonamble and Sydney Basins in the northeast and the Murray Basin in the west.

The truncation of the east-northeasterly trends at the western province boundary indicates a probably basement discontinuity separating an area of older basement to the west from the younger rocks of the eastern Lachlan Geosyncline to the east. Similarly the truncation of the north-northwesterly trends by east-northeasterly trends at the northern province margin suggests a basement discontinuity separating older rocks of the Lachlan Geosyncline to the south from a younger basement to the north.

The Griffith Gravity Shelf correlates largely with the Lachlan Geosyncline but also includes part of the Murray Basin in the south. The predominent contour trend is north-northwesterly, suggesting that rocks of the geosyncline are present over the entire area of the unit and form the basement to the Murray Basin sediments in the south.

The Ovens Valley Graben, shown on the 1974 Tectonic Map of New South Wales (Scheibner, 1974) coincides closely with the gravity low in western JERILDERIE, leading to the question of how much use was made of gravity data in delineating the graben. Jerilderie No. 1 well (Australian Oil and Gas, 1962), on the northeast flank of the low, revealed about 1300 m of sediment which would account for the low, given a density contrast of about 0.4 gm/cm^3. However, the orientation of the low is north-northwesterly, parallel to Lachlan Geosyncline trends, and the southwestern part of the low correlates with granitic outcrop, implying an intrabasement case of the low.

The Bogan Gravity Ridge correlates fairly closely with the Bogan Gate Synclinorial Zone shown in the schematic structural map inset on the 1974 Tectonic Map of New South Wales (Scheibner, 1974), but it should be mentioned that the other structural divisions do not show such good correlation with gravity features. The high gravity values show that the rocks which characterise the synclinorial zone are denser than those in adjacent areas. Fitzpatrick (1974) points out that the granites within this zone are relatively small intrusions in marked contrast to the large batholiths which characterize the adjacent regions. That this unit has far less granite than the adjacent units is one reason for the higher gravity values.

Ultrabasic outcrops are found in COOTAMUNDRA, WAGGA, and TALLANGATTA in the southern part of the unit. Lodwick & Flavelle (1968) noting the correlation of these ultrabasic rocks with areas of high Bouguer anomaly, interpreted the high gravity areas as delineating the subsurface extent of basic and ultrabasic intrusives. Watts (1971) attributed a prominent gravity high in southeast COOTAMUNDRA to basic metamorphic rocks.

The Hume Gravity Trough, the Macquarie Gravity Complex, and the Monaro Gravity Low coincide with parts of the Lachlan Geosyncline which are characterized by large granite batholiths. Many of the areas of lowest gravity correlate with these batholiths, such as the Murrumbidgee Batholith (Lodwick & Flavelle, 1968) and the Nymagee Granite. These correlations and the extent of granite outcrop suggest that the low Bouguer anomalies in these units are the result of a predominance of granitic rocks. The extent and continuity of the Hume Gravity Trough suggest that granitic rocks extend in a continuous belt between known batholiths in NYMAGEE and TALLAGATTA. A low which correlates with the Bathurst Granite in BATHURST extends northwards into DUBBO, indicating a probable extension of granitic rocks into DUBBO beneath the Hill End Trough.

The gravity high at Lake George, which was attributed by Kevi (1964) to basic intrusives metamorphosed to amphibolites, is a small but prominent gravity high feature in north-central CANBERRA at the southern end of the Macquarie Gravity Complex.

Many of the areas of low Bouguer anomaly in this province are topographically high, suggesting that isostatic effects should be considered as, from isostatic considerations, low Bouguer anomalies are expected in highlands regions. However there are sufficient high Bouguer anomaly features within and low Bouguer anomaly features outside the topographically high areas to indicate that isostatic effects are of secondary importance in influencing the gravity anomalies. An interesting point is that two of the topographically highest parts of Australia (Plate 3), the Snowy Mountains and the area in southwest TALLANGATTA near Bogong, correspond fairly closely with areas of high gravity, showing that dense rocks are present near the surface in these areas.

Gladstone-Eden Regional Gravity Ridge

This province, extending along the coast from Queensland through northern New South Wales to eastern Victoria, is characterized by high Bouguer anomalies which increase rapidly toward the coast. At several places Bouguer anomaly values exceed +40 mGal. Within the survey area, the province correlates with parts of the Sydney Basin in the north and the Lachlan Geosynclien in the south.

The high gravity values and the strong Bouguer anomaly rise towards the coast is attributed to the rapid thinning of the continental crust as evidenced by the comparative narrowness of the continental shelf. As Mayne et al. (1974) point out that the Sydney Basin sediments do not have a gravity expression, the noticeably lower Bouguer anomaly values in WOLLONGONG are believed to indicate lower-density basement.

Latrobe Regional Gravity Low

This province of low Bouguer anomaly values correlates with the onshore Gippsland Basin. The gravity contours of depth to magnetic basement and gravity relief probably reflects variations in thickness of Cainozoic and Upper Mesozoic sediments, which may have a combined thickness of up to 12 000 m offshore. A gravity spur extending into the region of low gravity from the west correlates with and is probably caused by a zone of basement uplift.

West Coast Regional Gravity High

This province in western Tasmania is characterized by high Bouguer anomalies, generally increasing in value towards the coast. The province can be readily divided into a northern unit, the Arthur Gravity High and a southern unit, the Gordon Gravity High. In the broader Arthur Gravity High, contour trends vary from northerly close to the west coast to northeasterly in the east. The major feature is a southwesterly-trending ridge near the centre of the unit. In the narrower Gordon Gravity High the contours are parallel to the coast and the Bouguer anomaly values are higher and the gradients stronger than in the northern unit. A particularly strong gradient extends along the southern side of Macquarie Harbour and then southwards to the coast. Another significant feature is the high area extending eastwards into an area of lower Bouguer anomaly.

The province encompasses the Proterozoic Rocky Cape Geanticline in the north, part of the Proterozoic Tyenna Geanticline in the south, and parts of the Palaeozoic Dundas Trough on its eastern flank. There are also some Devonian granite outcrops, scattered outcrops of Cambrian ultrabasics and, in the north, Tertiary basalts.

The regionally high gravity values and gradients parallel to the coast are probably caused by thinning of continental crust. On a local scale the stronger gradients and higher gravity values in the Gordon Gravity High are probably due to the Cape Sorell ultrabasics (Johnson, 1972). The strong gravity gradient which extends along the southern side of Macquarie Harbour and then southwards to the coast coincides with the southern part of a belt of fairly strong magnetic anomalies revealed by a high-altitude magnetic survey (Finney & Shelly, 1967). The northern part of this belt runs along the east flank of the southwest-trending ridge in the Arthur Gravity High. The gravity and magnetic data together suggest that there is a major structural feature along this belt and it may be significant that the Palaeozoic Dundas Trough lies just east of the belt. The southwest-trending ridge in the Arthur Gravity High correlates with the Proterozoic Keith Metamorphics, a belt of low-grade regional metamorphic greenschist, amphibolite, and pelitic schist, which Gee (1968) interprets as a high-angle shear zone of Proterozoic age. The Bouguer anomaly values on this ridge reach maximum values exceeding +35 mGal over outcrops of the Bald Hill ultrabasics. Although the ultrabasic rocks may have a local effect on the Bouguer anomaly level their limited outcrop suggests they are not extensive enough to cause the regional feature. The relatively low area west of the ridge may indicate a deep trough of unmetamorphosed Proterozoic sediments. The high area in the eastern part of the Gordon Gravity High is over an area broadly mapped as Proterozoic metamorphics and may indicate a denser facies of these rocks.

Mersey Regional Gravity Complex

This province, occupying most of inland Tasmania, is characterized by average Bouguer anomaly values which are lower than in the coastal areas. It contains numerous local Bouguer anomaly minima of less than -20 mGal, and the major gravity features are broad lows in the north of the province. The province encompasses Proterozoic rocks of the Tyenna Geanticline and Palaeozoic rocks of the Dundas Trough in the west and Palaeozoic and Cainozoic sediments of the Tasmania Basin in the east. Jurassic dolerites and Permian and Triassic sediments crop out in the central and eastern parts, and Devonian granites, Jurassic dolerites, Tertiary basalts, and Siluro-Devonian, Permian, and Tertiary sediments in the northern part.

Regionally low gravity values in this province probably indicate that the crust becomes thicker towards the centre of Tasmania. Johnson (op. cit.) used gravity data to estimate crustal thicknesses over the island in his studies of crustal structure in Tasmania. Local Bouguer anomaly lows can be attributed to upper crustal causes. A northwest-trending low west of Launceston correlates with a Tertiary sedimentary basin (Longman & Leaman, 1971); a low southeast of Launceston correlates fairly closely with a large granite body mapped in this area; and a large low in the northwestern part of the province is attributed to a large partly exposed granite body. The lows in the northeastern part of the island, including those in the adjacent province are also attributed to granite bodies (Leaman, Symonds, & Shirley, 1973; Leaman & Symonds, 1975). The limited gravity data available to Johnson (op. cit.) revealed a small low in the southern part of the province, which he attributed to a small granite body, part of which crops out at Cox's Bight on the south coast. The latest data indicate a much larger depression, which is probably caused by a large granite body beneath the surface.

East Tasmanian Regional Gravity Ridge

This province, covering the eastern side of Tasmania, is characterized by moderate to high Bouguer anomalies with gravity values increasing towards the coast. The strongest gradients and highest Bouguer anomaly values occur in the extreme northeastern part of the province and on the Tasman Peninsula in the south. The gravity pattern is more disturbed than in the West Coast Regional Gravity High.

The province extends over outcrops of Devonian granite and Siluro-Devonian sediments in the northern part, mainly Jurassic dolerites in the central part, and Jurassic dolerites and Permian and Triassic sediments in the southern part. The higher Bouguer anomaly values and the increase in gravity towards the coast are again attributed to the thinning of the continental crust. Leaman (pers. comm.) points out that an abrupt change in gravity levels occurs across a line running northwards for about 120 km from Prion Bay on the south coast, and that this line corresponds to a major geological boundary separating Precambrian rocks to the west from Permian and younger rocks to the east. This suggests the existence of a major structural fault along this line. Jurassic dolerites which cover much of the province are denser than surrounding rocks and are probably the cause of many of the local highs in the region. Leaman (1972) used gravity data to study the distribution and structural relationships of dolerites in the Hobart district.

CONCLUSIONS

The following conclusions have been drawn from an analysis of the gravity results.

1. The Wonaminta Block extends northwestwards from outcropping areas to near the northwest corner of New South Wales.

2. The extent of the Willyama Block beyond its outcropping portions is delineated. The gravity suggests that the block may extend in a belt southwestwards from the outcropping areas to the South Australian coast. Alternatively this belt may be made up of rocks equivalent to those found in the Kanmantoo Trough.

3. A major fault extends from east of Broken Hill, in a southwesterly direction, to near the South Australian coast.

4. The Bancannia Trough is a deep graben with a clear gravity expression.

5. The sediments in the Darling Basin are thick enough and have a sufficiently low density to cause a large regional low.

6. The basement of the broad shallow Murray Basin does not vary greatly in density and therefore probably not in lithology.

7. A high-density basement underlies southern and south-western Victoria.

8. The boundary between the Murray Basin basement and the eastern part of the Lachlan Geosyncline is marked by the westerly limit of north-northwest-trending Bouguer anomaly contours.

9. A belt of dense rocks, probably marking an ancient sea floor, extends through the eastern Lachlan Geosyncline.

10. The general increase in gravity towards the coast in New South Wales and Tasmania reflects the thinning of the continental crust as the continental margin is approached.

11. The Gippsland Basin has a clear gravity expression.

12. The extent of a belt of Proterozoic metamorphic rocks, thought to indicate a major structural division in northwest Tasmania, is delineated.

13. Large batholiths are indicated in the north and south of Tasmania.

14. A north-south structural division is suggested in the southern part of Tasmania.

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APPENDIX 1: SURVEY STATISTICS

Survey commenced	:	21 Nov 1973
Survey completed	:	16 June 1974
Follow-up work commenced	:	22 October 1974
Follow-up work completed	:	29 October 1974
Total survey days	:	208
Total helicopter days available	:	190
Days unserviceable	:	13
Pilot days off	:	9
Days lost during maintanence	:	13
Days lost during bad weather	:	15
Loops flown	:	996
New readings	:	7658
Flying time	:	1219.45 hours
Ferry time	:	123.10 hours

APPENDIX 2: SURVEY PERSONNEL AND EQUIPMENT

Staff

Contractor	:	Wongela Geophysical Pty Ltd
Party Leader	:	L.N. Ingall
Meter Readers	:	B. Riddle, L.N. Ingall
Draughtsman	:	L. Spain
Base Readers	:	Various field hands
Helicopter Staff	:	2 pilots, 1 engineer
BMR Supervisors	:	I. Zadoroznyj, A.R. Fraser

Equipment

2 LaCoste & Romberg gravity meters (Nos. 81, 101)
2 Worden gravity meters (Nos. 274, 592)
4 Mechanism microbarometers
1 west and dry bulb thermometer

Helicopters

2 Bell 47 G3B1 (VH-UHA, VH-UTR)
1 Bell Jetranger (VH-INF)

Vehicles

1 Datsun 1-ton truck
1 Datsun 1-ton van

APPENDIX 3: SURVEY PROCEDURE

Field Operations

The field operations were carried out by Wongela Geophysical Pty Ltd of Sydney, using the methods adopted on previous BMR reconnaissance helicopter gravity surveys. All traversing was done by the cell method (Hastie & Walker, 1962).

Before the helicopter gravity operation, the Survey Branch of the then Department of Services and Property (now Administrative Services) optically levelled and photo-identified a network of elevation traverses. The benchmarks on these traverses were elevation control stations for the survey and an area enclosed by the traverses is a segment. The segmentation of the survey area is shown in Plate 10. In the flying of the survey, loops were not allowed to cross segment boundaries. This method of flying meant that each segment could be computed independently for elevation control.

Gravity control on the survey was maintained by tying to previously established accurate gravity stations termed 'Isogal stations' (Wellman, 1974).

Horizontal control was maintained by accurately pin-pricking aerial photographs and plotting station locations on 1:250 000 photo-centre base maps.

Computing procedure

The results were computed at Monash University Melbourne, Vic., using a CDC 3200 computer. The gravity and elevation tie points (nodes) were computed twice:

1. With only one fixed node. This is computed to determine the internal accuracy of the segment, and systematic errors are not taken into account.

2. With all of the fixed nodes. This computed to determine the external accuracy of the segment to obtain the final station elevations for the computation of Bouguer anomalies. In this computation systematic errors are corrected, so that the external standard deviation of the adjustments is always higher than the internal deviation.

The internal and external network adjustments are shown in the following table. The internal and external standard deviations are the standard deviations of least squares adjustments to legs in the network.

ISD = internal standard deviation
ESD = external standard deviation
SD = standard deviation
MA = maximum adjustment

TABLE 2. NETWORK ADJUSTMENTS

Segment	Gravity (mGal)				Elevation (m)			
	ISD		ESD		ISD		ESD	
	SD	MA	SD	MA	SD	MA	SD	MA
A	0.04	0.13	0.05	0.25	1.09	3.24	1.76	4.49
B	0.04	0.17	0.04	0.17	1.07	2.77	1.50	4.46
C	0.08	0.28	0.07	0.21	1.47	4.30	2.05	6.40
D	0.03	0.13	0.10	0.35	2.05	6.48	3.28	9.60
E	0.04	0.15	0.05	0.20	1.80	5.26	2.29	5.92
F	0.05	0.15	0.06	0.14	1.44	6.15	2.24	8.34
G	0.03	0.10	0.05	0.37	3.40	13.19	5.63	17.86
H	0.03	0.10	0.04	0.10	1.28	3.32	2.38	6.82
I	0.02	0.06	0.04	0.15	1.86	5.97	2.61	9.71
J	0.05	0.17	0.05	0.16	3.03	9.79	3.68	12.48
K	0.02	0.07	0.03	0.10	1.85	6.11	2.14	11.91
L	0.04	0.08	0.04	0.12	1.14	2.63	1.60	3.67
W	0.02	0.04	0.02	0.07	5.80	16.19	5.13	15.54
X	0.02	0.06	0.03	0.09	3.69	9.11	5.20	14.82
Y	0.03	0.08	0.03	0.08	5.03	10.44	5.81	13.96
Z	0.03	0.10	0.03	0.12	2.71	7.32	4.78	19.90

TABLE 3. GRAVITY READINGS IN 1:250 000 SHEET AREAS

1:250 000 Sheet Name	New Readings	Flying Hours	Ferry Hours	Loops
ANABRANCH	160	29.25	3.10	24
BAIRNSDALE	152	29.05	2.30	24
BALARAT	155	27.10	1.55	18
BALRANALD	163	29.20	3.45	24
BATHURST	159	29.00	3.40	23
BEGA	161	29.30	2.35	23
BENDIGO	132	23.05	1.45	19
BROKEN HILL	321	43.00	4.15	27
CARGELLIGO	144	23.00	3.00	19
COBHAM LAKE	150	27.10	3.55	21
COLAC	65	9.20	0.55	9
DENILIQUIN	157	7.50	3.00	21
FORBES	160	29.20	3.10	24
HAMILTON	156	28.40	1.50	23
HORSHAM	150	27.30	2.25	21
IVANHOE	28	4.50	0.5	4
JERILDERIE	163	29.20	3.10	24
MALLACOOTA	119	21.50	2.00	18
MANARA	78	14.10	2.40	10
MELBOURNE	162	14.35	1.05	18
MENINDEE	250	36.50	5.10	23
MILDURA	163	29.50	2.10	24
MILPARINKA	134	24.10	5.00	17
NARRANDERA	59	11.35	1.25	10

TABLE 3 (continued)

1:250 000 Sheet Name	New Readings	Flying Hours	Ferry Hours	Loops
NARROMINE	162	22.00	2.15	22
NYMAGEE	157	28.20	3.15	24
OUYEN	161	28.05	3.40	24
PINNAROO	341	48.10	4.40	32
POONCARIE	92	16.15	1.35	12
PORTLAND	39	6.40	0.50	4
QUEENSCLIFF	23	4.25	0.25	3
RENMARK	187	25.15	1.55	16
ST ARNAUD	159	27.45	2.05	23
SALE	26	4.35	0.20	4
SWANHILL	161	27.50	2.00	23
SYDNEY	153	19.15	1.55	26
TALLANGATTA	163	31.50	1.50	23
URISINO	125	20.25	2.10	16
WAGGA	120	22.30	1.25	17
WANGARATTA	152	28.50	1.55	22
WARBURTON	161	29.30	2.35	25
WARRAGUL	132	23.45	2.45	21
WHITECLIFFS	90	16.25	2.35	12
WILCANNIA	105	16.55	2.25	16
WOLLONGONG	99	16.55	2.40	17
SK55/1	21	2.30	-	2
SK55/2	8	1.30	0.30	1

TABLE 3 (continued)

1:250 000 Sheet Name	New Readings	Flying Hours	Ferry Hours	Loops
SK55/1	49	6.30	-	4
SK55/3	57	5.35	0.30	7
SK55/5	138	24.15	1.30	17
SK55/6	184	19.30	1.20	21
SK55/7	138	19.50	-	15
SK55/9	46	5.40	1.05	5
SK55/10	291	38.00	2.45	34
SK55/11	175	23.00	-	19
SK55/14	144	20.20	4.35	16
SK55/15	17	2.15	0.20	2
SJ55/14 & 15	41	5.35	-	3
TOTAL	7658	1219.45	123.10	996

APPENDIX 4 - GRAVITY SURVEYS

Subsidized Surveys

Name	Basin	Company	BMR Subsidy No.
Urisino-Tongo (3)*	Great Artesian	L.H. Smart	62/1920
White Cliffs (7)	Great Artesian	Mid Eastern Oil	64/4801
Tibooburra-Louth (2)	Great Artesian	American Overseas	65/4818
Nucha (5)	Great Artesian	Planet Exploration	65/4813
Packsaddle (6)	Great Artesian	Planet Exploration	67/11185
Clarence-Winathee (4)	Great Artesian	Clarence River Basin Oil	68/3041
Dandaloo	reat Artesian	A.J. Wood	64/4803
East Darling (8)	Murray Darling	Planet Exploration	63/1905
Ivanhoe (11)	Murray Darling	Texam	64/4809
Scopes (10)	Murray Darling	Alliance Oil	66/4826
Four Corners (10)	Murray Darling	Alliance Oil	68/3005
Murrumbidgee (12)	Murray Darling	Planet Exploration	68/3032
Blantyre Basin (9)	Murray Darling	NSW Oil and Gas	69/3029
Jerilderie (16)	Murray Darling	Alliance Oil	69/3079
Coleraine (20)	Otway	Alliance Oil	66/4821
Hawkesdale (21)	Otway	Shell Development	68/3035
Terang-Portland (22)	Otway	Shell Development	69/3054
Casterton (19)	Otway	Planet Exploration	70/86
Colac-Geelong (23)	Otway	Shell Development	71/560
Stockyard Hill (27)	Gippsland	Woodside (Lakes Entrance) Oil	66/4823

BMR Surveys

Title	Author	BMR Record No.
Discussion of gravity results, East Gippsland Victoria	J.C. Dooley & J.M. Mulder	1953/77
Gravity surveys of Port Phillip Bay and adjacent areas, Victoria, 1957-58 (24)	S. Cunson & L.W. Williams	1965/64
Regional gravity traverses, southeastern NSW 1966	J.R.H. Van Son	1966/184
Regional gravity surveys, eastern Victoria 1961 and 1964	J.R.H. Van Son & W.J. Langron	1967/11
Helicopter gravity training survey, A.C.T. and southern NSW 1966 (15)	G.D. Lodwick & A.J. Flavelle	1968/85
Reconnaissance helicopter gravity surveys, northern NSW and southern Qld 1968 (1)	F. Darby	1969/109
Interpretation of a positive Bouguer Anomaly feature near Cootamundra, NSW (14)	M.D. Watts	1971/34
Gravity survey of the valleys of the Goulbourn and Ovens Rivers, Victoria 1972 (18)	G.R. Pettifer	1973/41
BMR gravity surveys, Gippsland Basin, Victoria 1948-1961	F.J.G. Neumann	1974/160

APPENDIX 5 - AEROMAGNETIC SURVEYS

Subsidized Surveys

Name	Basin	Company	BMR Subsidy No
Darling Area (2)*	Great Artesian	Planet Exploration	62/1731
Mootwingee-Bancannia (3)	Great Artesian	Geosurveys	64/4605
Ivanhoe (5)	Murray Darling	Exploration Drilling	62/1717
Echuca (7)	Murray Darling	Seismic Analysis	62/1723
Menindee (4)	Murray Darling	North Australian Petroleum	62/1729
Murray Basin (6)	Murray Darling	Planet Exploration	62/1732
Darnick Range (4)	Murray Darling	North Australian Petroleum	63/1708
Bass Strait -Encounter Bay (12)	Otway, Bass, Gippsland	Hematite Petroleum	62/1707 62/1711
Andersons Inlet (13)	Gippsland	Oil Development	62/1713
Sydney-Nowra (8)	Sydney	L.H. Smart	62/1726
Terrigal (9)	Sydney	Central Coast Oil	64/4600
Sydney-Newcastle Offshore (10)	Sydney	Shell Development	66/4622
Portland-Geelong (11)	Otway	Shell Development	70/373
Offshore Tasmania (14)	Tasmania	Esso Exploration	66/4626
Offshore SE Tasmania (15)	Tasmania	Esso Exploration	66/4627

BMR Surveys

Title	Author	BMR Record No.
Gippsland Basin Airborne magnetic surveys, Victoria, 1951-52, and 1956	J.H. Quilty	Report No. 95
Forbes, West Wyalong, and Bourke Areas, airborne magnetic and radiometric survey, NSW 1960	R.M. Carter	1960/105

Title	Author	BMR Record No.
Cobar, Nymagee, and Cargelligo airborne magnetic and radiometric surveys	A.G. Spence	1961/51
Broken Hill airborne magnetic and radiometric surveys, NSW 1957	A.G. Spence	1963/24
Narromine and Bathurst airborne magnetic and radiometric surveys, NSW 1961	G.A. Young	1963/114
Tasmania aeromagnetic survey	W.A. Finney & E.P. Shelley	1967/19
Western Victoria detailed aero-magnetic survey, 1966	B.A. Dockery	1967/44
Airborne magnetic and radiometric survey of the western part of the Sydney 1:250 000 map area, NSW 1966	R. Gerdes	1967/52
Western Victoria detailed aero-magnetic survey, 1967	R.A. Gerdes	1968/146
Western Victoria detailed aero-magnetic survey, 1968	R.A. Gerdes	1968/147
Bass Strait and Encounter Bay aeromagnetic survey, 1960-1961	Haematite Exploration Pty Ltd	PSSA No. 60
Airborne magnetic & radiometric survey of Bendigo, Wangaratta, and Tallangatta, Vic., 1972	D.N. Downie, S.S. Lambourne & J.E. Olsen	1976/2

APPENDIX 6 - SEISMIC SURVEYS

Subsidized Surveys

Name	Basin	Company	BMR Subsidy No.
Fort Grey-Yandama (15)*	Great Artesian	BOC of Australia	62/1649
Mount Jack (22)	Great Artesian	Woodside (Lake Entrance) Oil	62/1625
Lake Pamamaroo (42)	Great Artesian	Alliance Oil Development	63/1537
Tibooburra (18)	Great Artesian	Alliance Oil Development	63/1525
Lake Stewart (15)	Great Artesian	Clarence River Basin Oil	64/4531
White Cliffs (28)	Great Artesian	Mid Eastern Oil	65/11028
Mootwingee (27)	Great Artesian	Geosurveys	65/4589
Olive Downs (14)	Great Artesian	Clarence River Basin Oil	64/4574
Bancannia (17)	Great Artesian	Planet Explortaion	66/11094
Tandou (44)	Great Artesian	North Australian Petroleum	66/11063
Paroo-Tibooburra (12)	Great Artesian	American Overseas	67/11155
Packsaddle (20)	Great Artesian	Planet Exploration	67/11185
Nucha (26)	Great Artesian	Planet Exploration	68/3021
Pincally (19)	Great Artesian	NSW Oil and Gas	69/3034
Hamilton Gate (13)	Great Artesian	Continental Oil	69/3085
Winnathee (16)	Great Artesian	North West Oil and Minerals	69/3082
Oaklands Basin (72)	Murray Darling	Australian Oil and Gas	62/1571

Name	Basin	Company	BMR Subsidy No.
Mildura (75)	Murray Darling	Planet Exploration	62/1607
Bundy-Lake Boga (81)	Murray Darling	Woodside (Lakes Entrance) Oil	62/1614
Magenta (74)	Murray Darling	Planet Exploration	62/1623
Wentworth (76)	Murray Darling	Australian Oil and Gas	62/1641
Stephens Creek (42)	Murray Darling	Oil Development	62/1652
Griffith (70)	Murray Darling	Australian Petroleum	62/1653
Lake Victoria (77)	Murray Darling	Australian Oil and Gas	63/1518
Murrayville-Casterton (80)	Murray Darling	Planet Exploration	63/1529
Wilcannia (29)	Murray Darling	Tasman Oil	65/11025
Pooncarie (48)	Murray Darling	Australian Oil and Gas	65/11053
Tarrara (46)	Murray Darling	Australian Oil and Gas	65/11059
Deniliquin (73)	Murray Darling	Australian Oil and Gas	66/11078
Ivanhoe (24)	Murray Darling	Exploration Drilling	66/11076
Lake Poopelloe (30)	Murray Darling	Canadian Superior	66/11109
South Tarrara (47)	Murray Darling	Australian Oil and Gas	66/11122
Lake Poopelloe R2 (30)	Murray Darling	Planet Exploration	68/3037
Lake Wintlow (41)	Murray Darling	Alliance Oil Development	68/3031
Lake Poopelloe R3 (25)	Murray Darling	Planet Exploration	69/3009

Name	Basin	Company	BMR Subsidy No.
Sunset (79)	Murray Darling	Associated Australian Oilfields	69/3018
Mount Emu (40)	Murray Darling	NSW Oil and Gas	70/197
Jerilderie North (69)	Murray Darling	NSW Oil and Gas	70/220
Narweena (78)	Murray Darling	Pexa Oil	70/221
Redbank (45)	Murray Darling	North Australian Petroleum	69/3039
Mossgiel (49)	Murray Darling	NSW Oil and Gas	69/3055
Nambuccurra (48)	Murray Darling	NSW Oil and Gas	69/3046
Hay (71)	Murray Darling	NSW Oil and Gas	69/3064
Port Campbell (102)	Otway	Frome-Broken Hill	62/1523
Warrnambool (96)	Otway	Frome-Broken Hill	62/1540
Dartmoor-Nelson (86)	Otway	Frome-Broken Hill	62/1567
Casterton (82)	Otway	Planet Exploration	62/1597
Cooriemungle (101)	Otway	Frome-Broken Hill	63/1550
Branxholme-Koroit (92)	Otway	Frome-Broken Hill	63/1535
SW Victoria (87)	Otway	Frome-Broken Hill	63/1511
Princetown (104)	Otway	Frome-Broken Hill	63/1505
Curdie Vale (103)	Otway	Frome-Broken Hill	64/4504
Timboon (100)	Otway	Frome-Broken Hill	64/4500
Merino (84)	Otway	Alliance Oil Development	64/4535
Koroit (97)	Otway	Frome-Broken Hill	64/4552
Offshore Otway Basin (94)	Otway	Shell Development	65/11052
Port Fairy-Nelson (91)	Otway	Shell Development	66/11062
PEP 22-D1 (88)	Otway	Shell Development	66/11124
Otway Marine (105)	Otway	Shell Development	66/11121

Name	Basin	Company	BMR Subsidy No.
Cape Bridgewater (89)	Otway	Shell Development	67/11175
Otway EP67 (107)	Otway	Esso Exploration	67/11188
Hawkesdale (98)	Otway	Shell Development	68/3053
Otway ER-68 (95)	Otway	Esso Exploration	68/3036
Macarthur-Portland (90)	Otway	Shell Development	69/3080
Wannon (83)	Otway	Alliance Oil Development	70/425
Nelson-Koroit (93)	Otway	Shell Development	70/963
East Gippsland (124)	Gippsland	Woodside (Lakes Entrance) Oil	62/1507
Lake Wellington (122)	Gippsland	Woodside (Lakes Entrance Oil	62/1552
Lakes Entrance-Woodside (123)	Gippsland	Arco	62/1591
Ninety-Mile Beach (130)	Gippsland	Arco	62/1640
Gormandale (120)	Gippsland	APM Development	63/1547
Seaspray (123)	Gippsland	Arco	64/4521
Gippsland Shelf (129)	Gippsland	Esso Exploration	64/4550
Woodside-Paynesville (119)	Gippsland	Woodside (Lakes Entrance) Oil	64/4573
Offshore Gippsland Basin (126)	Gippsland	Shell Development	65/11045
Gippsland EC-67 (132)	Gippsland	Esso Exploration	67/11184
Venus Bay (112)	Gippsland	Alliance Oil Development	67/11193
Sole (127)	Gippsland	Shell Development	67/11187
Gippsland EH68 (131)	Gippsland	Esso Exploration	68/3015
Toongabbie (121)	Gippsland	APM Development	68/3022

Name	Basin	Company	BMR Subsidy No.
East Gippsland Basin (133)	Gippsland	Magellan Petroleum	68/3049
Gippsland G69A (141)	Gippsland	Esso Exploration	68/3058
Cape Patterson (113)	Gippsland	Mid Eastern Oil Co. N.L.	69/3068
Tarwin (118)	Gippsland	APM Development	70/122
Bemm River (125)	Gippsland	WYP Development	70/768
Sydney Basin (66)	Sydney	Australian Oil and Gas	62/1546
Newcastle-Maitland (56)	Sydney	Planet Exploration	62/1596
Singleton-Camden (60)	Sydney	Australian Oil and Gas	62/1605
Nowra-Coolah (39)	Sydney	L.H. Smart	62/1613
Woronora-Dural (61)	Sydney	American Overseas	62/1642
Offshore Sydney Basin (54)	Sydney	Shell Development	64/4565
Richmond-Cessnock (59)	Sydney	Shell Development	65/4577
Putty-Oakdale (58)	Sydney	Australian Oil and Gas	65/11018
Denman (51)	Sydney	Australian Oil and Gas	65/11061
Girvan (52)	Sydney	Australian Oil and Gas	65/11058
Offshore Sydney (62)	Sydney	Shell Development	67/11170
Currambene (67)	Sydney	Genoa Oil	69/3016
Broken Bay (63)	Sydney	Longreach Oil	69/3070
Parkes (50)	Sydney	NSW Oil and Gas	70/361
Stockton (55)	Sydney	NSW Oil and Gas	70/482

Name	Basin	Company	BMR Subsidy No.
South Sydney Basin (68)	Sydney	Magellan Petroleum	70/486
South Broken Bay (65)	Sydney	Longreach Oil	70/803
Charlotte Head (53)	Sydney	NSW Oil and Gas	70/828
Eastern Bass Strait (128)	Bass	Esso Exploration	66/11070
Bass ED67 (114)	Bass	Esso Exploration	67/11196
Tasman-Bass Strait (135)	Tasmania, Sydney, Gippsland	Magellan Petroleum	69/3023
Sailfish (134)	Tasmania	NSW Oil and Gas	70/884

BMR Surveys

Title	Author	BMR Record No.
Final Report on a seismic reflection survey in the Sydney Basin	C.S. Robertson	1958/48
Rosedale seismic survey, Victoria 1961	K.F. Fowler	1961/165
Murray Basin seismic survey 1960	S.J. Watson	1962/164
Otway and Sydney Basins experimental 'vibroseis' survey, 1964	Seismograph Services Limited	1965/198
Otway Basin experimental for comparison with the 'vibroseis' survey, Victoria, 1965-volcanics project	J.S. Raitt	1966/25
Sydney Basin experimental survey for a comparison with a 'vibroseis' survey, New South Wales, 1965	E. Schwing (I.F.P.)	1966/115

Title	Author	BMR Record No.
Deep crustal reflection seismic test survey, Tidbinbilla, A.C.T. and Braidwood, N.S.W., 1969	F.J. Taylor F.J. Moss & J.C. Branson	1972/126
Deep crustal reflection seismic test survey, Mildura, Victoria and Broken Hill, N.S.W. 1968	J.C. Branson F.J. Moss & F.J. Taylor	1972/127

APPENDIX 7 - BOREHOLES

Name	Basin	Company	BMR Subsidy No.
Binerah Downs (13)*	Great Artesian	Clarence Oil	66/4206
Bancannia South (15)	Great Artesian	Planet Exploration	67/4268
Bancannia North (14)	Great Artesian	Planet Exploration	67/4277
Jupiter (16)	Great Artesian	Planet Management and Research	69/2005
Wentworth (45)	Murray-Darling	Australian Oil and Gas	62/1212
Bundy (47)	Murray-Darling	Woodside (Lakes Entrance) Oil	62/1218
Jerilderie (49)	Murray-Darling	Australian Oil and Gas	62/1216
Balranald (46)	Murray-Darling	Woodside (Lakes Entrance) Oil	62/1106
Ivanhoe (103)	Murray-Darling	North Shore Oil Crop.	63/1028
Killendoo (48)	Murray-Darling	Amalgamated Pet-roleum Exploration	64/4001
Lake Victoria (44)	Murray-Darling	Australian Oil and Gas	64/4049
Blantyre (41)	Murray-Darling	Mid Eastern Oil	64/4131
Pondie Range (17)	Murray-Darling	Mid Eastern Oil	66/4226
Tararra (43)	Murray-Darling	Australian Oil and Gas	66/4238
Poopelloe Lake (18)	Murray-Darling	NSW Oil and Gas	69/2014
Mount Emu (42)	Murray-Darling	NSW Oil and Gas	69/2038
Morkalla (51)	Murray-Darling	Associated Aust. Oilfields	70/233

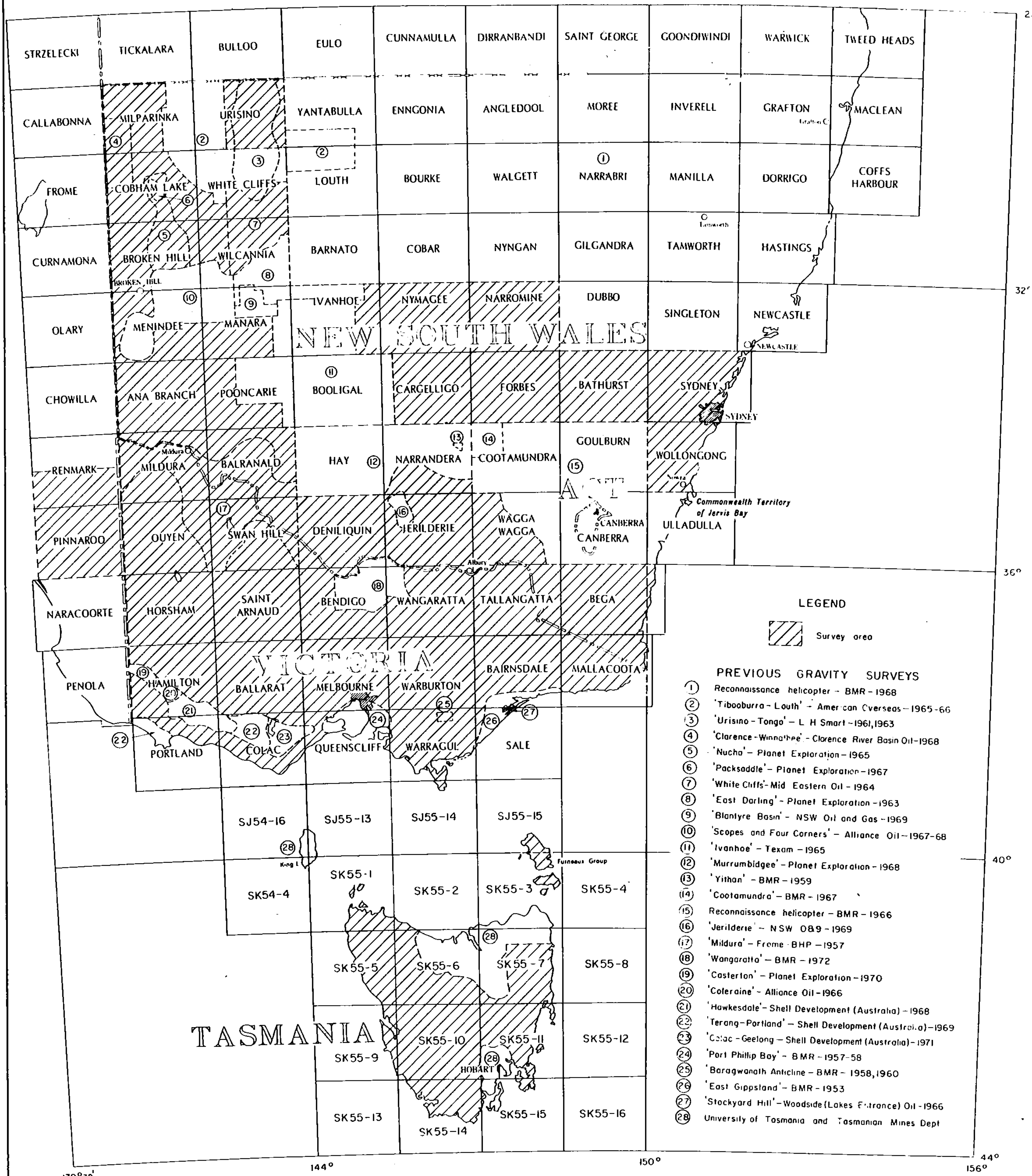
Name	Basin	Company	BMR Subsidy No.
Sunset (50)	Murray-Darling	Associated Aust. Oilfields	70/232
Port Campbell No. 1 (69)	Otway	Frome-Broken Hill	62/1020
Port Campbell No. 2 (68)	Otway	Frome-Broken Hill	62/1016
Flaxman's (65)	Otway	Frome-Broken Hill	62/1074
Anglesea (72)	Otway	Oil Development	62/1217
Pretty Hill (61)	Otway	Frome-Broken Hill	62/1115
Sherbrook (67)	Otway	Frome-Broken Hill	63/1045
Eumeralla (57)	Otway	Frome-Broken Hill	62/1308
Fergusons Hill (67)	Otway	Frome-Broken Hill	63/1061
Heathfield (53)	Otway	Planet Exploration	64/4019
Port Campbell No. 4 (66)	Otway	Frome-Broken Hill	64/4063
Tullich (52)	Otway	Planet Exploration	64/4088
Pecten (70)	Otway	Shell Development	67/4239
Mussel (101)	Otway	Esso Exploration	69/2021
Hindhaugh Creek (71)	Otway	Pursuit Oil	69/2026
Hawkesdale (60)	Otway	Shell Development	69/2023
Moyne Falls (58)	Otway	Shell Development	69/2023
Nerita (73)	Otway	Shell Development	67/4258
Voluta (56)	Otway	Shell Development	67/4263
Casterton No. 1 (54)	Otway	Planet Exploration	65/4135
Casterton No. 1 (55)	Otway	Planet Exploration	67/4270
Prawn (100)	Otway	Esso Exploration	67/4273
Nautilus (102)	Otway	Esso Exploration	68/2008
Garvoc (63)	Otway	Interstate Oil	68/2020
Woolsthorpe (59)	Otway	Interstate Oil	68/2019

Name	Basin	Company	BMR Subsidy No.
Purrumbete (64)	Otway	Interstate Oil	68/2021
Rowans (62)	Otway	Shell Development	72/896
Snail (74)	Otway	Haematite Petroleum	72/3159
Rosedale (75)	Gippsland	AMP Development	62/1035
Wellington Park (79)	Gippsland	Arco Ltd	62/1077
North Seaspray (80)	Gippsland	Arco Ltd/Woodside (Lakes Entrance)	62/1305
SW Bairnsdale (76)	Gippsland	Arco Ltd/Woodside (Lakes Entrance)	62/1224
Merriman (83)	Gippsland	Arco Ltd/Woodside (Lakes Entrance)	63/1301
Carr's Creek (82)	Gippsland	Arco Ltd/Woodside (Lakes Entrance)	63/1306
Seaspray (81)	Gippsland	Arco Ltd	64/4002
Duck Bay (78)	Gippsland	Arco/Woodside	64/4014
Gippsland Shelf (88)	Gippsland	Esso Exploration	64/4124
Woodside South (84)	Gippsland	Woodside (Lakes Entrance) Oil	65/4159
Gippsland Shelf No. 4	Gippsland	Esso Exploration	65/4183
Sunday Island (86)	Gippsland	Woodside (Lakes Entrance) Oil	65/4180
St Margaret I. (85)	Gippsland	Woodside (Lakes Entrance) Oil	65/4185
Groper No. 2 (87)	Gippsland	Esso Exploration	69/2028
Milton (77)	Gippsland	Ashburton Oil	69/2033
Sailfish (94)	Gippsland	NSW Oil and Gas	71/472
Cobia (92)	Gippsland	Esso Exploration	72/2703

Name	Basin	Company	BMR Subsidy No.
Morwong (89)	Gippsland	Esso Exploration	72/3225
Mulgoa No. 2 (36)	Sydney	Australian Oil and Gas	62/1024
Mt Hunter (37)	Sydney	Australian Oil and Gas	62/1083
Kurrajong Hts (34)	Sydney	Australian Oil and Gas	62/1109
East Maitland (29)	Sydney	Planet Exploration	62/1116
Stockyard Mt (39)	Sydney	Fairmont Drillers	62/1114
Mt Murwin (31)	Sydney	Australian Oil and Gas	63/1000
Loder (27)	Sydney	Australian Oil and Gas	62/1135
Woronora (38)	Sydney	Australian Oil and Gas	63/1022
Belford (28)	Sydney	Australian Oil and Gas	64/4109
Camberwell (26)	Sydney	Australian Oil and Gas	65/4179
Dural South (35)	Sydney	Shell Development	66/4209
Martindale (25)	Sydney	Australian Oil and Gas	67/4243
Coonemia (40)	Sydney	Genoa Oil	69/2010
Howes Swamp (32)	Sydney	Esso Exploration	70/139
Higher Macdonald (33)	Sydney	Australian Oil and Gas	68/2037
Jerry Plains (30)	Sydney	Esso Exploration	69/2004
Clam (99)	Tasmania	Esso Exploration	69/2016
Bluebone (95)	Tasmania	Esso Exploration	69/2029

Name	Basin	Company	BMR Subsidy No.
Bass 1 (97)	Bass	Esso Exploration	65/4167
Bass 2 (96)	Bass	Esso Exploration	66/4187
Bass 3 (98)	Bass	Esso Exploration	67/4241

PLATE I



RECONNAISSANCE HELICOPTER GRAVITY SURVEY

EASTERN AUSTRALIA 1973/74

LOCALITY MAP

100 0 100 200 300 400 KILOMETRES

Record No. 1975/85

A/B2-86A

GRAVITY PROVINCES

A Diamantina Regional Gravity Shelf
B Bourke Regional Gravity High
C Barrier Regional Gravity Ridge
- Unit I Wonaminta Gravity Ridge
- Unit II Bancania Gravity Low
- Unit III Willyama Gravity High
- Unit IV Waikerie Gravity Ridge

D Darling Regional Gravity Low
- Unit I Poopelloe Gravity Low
- Unit II Milkengay Gravity Low

E Murray Regional Gravity Complex
- Unit I Tyrell Gravity Shelf
- Unit II Murrumbidgee Gravity Complex
- Unit III Goulburn Gravity Complex

F Gambier Regional Gravity High
G Melbourne Regional Gravity High
H Lachlan Regional Gravity Complex
- Unit I Griffith Gravity Shelf
- Unit II Hume Gravity Trough
- Unit III Bogan Gravity Ridge
- Unit IV Macquarie Gravity Complex
- Unit V Monaro Gravity Low

I Gladstone–Eden Regional Gravity Ridge
J Latrobe Regional Gravity Low
K West Coast Regional Gravity High
- Unit I Arthur Gravity High
- Unit II Gordon Gravity High

L Mersey Regional Gravity Complex
M East Tasmania Regional Gravity Ridge

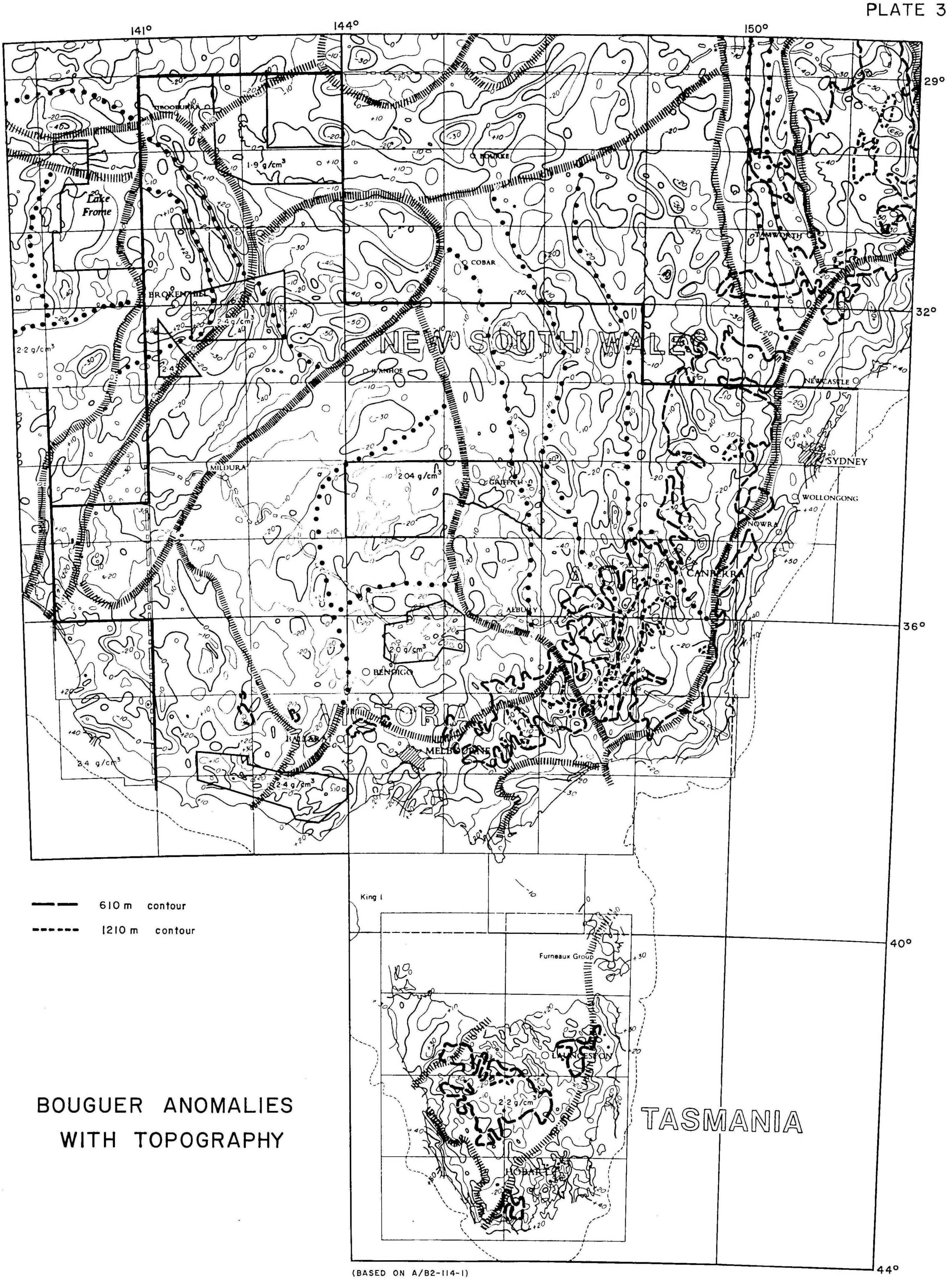
|||||||||| GRAVITY PROVINCE BOUNDARY

•••• UNIT BOUNDARY

—— SURVEY BOUNDARY

BOUGUER ANOMALY CONTOURS AND GRAVITY PROVINCES

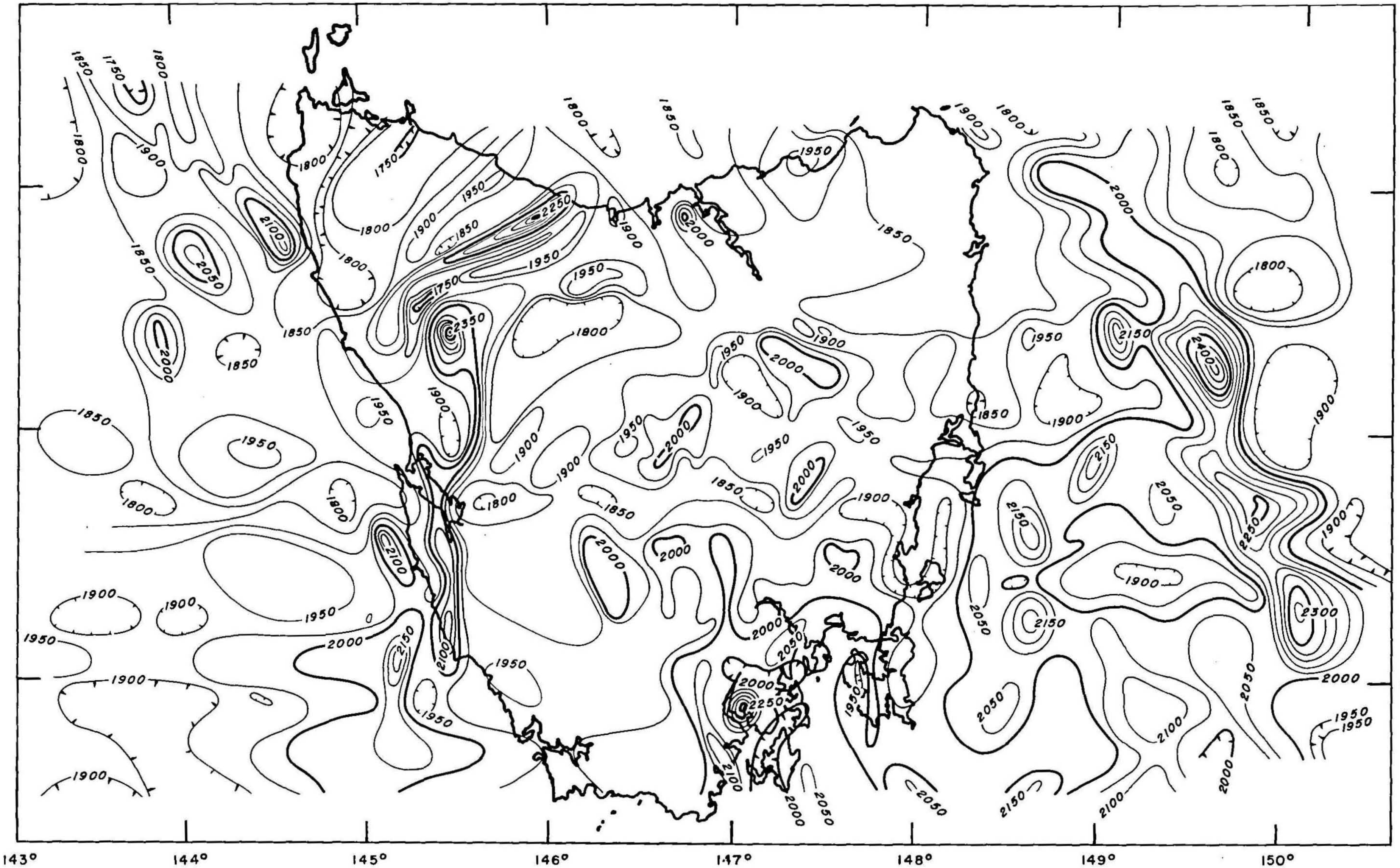
50 0 50 100 150 200 KILOMETRES



BOUGUER ANOMALIES WITH TOPOGRAPHY

(BASED ON A/B2-114-1)

Record No.1975/85



TOTAL MAGNETIC INTENSITY TASMANIA

—2000— Magnetic contour

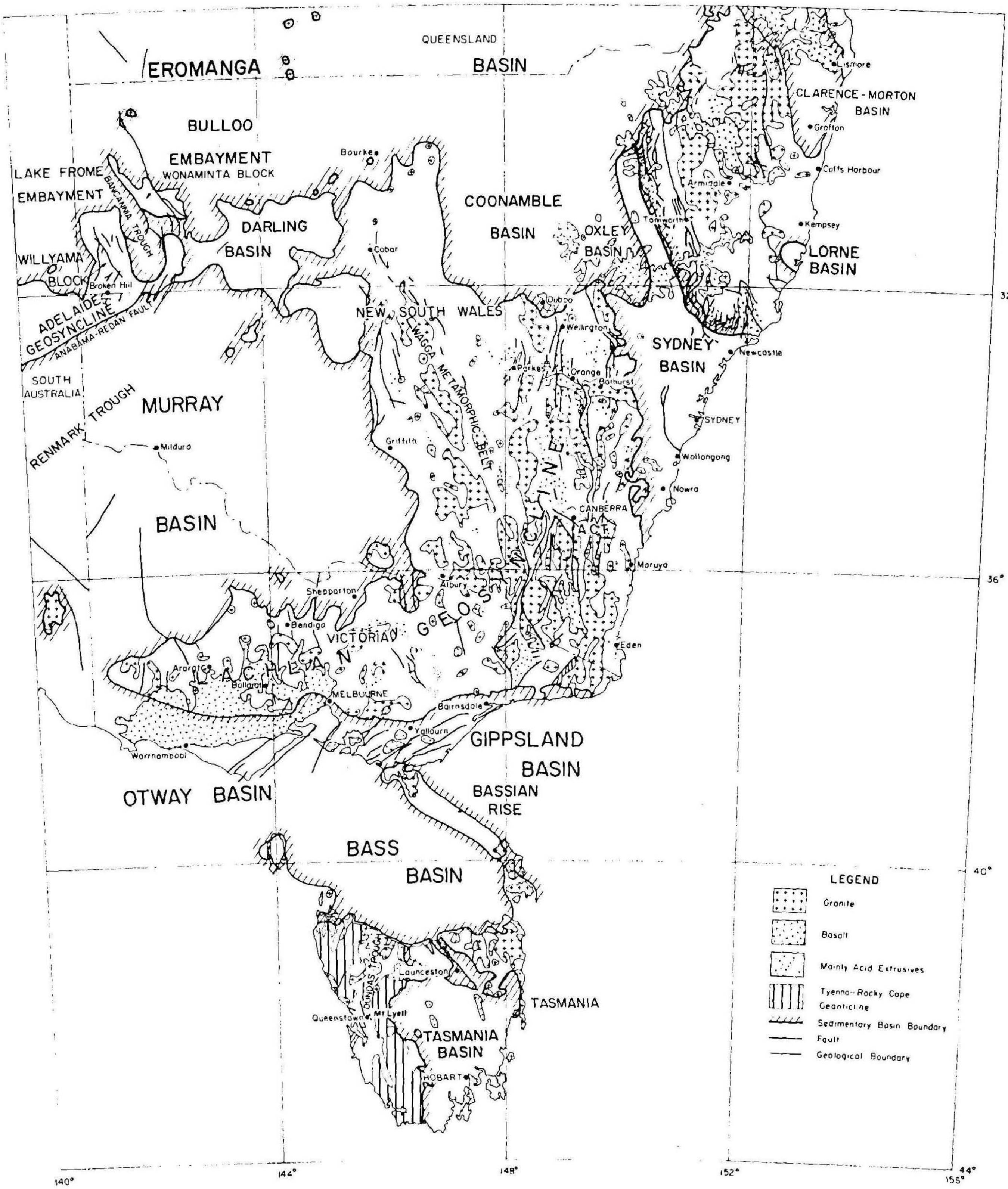
Magnetic low

Contour interval 50nT

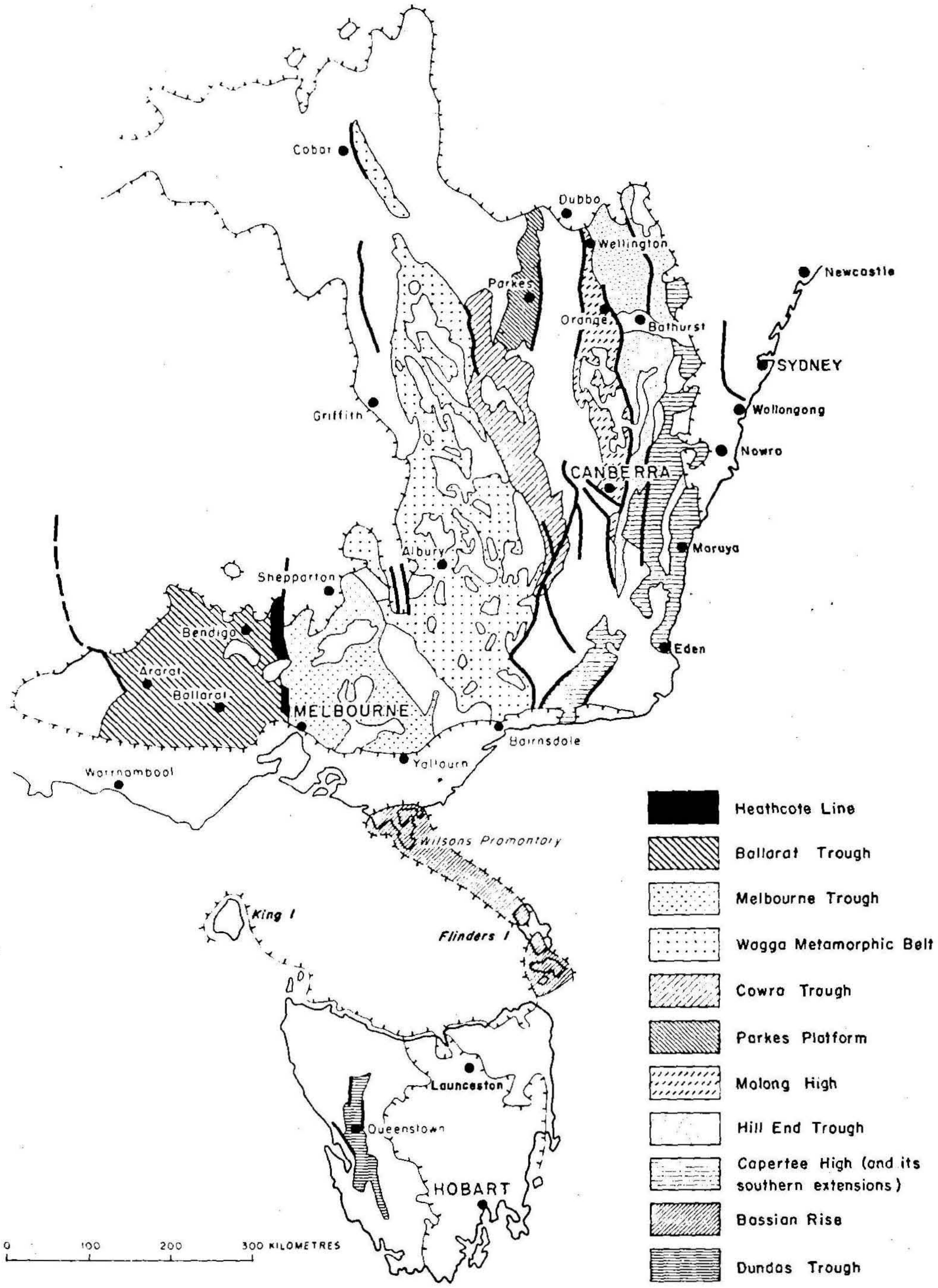
20 0 40 80 kilometres

K55/B1-49A

PLATE 4

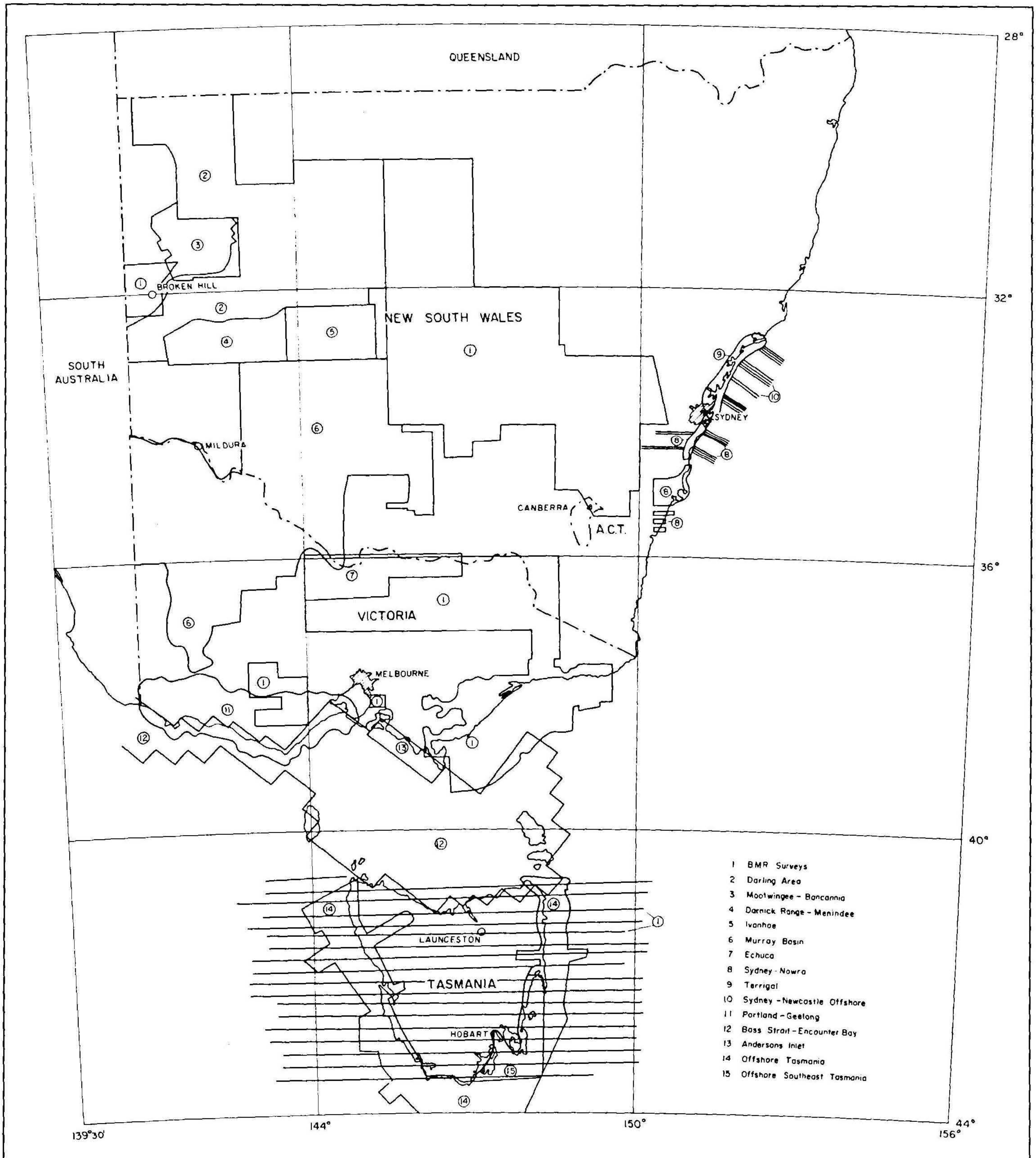

QUEENSLAND
EROMANGA
BASIN
BULLOO
EMBAYMENT
WONAMINTA BLOCK
LAKE FROME
EMBAYMENT
BANCANNIA TROUGH
WILLYAMA BLOCK
Broken Hill
ADELAIDE GEOSYNCLINE
ANABAMA-REDAN FAULT
DARLING BASIN
Bourke
Cobar
COONAMBLE BASIN
OXLEY BASIN
NEW SOUTH WALES
CLARENCE-MORTON BASIN
Lismore
Grafton
Coffs Harbour
Armidale
Tamworth
Kempsey
LORNE BASIN
SYDNEY BASIN
Newcastle
SYDNEY
Wollongong
Nowra
Dubbo
Wellington
Parkes
Orange
Bathurst
WAGGA METAMORPHIC BELT
SOUTH AUSTRALIA
RENMARK TROUGH
MURRAY BASIN
Mildura
Griffith
CANBERRA
A.C.T.
Moruya
Albury
Shepparton
Bendigo
VICTORIA
LACHLAN GEOSYNCLINE
Eden
Ararat
Ballarat
MELBOURNE
Bairnsdale
Yallourn
GIPPSLAND BASIN
Warrnambool
OTWAY BASIN
BASSIAN RISE
BASS BASIN
DUNDAS TROUGH
Launceston
TASMANIA
Queenstown
Mt Lyell
TASMANIA BASIN
HOBART
28°
32°
36°
40°
44°
140°
144°
148°
152°
156°
LEGEND
Granite
Basalt
Mainly Acid Extrusives
Tyenna-Rocky Cape Geanticline
Sedimentary Basin Boundary
Fault
Geological Boundary
100 0 100 200 300 400 KILOMETRES

GEOLOGY

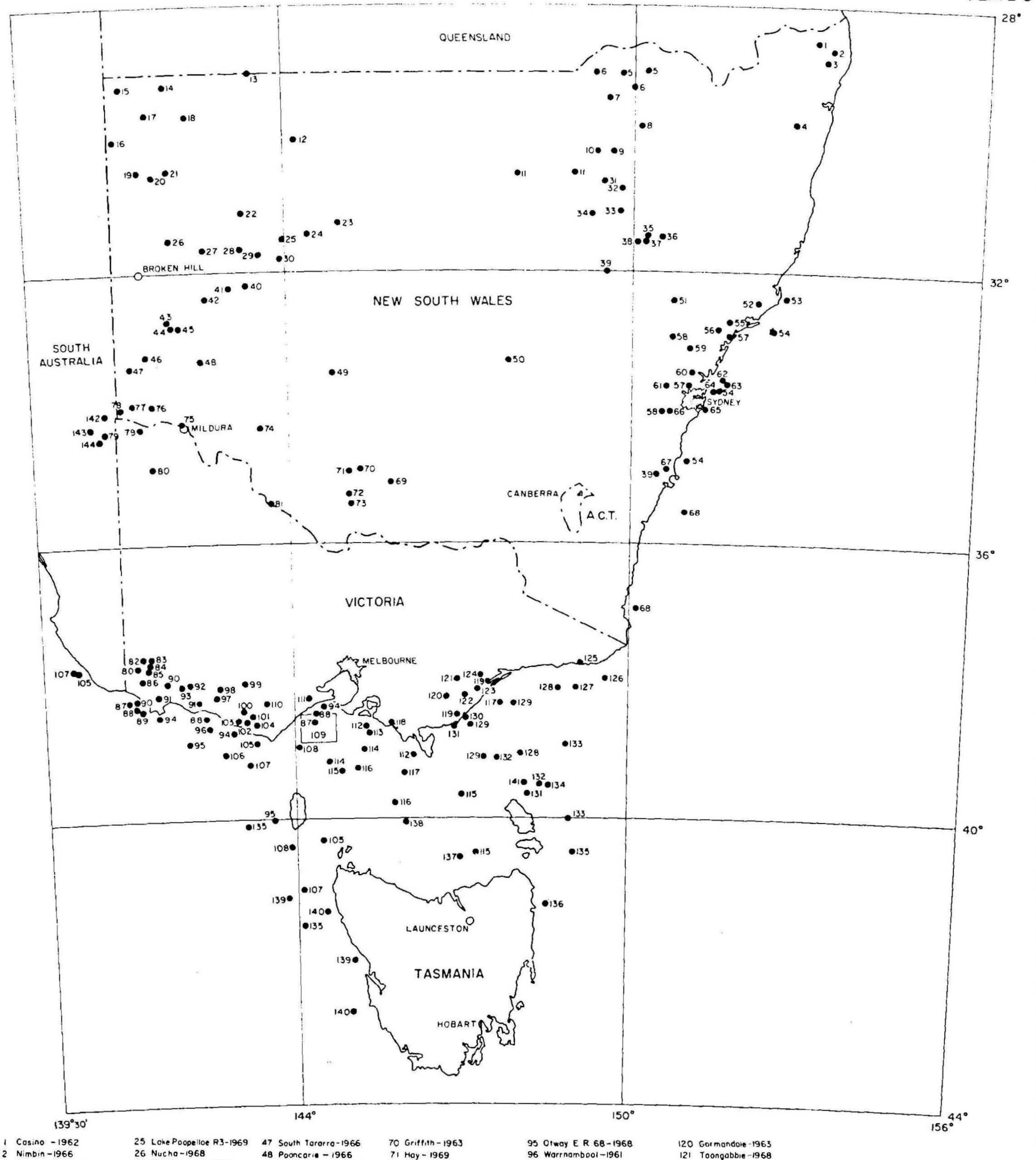


ELEMENTS OF THE LACHLAN BELT

(R. G. Warren, Bulletin 145)



AEROMAGNETIC SURVEYS

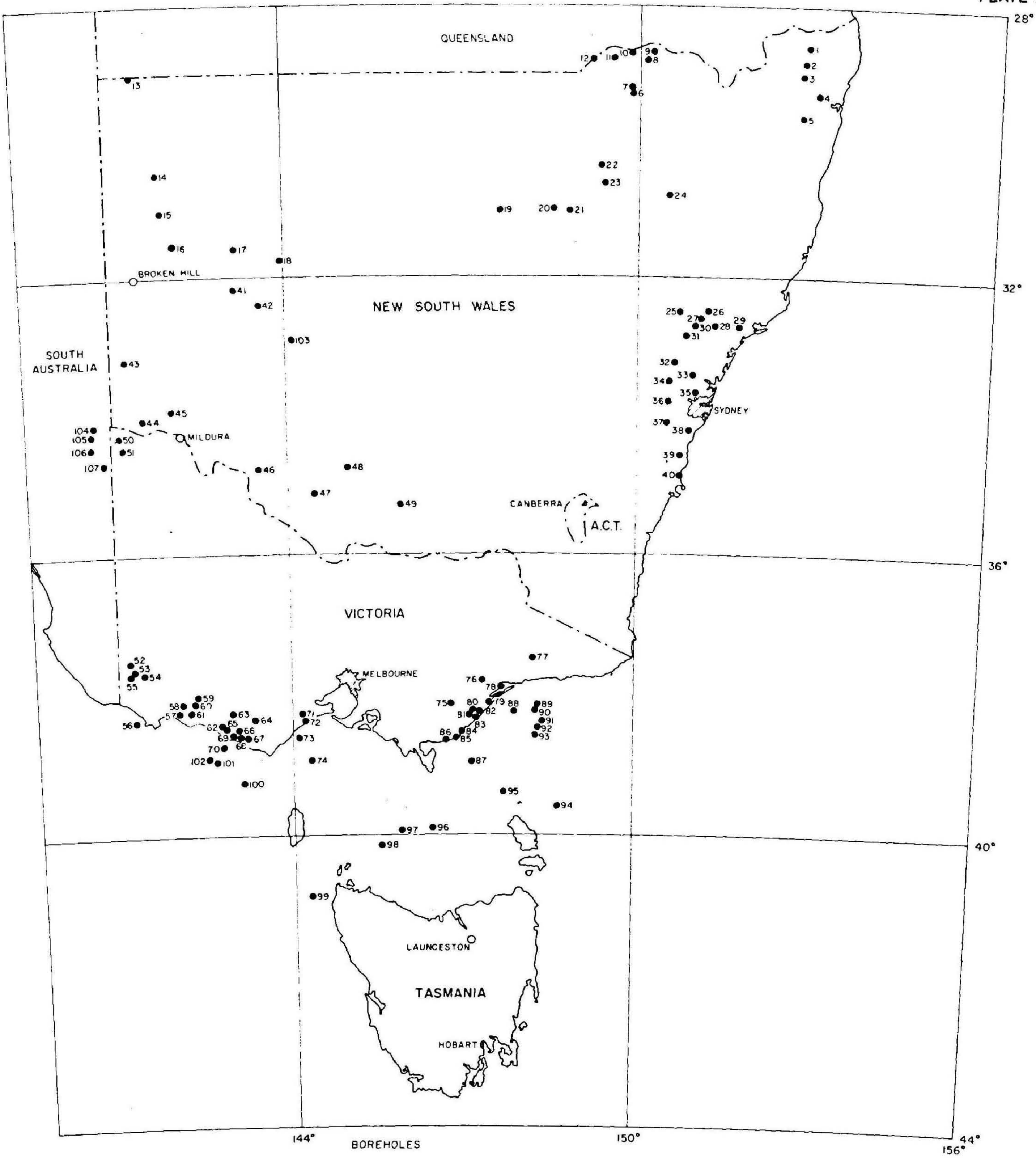


1 Casino -1962
2 Nimbin -1966
3 Blue Knob -1963
4 P E L 66 -1968
5 Boolooroo -1967
6 Moree -1964
7 Garah -1965
8 Pallamallawa -1965
9 Yetman - Wee Waa -1962
10 Edgeroi -1963
11 Pilliga - Merri Merri -1965
12 Paroo - Tibooburra -1967
13 Hamilton Gate -1970
14 Olive Downs -1965
15 Fort Grey - Yandama -1962
Lake Stewart -1964
16 Winnathee -1969
17 Bancannia -1966
18 Tibooburra -1963
19 Pincally -1969
20 Packsaddle -1967
21 Lake Windaunka -1967
22 Mount Jack -1962
23 Helyambo -1969
24 Ivanhoe -1966
25 Lake Poopelloe R3 -1969
26 Nucha -1968
27 Mootwingee -1965
28 White Cliffs -1965
29 Wilcannia -1965
30 Lake Poopelloe -1966
Lake Poopelloe R2 -1968
31 Bohena -1964
32 Keepit Dam -1964
33 Walgett - Gunnedah -1962
34 Narrabri - Coonamble -1962
35 Breeza -1968
Blackville -1969
36 New Windy -1965
37 Bundulla -1970
38 Caroona -1963
39 Nowra - Coolah -1962
40 Mount Emu -1970
41 Lake Wintlow -1968
42 Stephen's Creek -1962
Lake Pamamaroo -1963
43 Tandou - Coomboh -1968
44 Tandou -1966
45 Redbank -1969
46 Tararra -1966
47 South Tararra -1966
48 Pooncarie -1966
Nambuccurra -1969
49 Mossgiel -1969
50 Parkes -1970
51 Denman -1966
52 Girvan -1966
53 Charlotte Head -1970
54 Offshore Sydney Basin -1964
55 Stockton -1970
56 Newcastle - Maitland -1962
57 Sydney - Newcastle -1965
58 Putty - Oakdale -1965
59 Richmond - Cessnock -1965
60 Singleton - Camden -1962
61 Woronora - Dural -1962
62 Offshore Sydney -1967
63 Broken Bay -1970
64 Sealion -1971
65 South Broken Bay -1970
66 Sydney Basin -1961
67 Currambene -1969
68 South Sydney Basin -1970
69 Jerilderie North -1970
70 Griffith -1963
71 Hay -1969
72 Oaklands Basin -1961
73 Deniliquin -1966
74 Magenta -1962
75 Mildura -1962
76 Wentworth -1962
77 Lake Victoria -1963
78 Norweena -1970
79 Sunset -1969
80 Murrayville - Casterton -1963
81 Bundy - Lake Boga -1962
82 Casterton -1962
83 Wannon -1970
84 Merino -1964
85 Bahgallah -1967
86 Dartmoor - Nelson -1961
87 SW Victoria -1963
88 P E P 22/D1 -1966
89 Cape Bridgewater -1967
90 Macarthur - Portland -1970
91 Port Fairy - Nelson -1966
92 Branxholme - Koroit -1963
93 Nelson - Koroit -1970
94 Offshore Otway Basin -1966
95 Otway E R 68 -1968
96 Warrnambool -1961
97 Koroit -1964
98 Hawkesdale -1969
99 Warrnambool - Pomborneit -1970
100 Timboon -1964
101 Cooriemungle -1963
102 Port Campbell -1960
103 Curdie Vale -1964
104 Princetown -1963
105 Otway Marine -1966
106 Portland - King Island -1972
107 Otway E P 67 -1967
108 Cape Grim - Cape Jaffa -1964
109 Torquay Embayment -1972
110 Colac - Geelong -1972
111 Paraparap -1972
112 Venus Bay -1967
113 Cape Patterson -1970
114 Bass ED 67 -1967
115 Bass EF 68 -1968
116 Bass Area -1965
117 Flinders Island - Kingston -1962
118 Tarwin -1970
119 Woodside - Paynesville -1965
120 Gormandale -1963
121 Toongabbie -1968
122 Lake Wellington -1961
123 Lakes Entrance - Woodside -1962
Seaspray -1964
124 East Gippsland -1960
125 Bemm River -1970
126 Offshore Gippsland Basin -1965
127 Sale -1967
128 Eastern Bass Strait -1966
129 Gippsland Shelf -1964
130 Nintey Mile Beach -1962
131 Gippsland EH68 -1968
132 Gippsland EC67 -1967
133 East Gippsland Basin -1968
134 Sailfish -1970
135 Tasman - Bass Strait -1969
136 East Tasmania T69B -1969
137 Bass B69A -1969
138 King Island East -1965
139 West Tasmania T69A -1969
140 Tasmania EE68 -1968
141 Gippsland G69A -1969
142 Hamley -1967
143 Murray Basin Provinces -1965
144 Loxton -1962

SUBSIDIZED SEISMIC SURVEYS

100 0 100 200km

PLATE 9

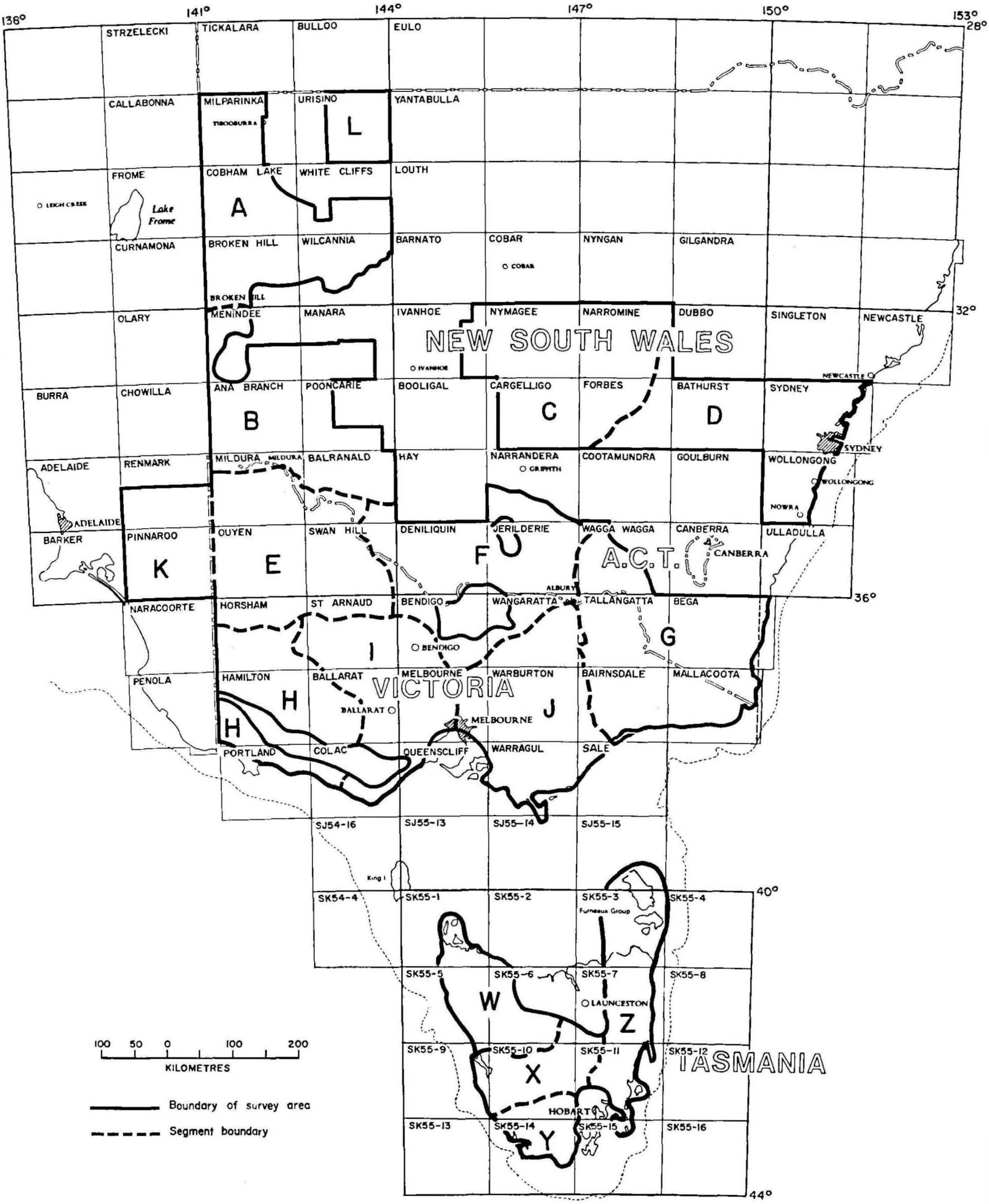


BOREHOLES

SUBSIDIZED BOREHOLES

1 Kyogle - 1963
2 Sextonville - 1963
3 Hogarth - 1968
4 Tullymorgan - 1965
5 Clifden 3 - 1963
6 Moree - 1973
7 Gil Gil - 1965
8 Limebon - 1967
9 Goondiwindi - 1964
10 MacIntyre - 1964
11 Boomi - 1963
12 Werrina 1&2 - 1969
13 Bineroh Downs - 1966
14 Bancannia North - 1968
15 Bancannia South - 1967
16 Jupiter - 1969
17 Pondie Range - 1966
18 Poopelloe Lake - 1969
19 Sandy Camp - 1963
20 Baradine West 2 - 1963
21 Baradine West - 1963
22 Wee Waa - 1963
23 Bohena - 1963
24 Kelvin - 1965
25 Martindale - 1967
26 Camberwell - 1965
27 Loder - 1963
28 Belford - 1964
29 East Maitland - 1962
30 Jerry Plains - 1969
31 Mt Murwin - 1963
32 Howes Swamp - 1970
33 Higher Macdonald - 1968
34 Kurrajong Heights - 1962
35 Dural South - 1966
36 Mulgoa 2 - 1958
37 Mt Hunter - 1961
38 Woronora - 1963
39 Stockyard Mtn - 1962
40 Coonemia - 1969
41 Blantyre - 1965
42 Mount Emu - 1969
43 Tararra - 1966
44 Lake Victoria - 1964
45 Wentworth - 1961
46 Balranald - 1962
47 Bundy - 1962
48 Killendoo - 1964
49 Jerilderie - 1962
50 Sunset - 1970
51 Morkalla - 1970
52 Tullich - 1964
53 Heathfield - 1964
54 Casterton - 1965
55 Casterton 2 - 1967
56 Voluta - 1967
57 Eumeralla - 1963
58 Moyne Falls - 1969
59 Wollsthorpe - 1968
60 Hawkesdale - 1969
61 Pretty Hill - 1962
62 Rowans - 1972
63 Garvoc - 1968
64 Purrumbete - 1968
65 Flaxman's - 1961
66 P Campbell 4 - 1964
67 Sherbrook - 1963 Fergusons Hill - 1964
68 P Campbell 2 - 1960
69 P Campbell 1 - 1959
70 Pecten - 1967
71 Hindhaugh Cr - 1969
72 Anglesea - 1962
73 Nerita - 1967
74 Snail - 1972
75 Rosedale - 1960
76 S W Bairnsdale - 1963
77 Milton - 1969
78 Duck Bay - 1964
79 Wellington Park - 1961
80 North Seaspray - 1962
81 Seaspray - 1964
82 Carr's Creek - 1963
83 Merriman - 1963
84 Woodside South - 1965
85 St Margaret I - 1966
86 Sunday Island - 1966
87 Groper 2 - 1969
88 Gippsland Shelf - 1965 (Barracouta)
89 Morwong - 1973
90 Gippsland Shelf 4 - 1965 (Marlin)
91 Halibut - 1965
92 Cobia - 1972
93 Kingfish - 1965
94 Sailfish - 1971
95 Bluebone - 1969
96 Bass 2 - 1966
97 Bass 1 - 1965
98 Bass 3 - 1967
99 Clam - 1969
100 Prawn - 1968
101 Mussel - 1969
102 Nautilus - 1968
103 Ivanhoe - 1963
104 North Renmark - 1962
105 Berri North - 1967
106 Berri South - 1966
107 Nadda - 1970

a) Unless otherwise stated well name refers to No.1 well
b) Proclaimed Discovery Well underlined



SEGMENTATION OF SURVEY AREA