

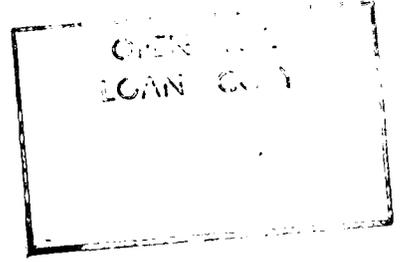
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



RECORD N<sup>o</sup>. 1962/53

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GIPPSLAND BASIN AIRBORNE  
MAGNETIC SURVEYS,  
VICTORIA 1951-52 AND 1956



by  
J. H. QUILTY

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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## SUMMARY

The Bureau of Mineral Resources, Geology and Geophysics made an aeromagnetic survey of the on-shore area of the Gippsland Basin, Victoria, in 1951-52 and of the off-shore area in 1956.

The anomaly trends of the aeromagnetic map can be correlated with several known geological structures in the Basin, some of which can be traced by their magnetic characteristics into the deeper parts of the Basin.

A contour map of estimated depths to magnetic basement rock shows a trough east of Lake Wellington containing probably 15,000 feet of sediments.

Depth estimates in parts of the south-western corner of the Basin are uncertain because of the presence of magnetic basalt flows in the sedimentary sequence.

## 1. INTRODUCTION

The Bureau of Mineral Resources, Geology and Geophysics made an aeromagnetic survey of the on-shore area of the Gippsland Basin, south-eastern Victoria, between July 1951 and April 1952. Between March and June 1956, the survey was extended to include an area forty to fifty miles seaward from the Gippsland coastline.

The object of these surveys was to delineate magnetic anomalies caused by certain igneous and metamorphic rocks, which comprise part of the 'basement' rocks in the area. It was expected that interpretation of the aeromagnetic data would provide information on the principal structural features of the Basin and on the thickness of sediments within it.

Oil was discovered in 1924 in Tertiary sediments at Lakes Entrance near the eastern end of the Gippsland Basin. Since that time, many bores have penetrated Tertiary sediments in the central and eastern parts of the Basin, and Mesozoic sediments in deeper bores in the western part of the Basin, but oil has not been found in commercial quantities. 'Shows' of oil have been reported in a borehole near Woodside in the western part of the Basin.

The aeromagnetic surveys were made to assist in oil exploration. Officers of the Bureau engaged in the 1951-52 survey were E. McCarthy (party leader), G.B. Clarke, J.K. Newman, K.M. Kennedy, and A.J. Barlow. The DC-3 survey aircraft, VH-BUR, was piloted by personnel from Trans-Australia Airlines. The results of the survey were published as a magnetic contour map in 1952. Comments on the results were made by McCarthy (1952) in general notes on the method of aeromagnetic surveying. In the 1956 survey, party members were P.E. Goodeve (party leader), A.G. Spence, R.M. Carter, M. Kirton, J.D. Pinn (geophysicists) and F. Walker, W. Porta, and C. Moon. Maps showing results of the survey were published in 1958.

## 2. GEOLOGY

The Gippsland Basin occupies the coastal region of south-eastern Victoria (Plate 1). It contains Tertiary and Mesozoic sediments which in places overlie Palaeozoic sediments.

Tertiary sediments crop out along the northern margin and over much of the western part of the Basin, but are elsewhere covered by a thin layer of Pleistocene and Recent alluvial deposits and dune limestone. From borehole information it is known that the Tertiary sediments include both marine and freshwater deposits. The Lower Tertiary rocks consist mainly of terrestrial sediments - brown coal, clay, sand, and gravel. Basalt (the Older Basalt) occurs near the base of the Tertiary succession. The Upper Tertiary sediments are marine limestone, marl, and clay. The total thickness of Tertiary sediments is less than 2000 ft near Lakes Entrance but is nearly 4000 ft at the western end of Lake Victoria. Remnants of the Older Basalt crop out in the western part of the Basin.

Mesozoic sediments, mostly Jurassic, crop out in the South Gippsland Highlands and at a few places on the northern margin of the Basin. Their existence underlying Tertiary rocks has also been proved by boring in the Basin. Mesozoic lacustrine sediments consisting of sandstone, shale, breccia, mudstone, and conglomerate with interbedded coal seams are present with an estimated thickness of several thousand feet confirmed by borehole information near Woodside. Cretaceous sediments have been identified recently by the Victorian Mines Department in a borehole at Hollands Landing in East Gippsland.

Palaeozoic rocks crop out in the highlands to the north of the Basin, and boring has shown that they immediately underlie the Tertiary sediments in the Lakes Entrance area. They are also believed to underlie the Mesozoic sediments in the deeper parts of the Basin, but there are no boreholes deep enough to confirm this.

The Palaeozoic rocks of the Gippsland area have been described by Boutakoff (1954/55). They range in age from Cambrian to Carboniferous. Ordovician slate, mudstone, claystone, sandstone, and quartzite crop out with small inliers of Cambrian sedimentary and volcanic rocks. The Ordovician sediments are entirely marine and are many thousands of feet thick in some places. Silurian sediments - sandstone, shale, schist, mudstone, and conglomerate - also attain thicknesses of many thousands of feet and, where contacts are visible, conformably overlie the Ordovician sediments.

The Devonian rocks consist mainly of limestone, shale, sandstone, granite, and porphyry. The lower Carboniferous sequence, which appears to overlie conformably the upper Devonian sediments and porphyry, consists of sandstone, conglomerate, shale, and mudstone with interbedded porphyry and some volcanic rocks. The following notes on stratigraphy related to oil geology in Gippsland are drawn from Boutakoff (*op. cit.*).

The Cambrian, Ordovician, Silurian, and lower Devonian may be ruled out as potential oil rocks, because of their intense folding, partial metamorphism, and widespread granitization. They constitute 'basement'. Middle Devonian limestones are potential source rocks. Upper Devonian and Carboniferous sediments would be excellent reservoirs owing to their lithology and mild folding. Permian, Triassic, or Jurassic marine sediments may exist off-shore as potential source rocks. It is possible that the Tertiary sediments in some parts of the basin may be thick enough and coarse enough to be potential reservoir rocks. Unconformities at the base of the upper Devonian, Permian, Jurassic, Eocene, Pliocene, and upper Pliocene may be important for oil migration.

It is therefore important in relation to oil search to determine the distribution of Mesozoic and Palaeozoic sediments of Middle Devonian and younger age underlying the Tertiary in the Basin.

The following notes on the geological structure of Gippsland are drawn from the work of Boutakoff (*op. cit.*), who studied the known geology in conjunction with the results of a gravity survey made by the Bureau of Mineral Resources (Dooley and Mulder, 1953).

Palaeozoic orogenies in eastern Victoria have occurred along both north-east and north-west axes (Plate 1). The north-west trend is largely predominant. These orogenic trends are seen in the Palaeozoic sedimentary outcrops north of the Basin and are also reflected in the gravity contours in the Basin area.

Mesozoic and Cainozoic epeirogenic movements have been directed mostly along a set of east-north-east and west-north-west axes. The east-north-east trend is predominant. Several of these features have marked gravity and physiographic expression. North-south and east-west trends, though uncommon, also occur.

With respect to the orogenic axes, there is considerable evidence that the north-west axes, as exemplified by the geological boundaries in north-eastern Victoria, gradually give place to the north-east direction as one approaches Bass Strait, and this direction is typical of the older rocks of Waratah Bay and Mornington Peninsula. If this change in direction applies to all Palaeozoic orogenic axes in Gippsland, the distribution of Devonian-Carboniferous sediments in the sunkland could be largely assessed.

In relating the epeirogenic axes to the Palaeozoic orogenic trends, Boutakoff shows that south of this swing to the north-east direction, in Bass Strait islands and Tasmania, the north-west trends are again predominant. The Gippsland and Bass Strait sunklands lie along the two hinges of this double set of re-entrants. He cites the work of Emil Haug (1927) who produced examples to show that throughout the world such re-entrants of orogenic axes are the loci for subsequent epeirogenic down-warp and faulting.

Evidence of recent warping is shown in the topographic survey over the Darriman structure prior to seismic work, where Garrett (1955) found that the contours of the Quaternary alluvium reflected the shape of this buried tectonic dome. Recent warping is also evident on the southern shores of Lake Wellington.

### 3. MAGNETIC METHOD

The difference in magnetic susceptibility of different minerals, i.e. the degree to which they become magnetized in a magnetic field, may be used to delineate some types of subsurface orebodies and rock structures. If the Earth's crust were composed of uniformly magnetized material or layers of material, the magnetic field measured on the surface of the Earth would follow a regular and predictable pattern. The observed variations or anomalies in this pattern are due to the non-uniform magnetization of the subsurface materials. Boundaries of strongly magnetized orebodies or rock structures enclosed by weakly magnetized rocks may therefore be delineated by measurement and analysis of these anomalies.

The magnetic properties of a rock are naturally those of its mineral constituents. The iron mineral magnetite is strongly magnetic; ilmenite, pyrrhotite, and haematite are less so. Other minerals are almost non-magnetic. Igneous and metamorphic rocks, by reason of their magnetite content, are generally more strongly magnetized than sedimentary rocks. This fact is the basis of the applicability of the magnetic method of prospecting over sedimentary basins. Normally, the basement rocks of a basin are magnetic igneous and metamorphic rocks, and the sediments within the basin are practically non-magnetic. Magnetic anomalies recorded over the basin normally arise in the basement rocks only, and the analysis of the anomalies enables conclusions to be drawn concerning the depth and configuration of this 'magnetic basement' surface, and hence the distribution of the overlying sediments.

In the Gippsland Basin, basement, so far as petroleum search is concerned, comprises lower Devonian and older rocks which have been strongly folded and metamorphosed. These rocks also over most of the area will constitute the 'magnetic basement'.

The magnetization of minerals may be either that induced by the Earth's present magnetic field, or it may consist of residual (remanent) magnetism from a previous magnetization. Both types of magnetism are sometimes found in the same rock.

With the invention of the airborne magnetometer, which was first used as a geophysical instrument in 1943, it has become practicable to carry out magnetic surveys of large areas, such as sedimentary basins, in a relatively short time. Compared with the ground method of magnetic surveying, the airborne method has the advantages that large areas can be surveyed rapidly, regardless of the type of terrain, and the results are less affected by local extraneous disturbances. The airborne magnetometer is designed to give a continuous record of the variations in the Earth's total magnetic field.

#### 4. EQUIPMENT

##### Airborne magnetometer

In the 1951-52 survey, the total magnetic field intensity was measured with an airborne magnetometer, type AN/ASQ-1, mounted at the rear end of the main compartment of the survey aircraft. In the 1956 survey, an airborne magnetometer type AN/ASQ-8 was used, mounted in a boom projecting from the aircraft's tail assembly.

The fluxgate magnetometer consists essentially of a detector element which is self-oriented with respect to the Earth's magnetic field, electronic oscillators (required for the operation of the detector unit), amplifiers, and recording equipment. Dobrin (1952, 156-176) and Landsberg (1952, 313-349) have described the operation of airborne magnetometers.

##### Navigational aids and cameras

An F. 24 aerial camera was used to take vertical photographs during flights in the 1951-52 survey, so that the aircraft's position could later be fixed on an airphoto mosaic.

In the 1956 survey of the off-shore area, Shoran radar equipment was used to navigate the aircraft along predetermined flight-lines. Shoran continuously measures and records the distance of the aircraft from two ground beacons located at positions accurately surveyed on the ground. The Shoran recordings are photographed on 35-mm film and are used later to plot the actual flight path of the aircraft.

The survey aircraft was also fitted with a 'gyrosyn' compass, a radio-altimeter, and a drift sight in addition to the normal radio communications equipment.

## 5. SURVEY OPERATIONS

Airphoto mosaic assemblies were used in 1951-52 for visual navigation along lines flown at 1000 ft above the terrain. The lines were flown in north-south directions, spaced approximately one mile apart. Several east-west tie lines were flown across the area to assist in reducing the magnetic data.

Using Shoran radar control, flight-lines across the off-shore area in 1956 were flown in north-south directions, spaced one mile apart. The northern end of each line crossed the coastline. Vertical 16-mm photography of the ground was taken when the aircraft passed over the coast or over the islands in Bass Strait, for identification and correlation with the 1951-52 photo-navigated survey. A series of east-west tie lines were flown. Flight altitude was 1000 ft above sea level.

## 6. PREPARATION OF MAGNETIC MAPS

After reduction, the magnetic data of the 1951-52 survey were transferred to a flight-line diagram, which had been prepared from a plot of the aerial photographs taken during flight. The data were presented in the form of contours of magnetic intensity, at ten-gamma intervals, on a set of maps corresponding to the 1-mile Australia series. These maps were published in 1952, and were subsequently reprinted with an overlay of gravity data and issued in 1959.

A composite map of the on-shore magnetic contours at a scale of 1 inch = 4 miles was published in 1952. The magnetic data on the above maps were corrected for a regional gradient in total magnetic field intensity of 7.5 gammas per mile in a direction S.14°W.

The magnetic data of the 1956 survey were transferred to a flight-line diagram prepared from a plot of the recorded Shoran co-ordinates. The data were presented with a contour interval of ten gammas on a series of six sheets at a scale of 1 inch = 2 miles, and issued in 1958.

The enclosed composite map (Plate 2) of aeromagnetic contours for both areas surveyed, with the data corrected for regional gradient of magnetic field, was prepared by officers of the Broken Hill Proprietary Company from series of maps supplied by the Bureau of Mineral Resources, and is reproduced with the Company's permission.

## 7. INTERPRETATION

### Magnetic rocks in Gippsland Basin

The known sedimentary rocks of the Gippsland Basin do not contain appreciable quantities of magnetite or other magnetic minerals, and may be considered practically non-magnetic. In considering the sources of the anomalies shown in the magnetic contour pattern, it is reasonable to assume that the anomalies are caused either by igneous and metamorphic rocks of Lower Palaeozoic age, or by Tertiary basalt. The Palaeozoic magnetic rocks include:

- (a) Plutonic rocks (granite, granodiorite, and syenite). Granite crops out at the western end of the Basin on Wilsons Promontory, and at the eastern end near Nowa Nowa and Orbost, and has been intersected at depths of 1200 to 1500 ft in the Lakes Entrance area.
- (b) Snowy River Volcanics (rhyolite, rhyo-dacite, and trachyte) probably of lower Devonian age, which crop out near the Basin.
- (c) Metamorphic rocks comprising mainly metamorphosed sediments, which are lower Devonian and older.

Magnetic anomalies may possibly arise from upper Devonian porphyry in the MacAllister River area but there is no direct evidence that they are magnetic.

Magnetic anomalies in parts of the survey area are due to the Tertiary Older Basalt, which is known to occur in places near the base of the Tertiary succession and which crops out on the western edge of the on-shore survey area.

#### Method of interpretation

A qualitative analysis of the aeromagnetic data showed a good correlation between the magnetic pattern and the known geological structure of the Basin. The results of the earlier gravity survey (Dooley and Mulder, 1953) had also shown this correlation.

Estimates of depth to the magnetic basement rocks were made on the magnetic anomalies. The depth rules used were based on the properties of total intensity anomalies calculated for prismatic bodies of magnetic material (Vacquier, Steenland, Henderson and Zietz, 1951). A second-derivative map was prepared for part of the area to provide better resolution of individual anomalies and more reliable depth estimates (Vacquier *et al*, *op.cit.*). The grid spacing used was approximately equal to the depth to the magnetic basement rocks estimated from measurements on the total intensity anomalies. A contour map of depth to magnetic basement rocks was made from the above measurements.

#### Interpretation of survey results

A study of the magnetic contour map (Plate 2) shows a strong correlation in some places between the anomaly pattern and the known geology. For example, the intense and elongated anomalies north-west of Orbost correspond to the Snowy River Volcanics; the intense and contorted anomalies near Alberton indicate shallow basalt.

In general the trend of the groups of magnetic anomalies is similar to that of the main Palaeozoic tectonic axes where they crop out, and the southward continuation of the magnetic trends is evidence that these Palaeozoic axes extend into the Gippsland Basin.

The steep gradients associated with the roughly circular magnetic anomalies at Orbost, and on the coastline toward Cape Everard at the eastern end of the Basin, indicate magnetic rocks at a shallow depth. The anomalies are believed to be due to the igneous and metamorphic rocks which crop out extensively to the north and east. Similar anomalies recorded south of the coastline in this area also indicate magnetic rocks at shallow depth beneath the sea.

The area of intense magnetic disturbance 15 miles north-west of Orbost coincides with the NNE-striking belt of Devonian Snowy River Volcanics. The trend of the magnetic contours indicates that this belt continues southward beneath the Tertiary sediments through Lakes Entrance and south of the coastline. The steep gradients of these anomalies indicate that there is no great depth of sediments overlying the volcanics.

Anomalies in the Lake King area lie due south of the anticlinal belt of Ordovician rocks in the Nicholson River area. These anomalies are considered to be related to the southward continuation of the Ordovician belt and to be caused by igneous intrusions in the Ordovician sediments.

A magnetically undisturbed zone coincides with a pronounced gravity 'low' whose axis strikes approximately north from the eastern end of Lake Wellington towards Tabberabbera. Both the gravity and magnetic features are probably due to the southerly extension of the Tabberabbera tectonic depression (Boutakoff, 1954/55). This depression appears to continue to Lake Wellington and then trends towards the south-south-west through a broad negative anomaly, which coincides with a broad gravity 'low'. The magnetic contours suggest that beyond this negative anomaly the depression strikes south. The broad negative anomaly probably marks the location of the greatest thickness of sedimentary rocks in the on-shore portion of the Gippsland Basin.

Immediately west of the Tabberabbera tectonic depression there is an axis of high gravity values (Dooley and Mulder, 1953) which, as pointed out by Boutakoff (op. cit.), is related to the Ordovician Pretty Boy tectonic ridge. The magnetic contours confirm the gravity evidence that the 'ridge' continues to the northern shore of Lake Wellington.

The Mount Wellington anticline coincides with a northerly trend in the anomaly pattern 15 miles west of Stratford.

The presence of basalt in the western part of the survey area tends to obscure any effects due to the older rocks, and introduces some uncertainty into the interpretation of the magnetic contours in terms of structures and trends in the Palaeozoic rocks. However, the magnetic pattern near Traralgon, with a north-south trend followed by a swing towards the west, could be related to the extension of the Walhalla tectonic axis, which enters the Basin from the north-west. The outcrop of Ordovician rocks between Foster and Waratah Bay, south-west of the Basin, gives evidence of a change of strike of this axis from north-west to north-east within the sunklands, and the magnetic contours in the Traralgon area appear to follow a similar trend.

The anomalies near Yallourn and Morwell and south-west of Traralgon are probably due to remnants of Tertiary basalt, and appear to reflect the intricate fault pattern in this area.

In the area south-west of Sale, the magnetic pattern outlines the wedge-shaped Baragwanath Uplift at the eastern end of the Carrajung structure, which dominates the geology of the Gippsland Basin. The deflection of contours south of Sale coincides with the northern edge of the Baragwanath Uplift and suggests an extension of this structure towards the area of deep basement south of Lake Wellington.

Farther south a prominent anomaly extends from the flanks of the Carrajung structure eastwards to within four miles of the coast. This anomaly does not correspond exactly with any known structure but is possibly due to thickbasalt. It lies between the Darriman anticline, which was indicated by the gravity work and later confirmed by a seismic survey (Garrett, 1955), and the Monkey Creek Nose. The borehole put down on the Darriman anticline intersected basalt at a depth of approximately 3700 ft, and it is probable that the main mass of the basalt flow has been preserved in the depression between the Darriman structure and the Monkey Creek Nose.

West of Alberton, the intensely anomalous pattern indicates magnetic rocks at shallow depth. The known occurrences of basalt account for some but not all of the anomalies recorded in this area. Geological features that appear to correlate with magnetic anomalies are the Hedley Dome, Slades Hill Block, and Kays Hill Block.

Palaeozoic metamorphic rocks crop out a few miles west of Corner Inlet and at Waratah Bay, and their presence at fairly shallow depth is suggested by the anomalies recorded at the head of Corner Inlet. Similar anomalies are recorded off-shore in this area.

The distinctive features of the central magnetic pattern off-shore are a broad elongate magnetic 'low' trending east-west and a prominent line of anomalies trending slightly west of south. The line of anomalies apparently marks the position and trend of a metamorphic belt of Palaeozoic rocks, and the relative decrease in horizontal extent of each anomaly in the line indicates a rise in the magnetic basement level toward the south from an area of deep basement situated east of Lake Wellington. The form of the magnetic basement surface is shown clearly in the depth contour map (Plate 3).

#### Second-vertical-derivative map (On-shore area).

A second-vertical-derivative map (Plate 4) was constructed in the following way. A square grid with a 2-mile spacing was placed over the total magnetic intensity map. This spacing was chosen because preliminary measurements on the anomalies showed that the depth to magnetic basement in the central part of the Basin on-shore was roughly 10,000 ft, and the filtering effect of a derivative construction would tend to accentuate anomalies whose sources lay at that depth. The values of magnetic intensity at each grid corner were interpolated from the contours and recorded.

Eight intensity values were used for calculation at each corner by the expression

$$(0.5/n^2)(3T_0 - 4T_1 + T_2) \quad (\text{Vacquier et al., 1951})$$

where  $n$  is the grid spacing in miles,  $T_0$  is the value at the origin multiplied by four,  $T_1$  is the sum of four corner values on a circle of radius equal to the grid spacing, and  $T_2$  is the sum of four corner values on a circle of radius equal to  $\sqrt{2}$  times the grid spacing.

The second vertical derivative values were contoured as shown in Plate 4. Heavy lines are contours of zero value of the derivative, commonly called lines of zero curvature. They are found to correspond approximately with the boundaries of some of the magnetized bodies. Short lines labelled a, b, c, etc., joining maxima or minima to zero curvature contours are depth indices as described by Vacquier et al. (op. cit.). These indices were used to calculate some of the depths shown on Plate 3.

Contour map of depth to magnetic basement rock

The contour map (Plate 3) based on depth estimates made at the places indicated, shows the depth below sea level to the magnetic basement rock surface. (See Chapter 3, MAGNETIC METHOD).

In the northern part of the Basin, the contours generally follow the trend of the major Palaeozoic axes southward until these axes are intersected by east-west trending epeirogenic axes on which movement dates from Mesozoic to Recent time. The trend of the Palaeozoic axes is again evident in the south-western part of the survey area. The features of the contour map are discussed in the following paragraphs.

Between Cape Everard and Orbost, at the eastern end of the Basin, the magnetic basement rock surface, corresponding with the Ordovician granitic and metamorphic rocks that outcrop to the north, is shown to be at shallow depth in the on-shore part of the area and at a depth of no greater than 2000 ft as far as 25 miles south of the coastline.

From Orbost to Lakes Entrance the basement rock deepens, the contours following the trend of the marine Tertiary boundary shown in Plate 1. The basement could reach a depth of almost 3000 ft near the coastline. Immediately west of this and near Lakes Entrance is a magnetic basement ridge which coincides with the southerly extension of the Snowy River Volcanics. The ridge is possibly a pre-Mesozoic erosional 'high' associated with these rocks.

In the Lake King area, the Nicholson River Ordovician belt deepens from the margin of the Basin to depths of about 5000 ft below sea level on-shore near Lake Victoria. Depths of 10,000 ft to the magnetic basement rock are indicated in the Tabberabberan depression, striking south through the eastern end of Lake Wellington. This abrupt change in the level of the magnetic basement rock surface suggests that the thickness of overlying Upper and Middle Palaeozoic sediments should be of the order of several thousand feet. The western boundary of the depression is defined by a basement ridge which terminates at the northern shore of Lake Wellington and appears to be a continuation of the Pretty Boy tectonic ridge, which crops out to the north.

Depths of 10,000 ft and greater are shown in the Stratford/Sale area. Since the magnetic anomalies in this area may be considered to be due to metamorphic and granitic rocks of Ordovician-Silurian age, part of the sedimentary thickness is attributable to Upper and Middle Palaeozoic sediments.

The wedge of the Baragwanath Anticline (see Plate 1) and the general outline of the Carrajung structure are shown by the contours, with a depth of 5000 ft to magnetic basement rock measured on the core of the structure south-east of Rosedale. Depth estimates on some subsidiary structures in the south-western corner of the Basin were uncertain because of the magnetic influence of Tertiary Older B salt lava flows.

The deepest part of the Basin on-shore is shown by the contours to be south of Lake Wellington. South-westward along the coastline, the area of deep basement rocks is intercepted by the projection of a basement ridge eastward from the main uplift area. On the ridge, magnetic basement rock is estimated to be 7000 ft below sea level. The contours show a rapid rise in the level of the magnetic basement rock surface south of Woodside and then a gradual rise toward Snake Island and Wilsons Promontory.

The most marked feature of the depth contours off-shore is the outline of a deep trough extending east from the deep basement area south of Lake Wellington. The trough is bounded on the north by a possible fault, and shallows gradually southward. A sedimentary thickness of 15,000 ft is probable in the deepest part of the trough, whose elongation is in a direction roughly parallel to the Rosedale fault. In the western part of the trough there is an extension in a south-westerly direction which could be due to the existence of a Palaeozoic depression, possibly a continuation of the Tabberabberan depression. The depth contours here are considered to indicate the form of the early Palaeozoic basement surface.

The southernmost part of the aeromagnetic survey area shows consistently shallow depths to magnetic basement rock east of Wilsons Promontory.

#### Summary of interpretation

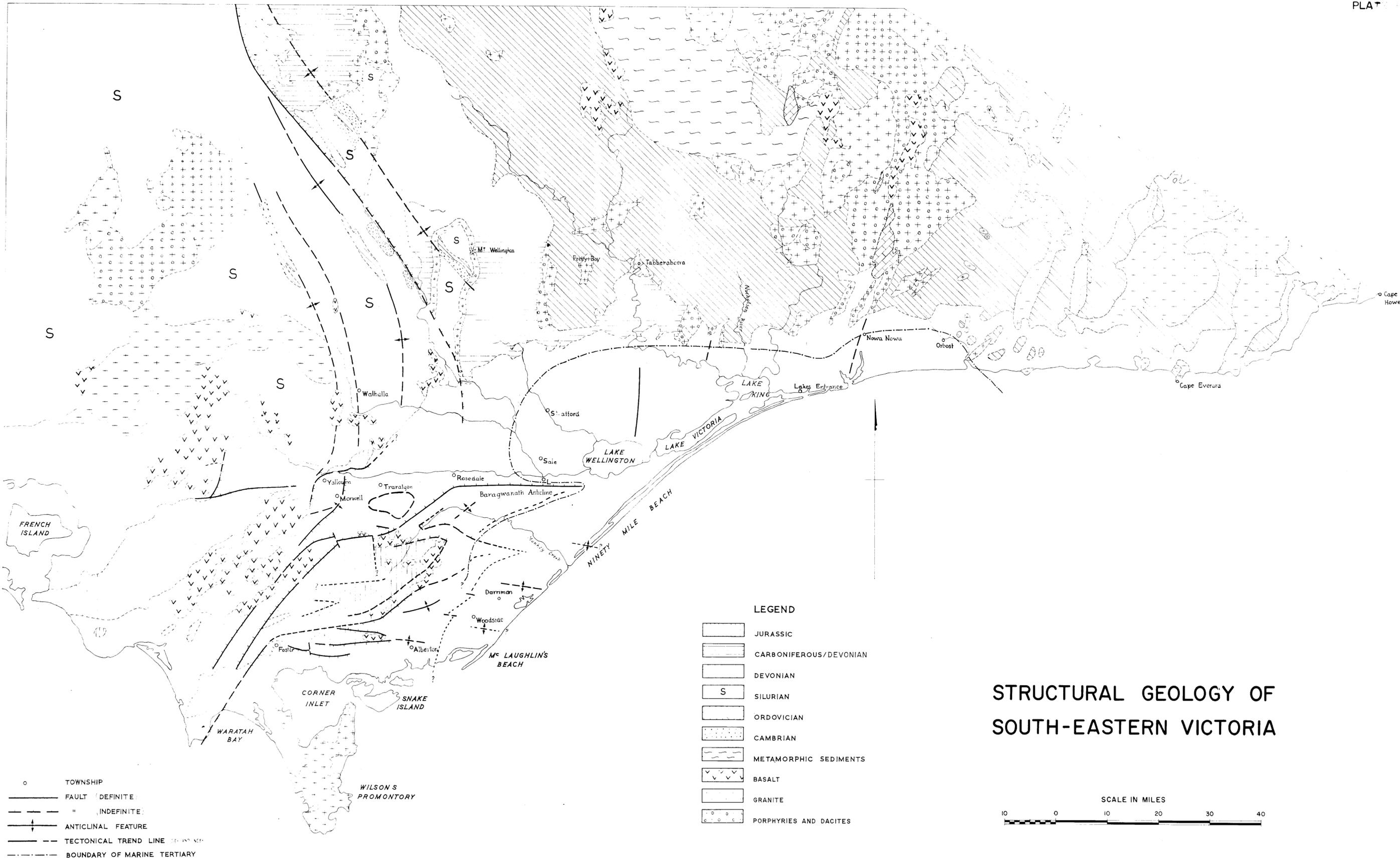
Several anomaly trends in the aeromagnetic map of the Gippsland Basin can be correlated with known Palaeozoic orogenic axes and with geological structures that result from later epeirogenic movement. The magnetic contours show the extension of several of these structures into the deeper parts of the Basin.

A contour map of depths to magnetic basement rock, based on depth estimates made on aeromagnetic anomalies and known geological structure, shows the depths to the magnetic basement surface and the consequent thickness of overlying sediments. Depth estimates in parts of the south-western corner of the Basin are uncertain because of the magnetic influence of the Tertiary basalt flows there.

A deep trough is indicated off-shore east of Lake Wellington. The sediments in the trough are probably as much as 15,000 ft thick.

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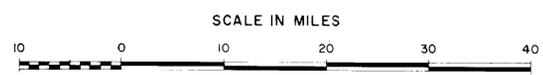
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**LEGEND**

[White Box]	JURASSIC
[Horizontal Lines Box]	CARBONIFEROUS/DEVONIAN
[Vertical Lines Box]	DEVONIAN
[Box with 'S']	SILURIAN
[Diagonal Lines Box]	ORDOVICIAN
[Stippled Box]	CAMBRIAN
[Wavy Lines Box]	METAMORPHIC SEDIMENTS
[V-shaped Pattern Box]	BASALT
[Cross-hatched Box]	GRANITE
[Circles Box]	PORPHYRIES AND DACITES

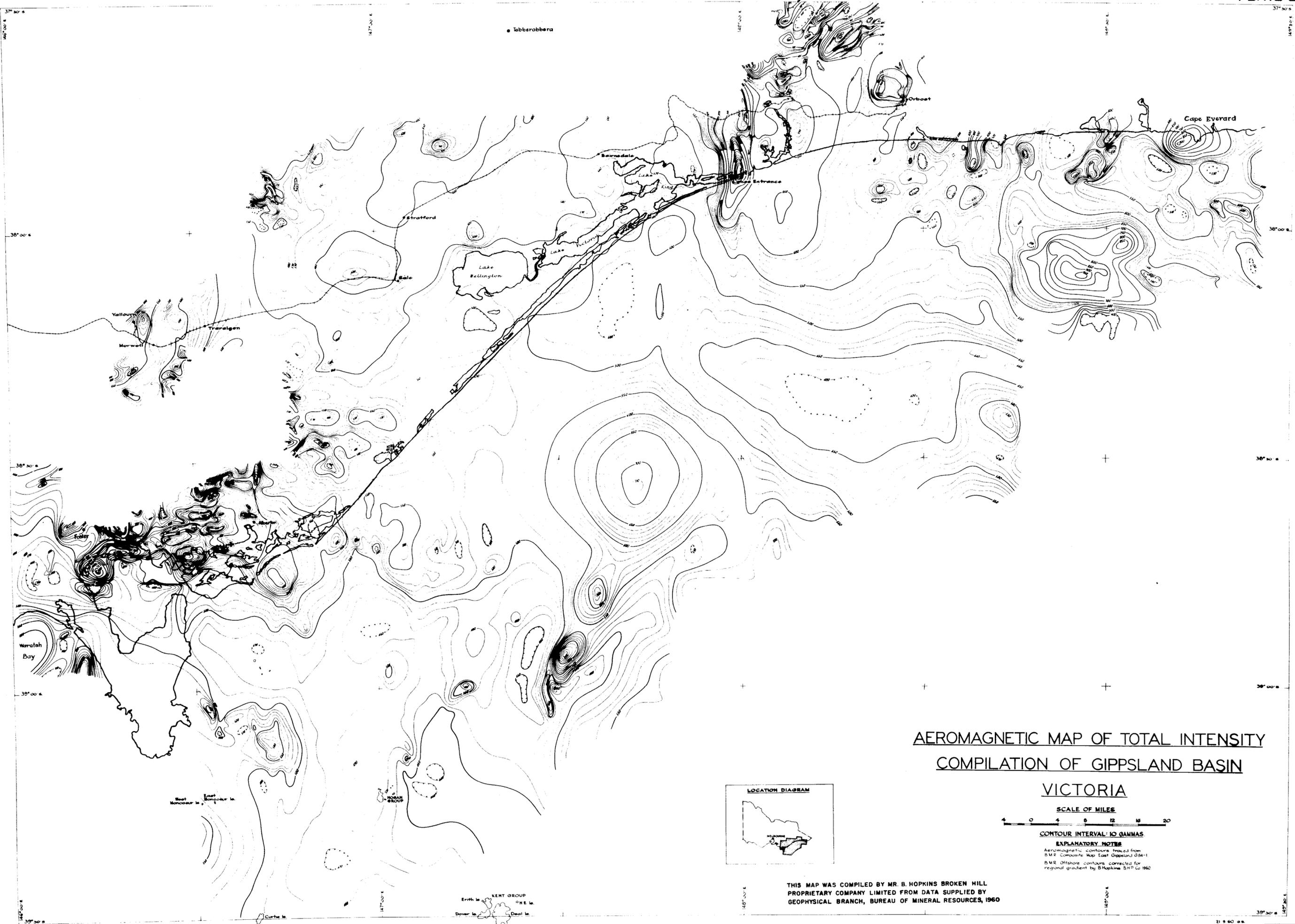
# STRUCTURAL GEOLOGY OF SOUTH-EASTERN VICTORIA



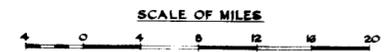
- TOWNSHIP
- FAULT (DEFINITE)
- - - " (INDEFINITE)
- ↑ ANTICLINAL FEATURE
- - - TECTONICAL TREND LINE (SEE MAP)
- - - BOUNDARY OF MARINE TERTIARY

**LOCATION DIAGRAM**





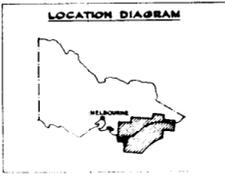
**AEROMAGNETIC MAP OF TOTAL INTENSITY  
 COMPILATION OF GIPPSLAND BASIN  
 VICTORIA**



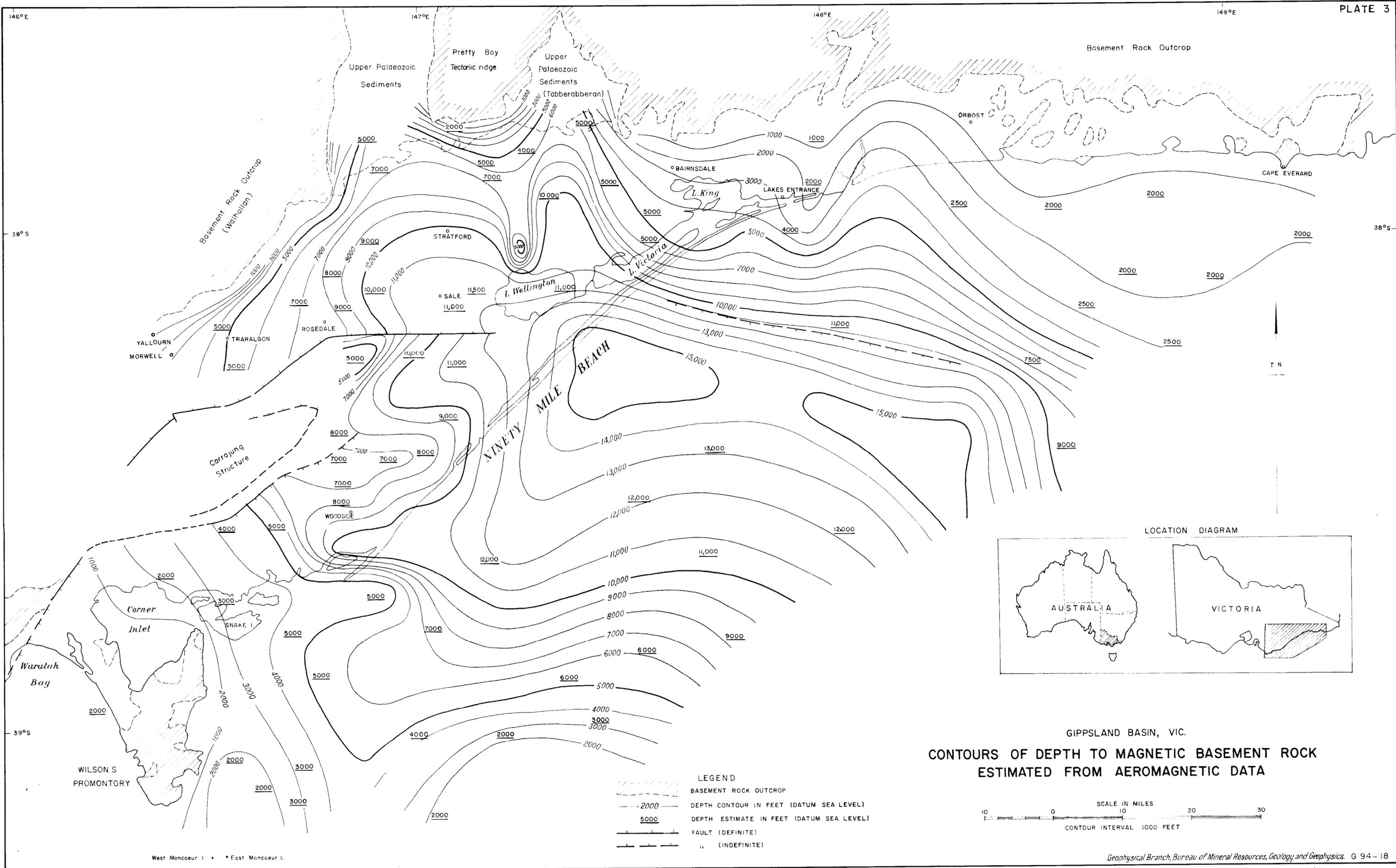
CONTOUR INTERVAL: 10 GAMMAS

**EXPLANATORY NOTES**

Aeromagnetic contours traced from  
 BMR Composite Map East Gippsland 034-1  
 BMR Offshore contours corrected for  
 regional gradient by B. Hopkins B.M.P. Co 1960

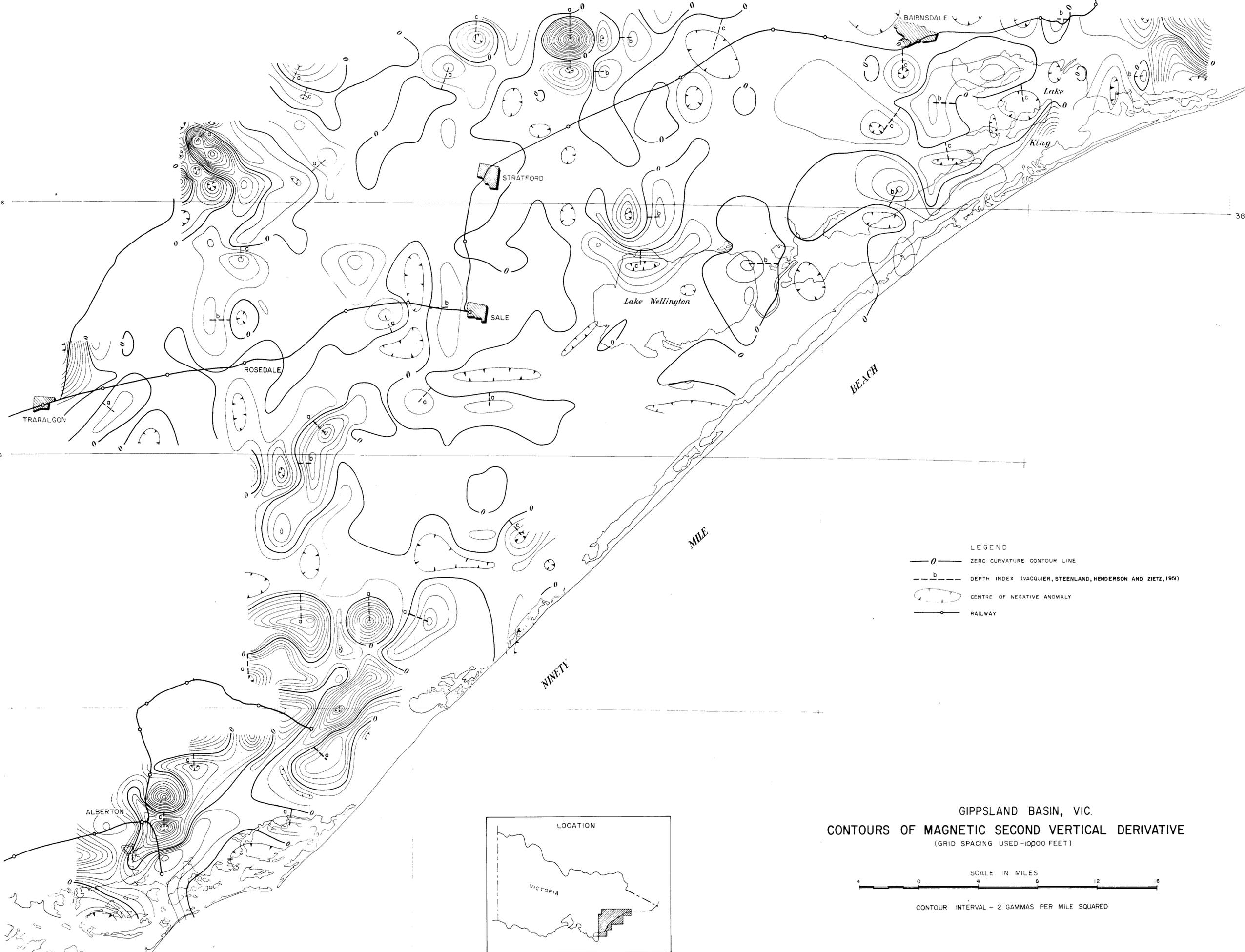


THIS MAP WAS COMPILED BY MR. B. HOPKINS BROKEN HILL  
 PROPRIETARY COMPANY LIMITED FROM DATA SUPPLIED BY  
 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, 1960



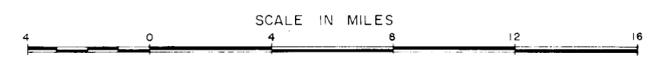
GIPPSLAND BASIN, VIC.  
 CONTOURS OF DEPTH TO MAGNETIC BASEMENT ROCK  
 ESTIMATED FROM AEROMAGNETIC DATA

West Moncoeur I. • • East Moncoeur I.



- LEGEND
- 0 — ZERO CURVATURE CONTOUR LINE
  - b - DEPTH INDEX (VACQUIER, STEENLAND, HENDERSON AND ZIETZ, 1951)
  - CENTRE OF NEGATIVE ANOMALY
  - ○ — RAILWAY

GIPPSLAND BASIN, VIC.  
 CONTOURS OF MAGNETIC SECOND VERTICAL DERIVATIVE  
 (GRID SPACING USED - 10000 FEET)



CONTOUR INTERVAL - 2 GAMMAS PER MILE SQUARED

