DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1974/155

CONTINENTAL MARGIN SURVEY PREVIEW REPORT FOR WESTERN TASMANIA AND THE EASTERN BIGHT:

by

L.A. TILBURY

Record 1974/155

CONTINENTAL MARGIN SURVEY PREVIEW REPORT FOR WESTERN TASMANIA AND THE EASTERN BIGHT:

by

L.A. TILBURY

CONTENTS

ILLUSTRATIONS

SUMMARY

During December 1971 and January 1972, the western Tasmanian and eastern Bight region will be surveyed as part of the Australian Continental Margin marine survey. This survey will obtain seismic, bathymetric, gravity, and magnetic data between the coast and the 4000 m isobath. The purpose of the survey is to investigate the extent of offshore sedimentary basins, the sedimentary structures, and the basement tectonics.

Two major sedimentary basins extend over most of the survey area. These are the Bass Basin between Tasmania and Victoria, and the Otway Basin in southwest Victoria and South Australia. The Bass Basin is a Tertiary basin which contains up to 4 km of sedimentary section and the Otway Basin, primarily a Cretaceous basin, contains up to 6 km of sedimentary section. Three other sedimentary basins in the region with minor offshore extent are the Murray Basin opening into Encounter Bay, the St Vincent Basin in the Gulf of St Vincent and the Pirie - Torrens Basin in Spencer Gulf.

Previous geophysical work has been carried out by the petroleum companies and is mainly confined to the shelf areas. Extensive seismic surveys have been carried out in the Bass and Otway basins and reconaissance surveys throughout the remainder of the region. Several aeromagnetic surveys have almost totally covered the area. Some 16 exploratory wells have been drilled, and provide stratigraphic and velocity data throughout the region.

The line spacing on this survey will be at 20 n mile with lines oriented east-west along the west coast of Tasmania and in Bass Strait, and north-south from longitude 141°E, near the South Australian border as far west as Port Lincoln. About 41 working days will be required to survey the 8100 n mile (15 000 km) of proposed traverse lines in this region.

1. INTRODUCTION

The marine geophysical survey from Hobart to Port Lincoln including Bass Strait, will be part of the Australian Continental Margin survey. This survey is being carried out by Compagnie Generale de Geophysique (CGG) for the Bureau of Mineral Resources (BMR) to obtain bathymetry, gravity, magnetic, and seismic information between the coastline and the foot of the continental slope at about the 4000 m isobath.

Proposed survey lines are indicated in Plate 1 and consist of some 8100 n miles of traversing. Around Tasmania and in the Bass, Gippsland, and eastern Otway basins the traverses will be run east-west with a 20 n mile spacing. West of longitude 141°E the traverses will run north-south to cross the major bathymetric and structural trends of the Otway Basin at right angles. A line spacing of 25 minutes of longitude (approx. 20 n mile) will be used. Two tie-lines parallel to the coast are planned throughout the area.

The prime navigation system will be the ITT satellite Doppler equipment using a Digital Corporation PDP-8 computer to obtain position fixes at roughly two-hourly intervals. A Marquardt sonar Doppler, Chernikeeff electromagnetic log and ship's pressure log will be used through a Hewlett-Packard 2116B computer to provide independent positioning systems. V.L.P. radio navigation will also be provided.

The gravity meter to be used will be a LaCoste & Romberg meter, mounted on a gyrostabilized platform, with an analogue computer to make cross-coupling corrections. Analogue records are made at the meter and in addition digital recording of meter values will be made by the navigation computer.

The Varian proton precession magnetometer with the sensor towed 200 m behind the ship will record the total magnetic field and a second magnetometer stationed on shore will record the daily variations of the Earth's field. Magnetic readings will be recorded in analogue and digital form in a similar fashion to the gravity data.

Digital values of water depth will be recorded from one of the three depth measuring systems. The Atlas-Edo system will record water depths between 0 and 200 + m, the Elac system will record water depths between 200 m and 3000+ m and the shallow section seismic cable output will give water depths via the Digitrac digital conversion unit where necessary for water depths greater than 3000 m.

The seismic energy source will consist of a 120-kilojoule sparker source using four pairs of electrodes. The main seismic cable is a 6-channel AGM streamer with a 300 m offset to the first active section and 200 m between successive geophone groups. Geophone groups in the cable are made up to 48 HC301 detectors over a group length of 50 m. The shallow section high resolution cable will be a Geotech streamer with an internal preamplifier. The active section has 28 geophones spaced over a 12 m length and will be towed 200 m behind the boat.

Seismic signals will be amplified by a Sercel AX626 amplifier using the Common Gain system of gain control. The shallow section signal will be amplified by a Sercel amplifier modified to operate independently on automatic gain control at high frequency.

Refraction profiles will be recorded using an Aquatronics FM radio receiver system and sonobuoys.

Seismic data will be recorded on four E.P.C. graphic display units and on an Ampex 14-channel tape recorder. The tape recorder will use 1-inch magnetic tape, FM modules and a recording speed of 15/16 inch/second. The main cable channel 2 will be displayed at two paper speeds on the EPC electrostatic recorders; one at a high paper speed of 30 cm/hr and the other at a low paper speed of 8 cm/hr. A fourth display unit will monitor all the recorded seismic data from the main cable and shallow cable in turn using the playback heads of the Ampex recorder.

This report collates the geological and geophysical information known about the survey area for use as an operations guide and for future interpretation of the area.

2. REGIONAL GEOLOGY

The area described by this report contains five sedimentary basins; namely, the Bass Basin, the Otway Basin, the Murray Basin (southern part), the St Vincent Basin and the Pirie-Torrens Basin. A summary of these basins has been taken from Richards & Hopkins (1969) for the Bass and Otway basins and Reynolds (1965) for the remaining three basins.

Bass Basin

The Bass Basin (Plate 2) is primarily an Upper Cretaceous and Tertiary basin containing up to 4000 m of sediments and lies almost entirely offshore between Tasmania and Victoria. It is separated from the Gippsland Basin by a basement high (the Bassian Rise) and from the Otway Basin by the Mornington King Island basement high.

The Bass Basin is effectively a large graben or rift feature which has been subsiding since at least Upper Cretaceous time. Tensional release has been provided by a system of normal faults trending northwest on the northeastern and southwestern flanks of the basin. On the northeastern flank a veneer of Eocene to Miocene sediments extends beyond these faults and laps onto basement. To the northwest the basin is divided by the Mornington/ King Island basement high (Plate 2) giving rise to the Torquay Sub-basin. This sub-basin, despite having geographical association with the Otway Basin during the Lower Cretaceous, is considered part of the Bass Basin because of the common depositional history during much of the Upper Cretaceous and Tertiary when they were interconnected for long periods.

The basal section of the Bass basin is a fluvio-deltaic complex (the Easternview Complex) of similar type and age to the Latrobe of the Gippsland Basin. Its thickness is probably in excess of 2000 m and includes Upper Cretaceous to lowermost Upper Eocene sediments. The Palaeocene to Lower Eocene is made up of alternating coal, silt, carbonaceous shale, and quartzose sandstone. This fluviodeltaic sequence is considered to have filled up the basin depocentre in a prograding mass, sourced primarily from the south and east. A localized angular unconformity occurs in places at the base of the Eocene, but elsewhere there appears complete conformity with the younger sediments. Following the true fluvio-deltaic deposition, a transitional sand facies of Upper Eocene was deposited. This is regarded as a thin transgressional sequence between the fluvio-deltaic sedimentation and the offshore facies, characterized by the Demons Bluff formation which is in excess of 150 m thick and is a silty mudstone and siltstone of restricted marine origin of Upper Eocene age.

The Oligocene consists primarily of silty mudstone, siltstone with minor sandstone and volcanics, and reaches a maximum thickness of 600+ m. It also marks the first major Tertiary marine transgression.

The Miocene has a maximum thickness of 1000+ m and comprises limey mudstone, calcarenites, and tuffites. It is correlative with the Miocene of Gippsland and is thus probably continuous with it.

Structures involving the Tertiary section are directly involved with basement block-faulting. The main structural movement was subsidence of the central part of the basin with the fault blocks along the flanks remaining relatively stable.

Otway Basin

The Otway Basin (Plate 2) is partly an onshore and partly an offshore basin which trends east-west across southwest Victoria into South Australia. It lies almost at right angles to the major trend in the underlying basement. The Otway is primarily a Cretaceous basin, and in this respect differs from the Bass and Gippsland basins which are Tertiary basins. During the Cretaceous the various depocentres were aligned roughly parallel to the present coastline and in a gross regional sense migrated to the southwest with each successively younger period of sedimentation.

The lower Cretaceous Otway Group (Plate 3) unconformably overlies older Jurassic or Palaeozoic rocks of various types. This Group consists of non-marine greywacke, mudstone, and coal deposited in a northwest-trending trough. Its thickness is probably in excess of 5000 m in more basinal areas. A clean quartzose sandstone (the Pretty Hill Sandstone) has been observed along the northernmost margin of the basin and may be the age equivalent of typical Otway Group greywacke to the south. The top of this sandstone is generally marked by an angular unconformity, and is overlain by younger Otway Group greywacke.

The Upper Cretaceous section represents a complete sequence, starting with a major marine transgression and ending with prograding sandy units. This sequence (the Sherbrook Group) consists of a basal sandstone (the Waarre Formation), an overlying ferruginous sandstone (the Flaxmans Beds) which is turn is overlain by mudstone (the Belfast Formation). This mudstone grades upwards into shallow-water marine sandstone and siltstone (the Paaratte Formation), overlain by non-marine sandstone and coal (the Curdies Formation). The total Upper Cretaceous section is believed to be well over 4000 m thick. At the end of the Upper Cretaceous the area was subject to some uplift and accompanying erosion.

The total Tertiary section may attain thickness of up to 2000 m. During the Palaeocene to Upper Eocene, clastic deposition resulted in lagoonal to shallow neritic mudstone, sandstone, and conglomerate (the Wangerrip Group and the Mepunga Formation).

A regional unconformity is generally recognized at the top of the Wangerrip Group and is diachronous from Upper Palaeocene to Middle Eocene in age. Overlying this unconformity is sandstone (the Mepunga Formation) which represents the last phase of clastic regression before the major transgression of the overlying marl sequence. This Palaeocene to Upper Eocene section attains 1200 m in thickness.

During the Upper Eocene to Pliocene the overall transgression of the sea covered the sandy regressive phase with a thick marl sequence which culminates in a Miocene shelfal limestone.

During the Pliocene tectonic movement uplifted southeast Australia and the sea began to regress. Extensive volcanism also occurred resulting in lava flows which now cover large areas of the onshore Otway Basin.

The three major stratigraphic sections, Lower Cretaceous, Upper Cretaceous, and Tertiary, were deposited during quite different periods of structural evolution. The Lower Cretaceous was a period of significant basement block-faulting resulting in large stable blocks surrounded by areas of major subsidence.

The Upper Cretaceous saw the formation of a prominent monoclinal downwarp or hingeline which ran roughly parallel to the present-day coastline and occurred a few miles inland from it. South of this hinge is an area of tilted normal fault blocks of considerable density. Most are parallel to the hingeline and downthrown to the southwest.

The Tertiary rocks are only slightly deformed by post-depositional movement and for the most part merely assume south regional dip.

Murray Basin (southern part)

The Murray Basin is a large basin of Mesozoic and Tertiary sediments which extends from southeastern South Australia into southwestern NSW and northwestern Victoria. This basin is mainly exposed onshore but in the southwest it opens into Encounter Bay (Plate 2).

The Basin is bounded on the southwest margin by a granite belt (apart from the small section that opens into Encounter Bay), on the west and northwest by Precambrian and Lower Palaeozoic rocks, and on the east and south by Silurian and Ordovician metamorphics. In the south between the metamorphics and the granite belt, the Murray Basin has a Tertiary connexion with the Otway Basin.

The actual southern and western margins of the Murray and the Otway Basins may be defined more clearly by the results of this survey.

St Vincent Basin

The St Vincent Basin was originally defined as a Cainozoic basin, but subsequent exploration and drilling has shown that extensive Permian and Cambrian sediments underlie the Cainozoic. The basin lies almost entirely in the Gulf of St Vincent (Plate 5) which is regarded as a graben or half-graben structure with the deepest part along the eastern side.

Cambrian rocks crop out along the northwestern edge of Fleurieu Peninsula (south of Adelaide), the northern edge of Kangaroo Island, and on Yorke Peninsula. These border the St Vincent Basin and comprise sandstone, dark grey limestone, dolomite, shale, some red beds and evaporites, limestone conglomerate, and 600 m of unfossiliferous cross-bedded sandstone and conglomerate. The overall thickness is at least 1500 m.

Permian sediments are mainly glacial tills and aqueoglacial sediments, with some marine sandy mudstone.

The Cainozoic sediments of the St Vincent Basin are mainly paralic with alternating marine and non-marine deposits up to 600 m thick. These are present near Adelaide, and crop out in fault blocks to the south.

The Tertiary section (600 m) is not thought to increase markedly in the submarine part of the Basin, but the sediments are apparently widespread. Below them are Permian sediments in the southern half of the shelf area, Cambrian in the shelf area and southern part of the Basin; and probably thick Upper Proterozoic sediments of the Adelaidean System.

Pirie-Torrens Basin

The Pirie-Torrens Basin (Plate 2) is an elongated, meridional, structural basin lying between Port Pirie in the south and Lake Torrens in the north. It is a graben structure, bounded by faults on the east and on the west, with its southern end opening into Spencer Gulf.

The eastern side follows the lower limits of Lower Cambrian sediments along the western scarp of the Flinders Range. Movement along this fault occurred during the overthrusting of the western Flinders Ranges in the Tertiary.

The oldest rocks known from the Basin are Cambrian dolomite and limestone up to 1500 m thick. These are overlain by Tertiary sediments with thicknesses in excess of 150 m, and are considered to be largely continental deposits.

3. PREVIOUS GEOPHYSICS

(a) AEROMAGNETIC SURVEYS

(i) Bass Strait - Encounter Bay aeromagnetic survey, for Haematite Exploration Pty Ltd (1961), covered all of their tenements in the Bass and Otway Basins (Plate 4). An important basement high (the Bassian Rise) exists in the eastern part of the area. The centre of Bass Strait is occupied by a basin trending northwest with a number of marked magnetic trends also in this direction. The Otway Basin has a remarkebly uniform and featureless magnetic field over most of its area. The depth to magnetic basement is considered to be in excess of 3000 m. Along an east-west line between Beachport and Kingston the basement rises sharply (probably faulted) towards the north. Most of the northwestern area has shallow basement (less than 300 m).

(ii) Young Rocks aeromagnetic survey, for Haematite Exploration Pty Ltd, (1968) traversed tenement SA/PI plus a small section of tenement SA7. The basement depth estimates show the sedimentary thickness to be less than 2000 m over most of the area. To the south and west the basement deepens.

(iii) Offshore Tasmania aeromagnetic survey, for Esso Exploration and Production Inc. (1966a), covered their tenements around the coast of Tasmania (Plate 4). Generally, magnetic basement extends offshore at shallow depth. One region in the southwest, on the continental shelf, showed a basement depth reaching 4000 m, but usually the only sizable deep sedimentary regions occurred in deep water.

(iv) Tasmania aeromagnetic survey, (Finney & Shelley, 1966) for the Bureau of Mineral Resources. In this survey, twenty east-west high-altitude traverses, of approximately 16 km spacing, were flown across Tasmania and offshore areas (to 130 km from the coast). The western offshore area is similar to the southern parts of the Otway Basin in that it is, in general, magnetically quiet. It also showed that magnetic basement is commonly close to the sea floor and in the northwestern part is very shallow. The Precambrian block of northwestern Tasmania extends offshore to the north-northwest.

(v) St Vincent Gulf aeromagnetic survey, for Beach Petroleum Pty Ltd (1964). Depths to magnetic basement were 1000 to 2000 m below the shelf and up to 3000 m along the eastern depression.

(vi) Eastern Great Australian Bight aeromagnetic survey, for Shell Development (Australia) Ltd (1966a), covered all their offshore tenements on the South Australian Shelf. Most of the area is underlain by shallow magnetic basement. To the southwest of Kangaroo Island an area of deep magnetic basement was established.

(b) GRAVITY SURVEY

St Vincent Gulf Gravity Survey, 1963 for Beach Petroleum Pty Ltd, (1963). This submarine gravity survey showed the extension of a gravity low from beneath Adelaide, along the eastern side of the Gulf, towards Kangaroo Island. On the eastern side this gravity low has a very steep gradient. A submarine shelf area below the western side of the Gulf corresponds to a series of positive Bouguer anomalies with a longitudinal trend.

The report on regional marine geophysical surveys (Riesz & Moss, 1971) shows two ships tracks crossing the survey area. These were the Oceanographer (USC & GS) 1967, (which also had magnetic and seismic coverage) and the Vema V-18 (Lamont), 1962 (plus magnetics). However, as they are not available in computer compatible form, the information obtained cannot be accurately integrated with the Continental Margins Survey.

(c) SEISMIC SURVEYS

Marine seismic surveys in the Bass and Otway Basins have been mainly carried out by Haematite and Esso. The traverses are shown in Plates 5 and 6, and the surveys are described in subsidy reports as follows:-

HAEMATITE EXPLORATION PTY LTD

Flinders Island - Kingston	62/1645
Cape Grim to Cape Jaffa	64/4561
Baudin (plus Magnetics)	70/178

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

Bass Marine	65/4588
King Island East	65/11037
Otway Marine	66/11121

Otway EP-67 (plus Magnetics)	67/11188
Bass ED-67	67/11196
Tasmania EE-68 (plus Magnetics)	68/3013
Bass EF-68	68/3014
Otway ER-68 (plus Magnetics)	68/3036
Otway EU-68 (plus Magnetics)	68/3052
Bass B69A (plus Magnetics)	68/3057
West Tasmania T69A (plus Magnetics)	69/3000
Otway O69B (plus Magnetics)	69/3061
Otway 071R	71/74

Other companies have done surveys in their respective tenements (Plate 4) and these surveys are described in the following subsidy reports.

MAGELLAN PETROLEUM AUSTRALIA LTD	
Tasman-Bass Strait	69/3023
FROME BROKEN HILL CO. PTY LTD	
Southwest Victoria	63/1511
Warrnambool Marine	62/1553
ALLIANCE OIL DEVELOPMENT AUSTRALIA NL	
Venus Bay	67/11193
BEACH PETROLEUM PTY LTD	
St Vincent Gulf	67/11192
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	
Offshore Otway Basin	65/11052
South Australian Shelf R1	66/11135
South Australian Shelf R2	67/11205
Cape Bridgewater Refraction Survey	67/11175
South Australian Shelf R3	68/3048

From these surveys the distinguishing features were:-

HAEMATITE:

(i) Flinders Island - Kingston survey (1962)

The basal Tertiary horizon ranges from 300 m to 3000 m depth. Two major features in region;

1. an anticlinal trend extending southeasterly from Anglesea and
2. a major depositional syncline (The Bass Basin).

(ii) Cape Grim to Cape Jaffa survey (1964)

This was a reconnaissance survey which found such features as folding, faulting, and pinchout.

(iii) Baudin survey (1970)

The survey area was in SA/P1 to the south of Kangaroo Island. Thin sediments were found over most of the area. Features of the sections included faults (mostly parallel to edge of shelf) and submarine canyons. Magnetic profiles were relatively undisturbed indicating a relatively non-magnetic basement.

ESSO:

(i) Bass Marine and King Island East surveys (1965(a), (b))

These were concerned with detailing a number of culminations found by the Flinders/Kingston survey. Several structural closures were mapped in the depth range of 600 m, and 1000 m. These were interpreted to be Miocene reef facies (an alternative interpretation is that they are the result of draping over a horst block). Bass Nos 1 and 2 wells were sited and drilled on these results.

(ii) Eastern Bass Strait and Bass ED-67 survey (1967(B))

These surveys extended the Flinders Island/Kingston survey to complete the reconnaissance of the Bass Basin. Excellent correlation was found between reflections and geological markers of Esso wells. The northwest area generally has shallow basement with numerous volcanic deposits and three basement uplifts.

(iii) Bass EF-68 and Bass B69A surveys (1968(b), (e))

These were detailed surveys over small areas using improved techniques.

(iv) Tasmania EE-68 and West Tasmania T69A surveys (1968(a), 1969(a))

These surveys were in Esso's tenement on the west coast of Tasmania. The traverses consisted of one line parallel to and ten at right angles to the coastline at approx. 16 km spacing. Four horizons were mapped with correlation being based on Prawn No. 1 well and basement outcrop on King Island. These horizons were a) Economic Basement
b) base of Tertiary-unconformity,
c) Eocene marker, and
d) lower Miocene marker.

Two areas of thick sediments were located and the magnetic basement found to be shallow from Macquarie Harbour southwards.

(v) Otway Marine seismic survey (1966(b))

This extended the Cape Grim/Cape Jaffa survey. Strong angular unconformities were present on all sections. Crayfish No. 1 well was sited on the result from this survey.

(vi) Otway EP-67, ER-68, 069B and 071R surveys (1967(a), 1968(c), 1968(d), 1969(b), 1971)

These surveys were concerned mainly with detailing specific areas (culminations etc.). Survey ER-68 found the Encounter Bay area to be one of shallow basement. Survey EU-68 defined the offshore portion of the Beachport Basement High and revealed it to be a horst block formed by Lower Cretaceous faulting. The Lower Cretaceous Crayfish Sandstone was deposited contemporaneously with the faulting and essentially filled the depressions in the broken basement surface. This sandstone pinches out against the basement high.

MAGELLAN:

Part of the Tasman/Bass Strait survey (1969) was in tenements T/2P and T/10P (Plate 4). The western edge of a structural ridge on trend with King Island was outlined in the south and seems to divide the Otway and Bass Basins. Tertiary sediments range from 300 to 1500 m thickness and thin to the south and west. Pre-Tertiary sediments decrease from 3000 m in the north to 2000 m in the south. Several anticlinal features were outlined with at least one extending into shallow water.

FROME BROKEN HILL AND ALLIANCE SURVEYS:

These surveys extended known structures out to sea.

BEACH:

This survey was in the St Vincent Gulf, but owing to the poor record quality the interpretation was unreliable.

SHELL:

(i) Offshore Otway Basin survey (1965)

This showed two reasonable horizons in the tertiary with one lying near the base, just above a major unconformity.

(ii) Cape Bridgewater Refraction survey (1967(b))

This survey took place in Frome's tenement with the traverse line south of Cape Bridgewater (near Portland). This revealed a refractor of 4800 m/s believed to be associated with the lower part of the Otway Group at a minimum depth of 4000 m. Another refractor of 5400 m/s is believed to be basement and occurs at a depth not less than 5000 m.

(iii) South Australian Shelf surveys R1, R2 and R3 (1966(b), 1967(a), 1968)

These surveys confirmed the results of the aeromagnetic survey and proved the existence of an extensive area of shallow basement. In the area adjacent to Kangaroo Island a thick section of sediments was established (up to 6000 m thick). A relatively undisturbed Upper Tertiary sequence unconformably overlies a thick section of folded sediments.

(d) EXPLORATORY WELLS

In the Survey area some 16 exploratory wells have been drilled, of which 11 are described in the following subsidy reports.

1965	Bass 1	65/4167
1966	Bass 2	66/4187
1967	Pecten Vic	67/4239
1967	Bass 3	67/4241
1967	Voluta Vic	67/4263
1967	Crayfish SA	67/4266

1967	Prawn Tas	67/4273
1968	Nautilus Vic	68/2008
1968	Argonaut SA	68/2018
1969	Clam Tas	69/2016
1969	Mussel Vic	69/2021

The stratigraphic tables and velocity logs (if carried out) are given in the Appendix.

4. OBJECTIVES AND PROGRAMME

The objectives of the survey are set out in the Contract with Compagnie Generale e Geophysique as:-

(i) to measure water depths along traverses approximately 20 n miles apart and out to a depth of about 4000 m.

(ii) to investigate the shallow sub-bottom, the extent of possible off-shore sedimentary basins, the sedimentary structures down to some few thousand metres and the basement tectonics in the main areas of operation.

(iii) to evaluate and where necessary modify or develop techniques and systems applicable to this type of multisensor geophysical survey.

The program, on this section of the Continental Margin Survey, will consist of 2 or 3 cruises to survey between Latitude 34°S and 44°S, and longitudes 136°E to 148°E. This area includes the west coast of Tasmania, Bass Strait, and the coast of South Australia as far west as Port Lincoln. Part of the east coast of Tasmania was not surveyed during 1971 and this area will be completed, and will add 8 operational days and 1600 n miles (3000 km) to this program.

Traverse lines will be at 20 n miles spacing and run east-west along the west coast of Tasmania and in Bass Strait (Plate 1). This will require 15 operational days and will cover 3000 n miles (5600 km).

At approximately longitude 141°E, near the South Australian border the traverses will change to north-south lines. For convenience the lines will be 25 minutes of longitude apart (approximately 20 n miles) except where the lines would coincide with the standard border of the 1:250 000 map sheets

(ie multiples of 0°, 1½°, 3°, 4½°, and 6° longitude) where they will be offset slightly. The traverse lines in Spencer Gulf and Vincent Gulf will be subject to change owing to the shallow water depth of Spencer Gulf and the busy sea-lanes in the Gulf of St Vincent. Traverse lines west of the South Australian border will require 11 operational days and cover 2200 n miles (4100 km).

Tie-lines will require 6.5 days covering 1300 n miles (2400 km) and will consist of one tie-line along each coast of Tasmania, one across Bass Strait, and another from the South Australian border to longitude 136°E.

Including tie-lines, the total mileage will be 8100 n miles (15000 km) and will require 41 working days to complete. Therefore the survey area should be completed after two or three cruises.

Summary of Program :	Days	Nautical Miles
West coast Tasmania and Bass Strait	15	3000
East coast Tasmania	8	1600
S. Australia border to Port Lincoln	11	1100
Tie-lines	7	1300
Totals	41	8100 (15000 km)

5. REFERENCES

ALLIANCE OIL DEVELOPMENT AUSTRALIA NL, 1967 - Venus Bay marine seismic survey. Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. 67/11193 (unpubl.).

BEACH PETROLEUM PTY LTD.

- 1963 - St Vincent Gulf gravity survey 63/1914
- 1964 - St Vincent Gulf aeromangetic survey 64/4609
- 1967 - St Vincent Gulf marine seismic survey 67/11192

Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. (unpubl.).

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

- 1965 (a) - Bass Marine seismic survey 65/4588
- 1965(b) - King Island East marine seismic survey 65/11037
- 1965(c) - Well completion report, Bass No. 1 65/4167

- 1966(a) - Offshore Tasmania aeromagnetic survey 66/4626
- 1966(b) - Otway Marine seismic survey 66/11121
- 1966(c) - Well completion report, Bass No. 2 66/4187
- 1967(a) - Otway EP-67 marine seismic and magnetic survey 67/11188
- 1967(b) - Bass ED-67 seismic survey 67/11196
- 1967(c) - Well completion report, Bass No. 3 67/4241
- 1967(d) - Well completion report, Crayfish No. 1 67/4266
- 1967(e) - Well completion report, Prawn No. 1 67/4273
- 1968(a) - Tasmania EE-68 marine seismic survey 68/3013
- 1968(b) - Bass EF-68 marine seismic survey 68/3014
- 1968(c) - Otway ER-68 marine seismic survey 68/3036
- 1968(d) - Otway EU-68 marine seismic and magnetic survey 68/3052
- 1968(e) - Bass B69A marine seismic and magnetic survey 68/3057
- 1968(f) - Well completion report, Nautilus No. 1 68/2008
- 1968(g) - Well completion report, Argonaut No. 1 68/2018
- 1969(a) - West Tasmania T69A marine seismic and magnetic survey 69/3000
- 1969(b) - Otway 069B marine seismic and magnetic survey 69/3061
- 1969(c) - Well completion report, Clam No. 1 69/2016
- 1969(d) - Well completion report, Mussel No. 1 69/2021
- 1971 - Otway 071R marine seismic survey 71/74

Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. (unpubl.)

FINNEY, W.A., & SHELLEY, E.P., 1966 - Tasmania aeromagnetic survey, 1966. Bur. Miner. Resour. Aust. Rec. 1966/139 (unpubl.).

FROME-BROKEN HILL CO. PTY LTD.

- 1962 - Warnambool marine seismic survey 62/1553
- 1963 - Southwest Victoria marine seismic survey 63/1511

Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. (unpubl.)

HAEMATITE EXPLORATION PTY LTD.

- 1961 - Bass Strait-Encounter Bay aeromagnetic survey 62/1711
- 1962 - Flinders Island - Kingston marine seismic survey 62/1645
- 1964 - Cape Grim to Cape Jaffa marine seismic survey 64/4561
- 1968 - Young Rocks aeromagnetic survey 68/3055
- 1970 - Baudin marine seismic survey 70/178

Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. (unpubl.).

MAGELLAN PETROLEUM AUSTRALIA LTD. 1969 - Tasman-Bass Strait marine seismic survey. Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. 69/3023 (unpubl.).

REYNOLDS, M.A., 1965 - The Sedimentary basins of Australia and the stratigraphic occurrence of hydrocarbons. Bur. Miner. Resour. Aust. Rec. 1965/196 (unpubl.).

RICHARDS, K.A., & HOPKINS, B.M., 1969 - Exploration in the Gippsland, Bass and Otway Basins, Australia. ECAFE Symp. Devel. Petrol. Resour. Asia Far East, Canberra, 1969.

RIESZ, E.J., & MOSS, F.J., 1971 - Regional marine geophysical surveys in the Australian area. Bur. Miner. Resour. Aust Rec. 1971/119 (unpubl.).

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD.

- 1965 - Offshore Otway Basin marine seismic survey 65/11052
- 1966(a) - Eastern Great Australian Bight aeromagnetic survey 66/4621
- 1966(b) - South Australian Shelf R1 marine seismic survey 66/11135
- 1967(a) - South Australian Shelf R2 marine seismic survey 67/11205
- 1967(b) - Cape Bridgewater refraction survey 67/11175
- 1967(c) - Well completion report, Voluta No. 1 67/4263
- 1967(d) - Well completion report, Pecten No. 1 & No. 1A 67/4239
- 1968 - South Australian Shelf R3 marine seismic survey 68/3048

Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts Rep. (unpubl.).

APPENDIX: STRATIGRAPHIC TABLES AND VELOCITY LOGS OF EXPLORATORY WELLS

CRAYFISH NO. 1 Latitude 37°17'S Longitude 139°36'E Water Depth 52 m.

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
78 - 334	256	Gambier Limestone	Miocene - Oligocene
- - - - - - - -	UNCONFORMITY		
334 - 365	32	Wangerrip Group	Eocene - Palaeocene
- - - - - - - -	UNCONFORMITY		
365 - 477	111	Sherbrook Group	Upper Cretaceous
- - - - - - - -	UNCONFORMITY		
477 - 1597	1120	Otway Group	Lower Cretaceous
- - - - - - -	MINOR UNCONFORMITY		
1597 - 3199+	1602	Pretty Hill Equivalent	Lower Cretaceous

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
449		2058
	2290	
886		2166
	2612	
1142		2252
	2891	
1422		2355
	3113	
1569		2410
	3286	
1703		2461
- - - - - -	- - - - - -	- - - - - -
1828		2501
	3489	
2286		2652
	3874	
2743		2799
	3956	
3154		2910

ARGONAUT: No. 1 Latitude 37°58' Longitude 140°16' Water Depth 77m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
0 - 77	77	Water	
77 - 239	162	No samples obtained	
239 - 297	57	Gambier Limestone	Miocene-Oligocene
297 - 325	28	Kingston Green Sand	Upper Eocene
325 - 681	372	Knight Group	Eocene-Paleocene
681 - 698	15	Bahgallah	Paleocene
698 - 3034	2336	Sherbrook Group - Curdies - Paaratte	Upper Cretaceous undifferentiated
3034 - 3516	481	Sherbrook Group - Belfast Shale	Upper Cretaceous
3516 - 3678	162	Sherbrook Group - Waarre Fm.	Upper Cretaceous

Velocity Log

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
480		1839
	2201	
6697		1938
	2529	
854		2026
1881	3496	2453
2283		2588
	3757	
2719		2724
	4150	
3035		2825
	3822	
3493		2926

VOLUTA NO. 1 Latitude 38°26' Longitude 141°19' Water Depth 91 m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
0? - 839	839(?)	Heytesbury Group	L.Miocene-L.Oligocene
839 - 1336	497	Wangerrip Group	Paleocene
1336 - 1548	212	Sherbrook Group - Curdies Fm	Upper Cretaceous
1548 - 2164	615	Sherbrook Group - Paaratte Fm	Upper Cretaceous
2164 - 3973	1809	Belfast Mudstone Equivalent	Upper Cretaceous

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
0		1524
	2165	
457		1986
	3850	
822		2561
	2344	
1066		2506
	2367	
1310		2478
	2782	
1630		2534
	2983	
1914		2593

PECTEN No. 1 & No. 1A Latitude 38°41' Longitude 142°40' Water Depth 63 m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
0 - 96	96	Limestone	Pleistocene
96 - 573	476	Heytesbury Group - Limestone - Marl	Oligocene - Miocene
573 - 801	228	Nirranda Group - Narrawaturk Marl - Mepunga Fm	Upper Eocene
801 - 1186	385	Wangerrip Group - Dilwyn Fm - Pebble Point Fm	Paleocene
1186 - 1795	608	Sherbrook Group - Curdies Fm - Paaratte Fm - Belfast Mudstone - Flaxmans Fm - Waarre Fm	Upper Cretaceous
1795 - 2850	1053+	Otway Group	Lower Cretaceous

No Velocity Log:

NAUTILUS NO. 1 Latitude 38°59' Longitude 142°33' Water Depth 100 m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
0 - 99	99	Water	
99 - 352	252	Port Campbell Limestone Fm	Miocene
352 - 1694	1342	Gellibrand Marl Fm	Miocene
1694 - 1715	20	Basal Tertiary Sand	Miocene
1715 - 1982	267+	Sherbrook Group - Belfast Shale Fm	Upper Cretaceous

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
796		2260
	3048	
1207		2478
	3233	
1712		2661
	3009	
1952		2700

MUSSEL NO. 1 Latitude 38°58' Longitude 142°46' Water Depth 85 m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
0 - 85	85	Water	
85 - 381	295	Port Campbell Limestone	Miocene-Oligocene
381 - 817	435	Gellibrand Marl Fm	Miocene-Oligocene
817 - 832	15	Clifton Fm	Miocene-Oligocene
832 - 954	121	Nirranda Group - Narrawaturk Marl Fm	Eocene
954 - 1212	257	Nirranda Group - Mebunga	Eocene
1212 - 1265	53	Wangerrip Group - Rivernook Fm	Paleocene
1265 - 1369	103	Wangerrip Group - Pebble Point Fm	Paleocene
1369 - 1979	610	Sherbrook Group - Belfast Fm	Upper Cretaceous
1979 - 2053	73	Sherbrook Group - Flacmans Fm	Upper Cretaceous
2053 - 2194	141	Sherbrook Group - Waarre Fm	Upper Cretaceous
2194 - 2419	224+	Otway Group	Lower Cretaceous

MUSSEL NO. 1 (cont)

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
252		1859
	2456	
335		1950
	2530	
426		2057
	2346	
458		2103
	2895	
640		2240
	2529	
883		2346
	2834	
1203		2453
	3108	
1691		2621
	3017	
1905		2682
	3718	
2240		2773

PRAWN NO. 1 Latitude 39°21' Longitude 143°07' Water Depth 108m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
107 - 734	626	Gellibrand Marl	Miocene - Oligocene
734 - 751	17	Clifton Limestone	Oligocene
751 - 921	169	Nirranda Group - Narrawaturk Marl	Upper Eocene
921 - 1185	263	Nirranda Group - Mepunga Fm Wangerrip Group - Dilwyn Fm	Eocene - Paleocene
1185 - 1206	20	Wangerrip Group - Rivernook Fm	Paleocene
1206 - 1265	58	Wangerrip Group - Pebble Point Fm	Paleocene
- - - - - - - - - - - - - - -		UNCONFORMITY	
1265 - 2175	910	Sherbrook Group - Curdies-Paaratte	Upper Cretaceous
2175 - 2228	52	Sherbrook Group - Belfast Fm	Upper Cretaceous
2228 - 2856	628	Sherbrook Group - Belfast - Flaxmans Fms	Upper Cretaceous
2856 - 2944	88	Sherbrook Group - Waare Fm	Upper Cretaceous
- - - - - - - - - - - - - - -		UNCONFORMITY	
2944 - 3193+	249+	Otway Group	Lower Cretaceous

PRAWN NO. 1 (cont)

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
893		2114
	2858	
1237		2279
	3144	
1435		2369
	3404	
1946		2574
	3262	
2201		2638
	5289	
2456		2723

CLAM NO. 1 Latitude 40°52' Longitude 144°13' Water Depth 30 m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	UNIT	AGE
0 - 101	101	Water	
101 - 293	191	Port Campbell Limestone Equivalent	Miocene - Oligocene
293 - 386	93	Jan Juc (Gellibrand Equivalent)	Miocene - Oligocene
386 - 513	126	Brown's Creek Group Equivalent	Miocene
513 - 600	87	Wangerrip Group - Rivernook Fm	Paleocene
600 - 819	218	Wangerrip Group - Dilwyn Fm	Paleocene
819 - 924	105	Basal conglomerate	Upper Cretaceous
924 - 1222	303	Sherbrook Group -Curdies - Paaratte Fms	Upper Cretaceous
1222 - 1249	27	Belfast Equivalent	Upper Cretaceous
1249 - 1271	21	Waare Equivalent	Upper Cretaceous
1271 - 1462	190	'Red Beds'	?Devonian
1462 - 1509	47	Siltstone	Lower Paleozoic
1509 - 1592	82+	Rocky Cape Group	Upper Pre-cambrian

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
286	1950	1767
381	2377	1828
518	2575	1950
679	2877	2042
822	3322	2194
938	2721	2255
1249	3279	2377
1447	3575	2468
1508		2529

BASS NO. 1 Latitude 39°46' Longitude 45°44' Water Depth 81 m

Stratigraphic Table

DEPTH (m)	THICKNESS (m)	LITHOLOGY	AGE
262 - 594	332+	Calcarenite	Upper Miocene
594 - 674	80	Calcareous mudstone	Mid-Miocene
674 - 772	97	Marl - calcareous mudstone	Mid-Miocene
772 - 941	169	Tuffite	Miocene
941 - 1150	208	Shale	Lower Miocene
115 - 1225	74	Shale & sandstone	Oligocene
1225 - 1298	73	Tuffite	Oligocene
1298 - 1638	340	Shale, siltstone, & sandstone	Oligocene
1638 - 1808	170	Shale, and siltstone	Eocene
1808 - 1944	135	Sandstone, siltstone, & shale	Eocene - Paleocene
1944 - 2353	407 +	Sandstone, siltstone, shale, & coal	Upper Cretaceous

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AGERAGE VELOCITY (m/s)
664		2122
	2275	
762		2140
	2393	
1140		2218
	2702	
1786		2372
	3799	
1949		2449
	3310	
2328		2542

BASS NO. 2 Latitude 39°53' Longitude 146°18' Water Depth 85 m

Stratigraphical Table

DEPTH (m)	THICKNESS (m)	LITHOLOGY	AGE
1757 - 659	578	Calcarenite	Upper & mid-Miocene
659 - 910	250	Calcareous mudstone	Mid & L. Miocene
910 - 1102	192	Mudstone, siltstone, sandstone	Oligocene
1102 - 1169	67	Argillaceous siltstone	Upper Eocene
1169 - 1370	200	Sandstone, siltstone, & coal	Mid & l. Eocene
1370 - 1679	309	Sandstone, siltstone, & coal	Paleocene (?)
1679 - 1757	78	Altered 'trachyte'	Unknown (?Mesozoic)
1757 - 1801	43+	Altered mudstone (tuffaceous)	Unknown (?Mesozoic)

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
62		2099
	2164	
918		2120
	2034	
993		2113
	2794	
1093		2161
	2394	
1160		2174
	2871	
1359		2253
	3233	
1640		2377

BASS NO. 3 Latitude 40° 00' Longitude 45°17' Water Depth 59 m

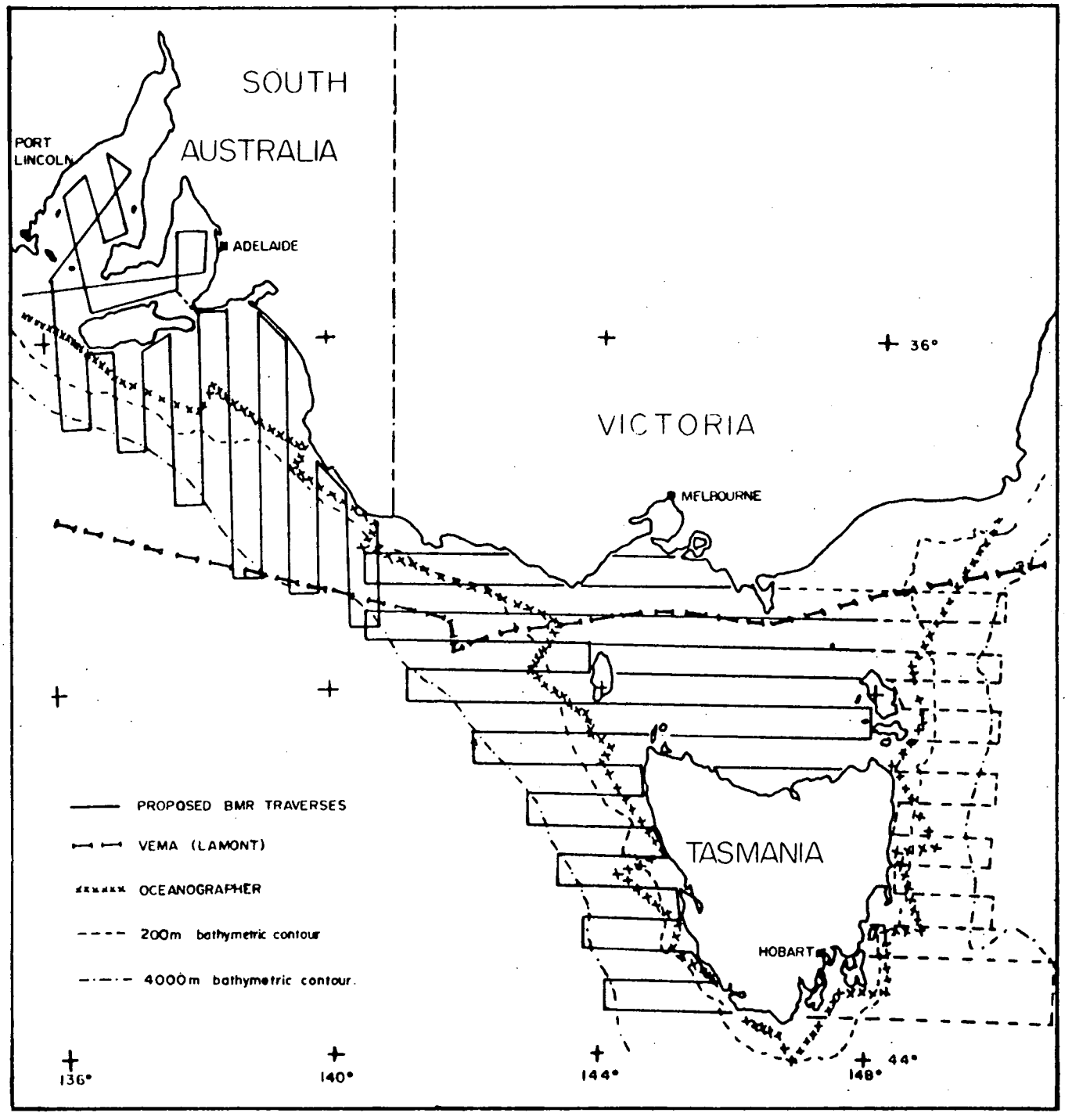
Stratigraphical Table

DEPTH (m)	THICKNESS (m)	LITHOLOGY	AGE
219 - 1149	914+	Skeletal calcarenite micritic limestone & mudstone	Miocene
1149 - 1434	284	Shale and mudstone	Oligocene
1434 - 1616	182	Shale and siltstone	Eocene
1616 - 1703	86	Sandstone, siltstone, and shale	Eocene
- - - - - - - - - - - -		UNCONFORMITY	
1703 - 2386	682	Sandstone, siltstone, and shale	Eocene - Paleocene
2386 - 2431	45+	Basement - quartzite & metamorphosed shale	

Velocity Log:

DEPTH (m)	INTERVAL VELOCITY (m/s)	AVERAGE VELOCITY (m/s)
610	2271	2149
1067	2488	2200
1435	2971	2267
1694	3422	2353
2142	3626	2517
2389		2599

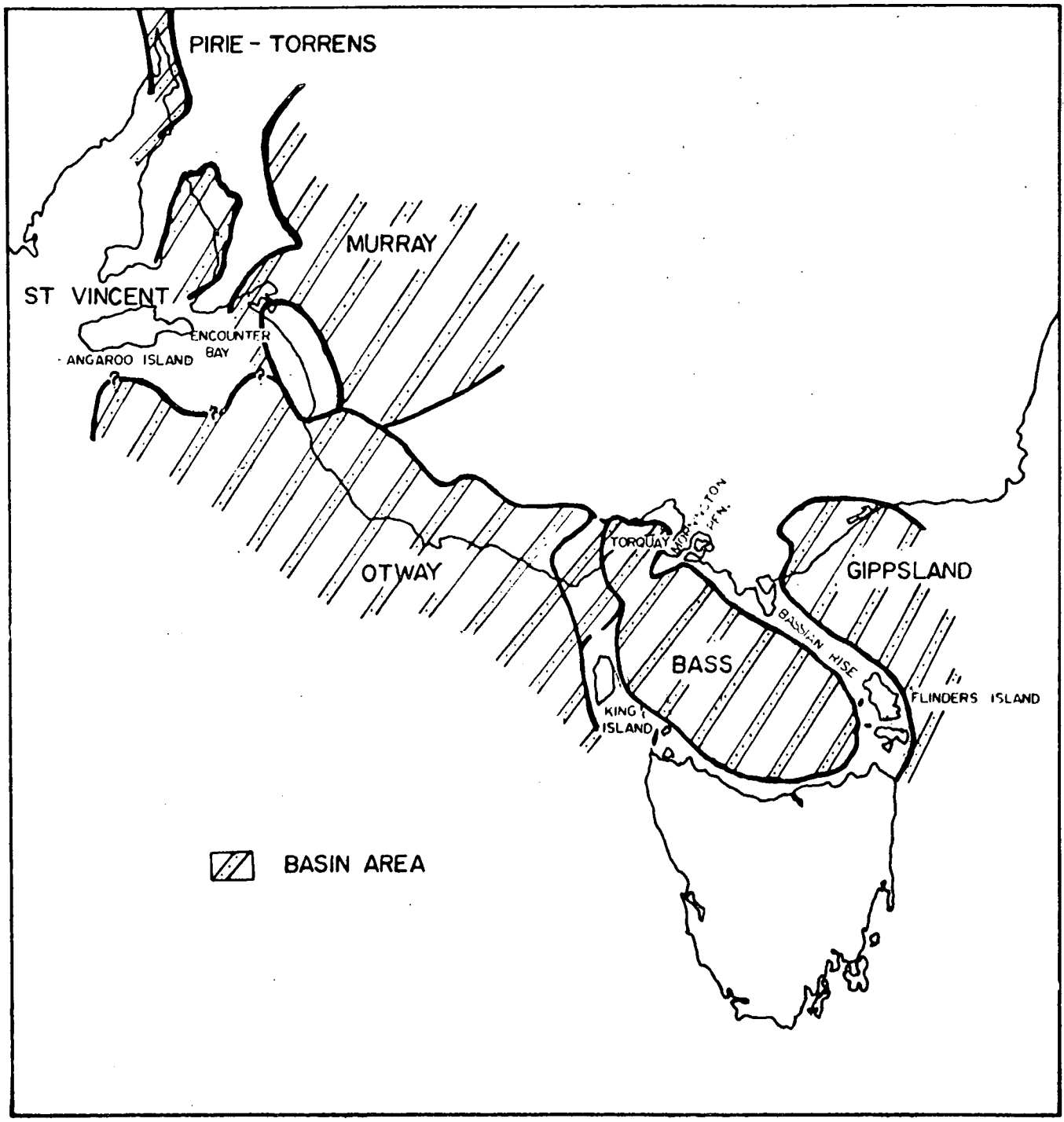
PLATE 1



Record No. 1974/155

PROPOSED TRAVERSES

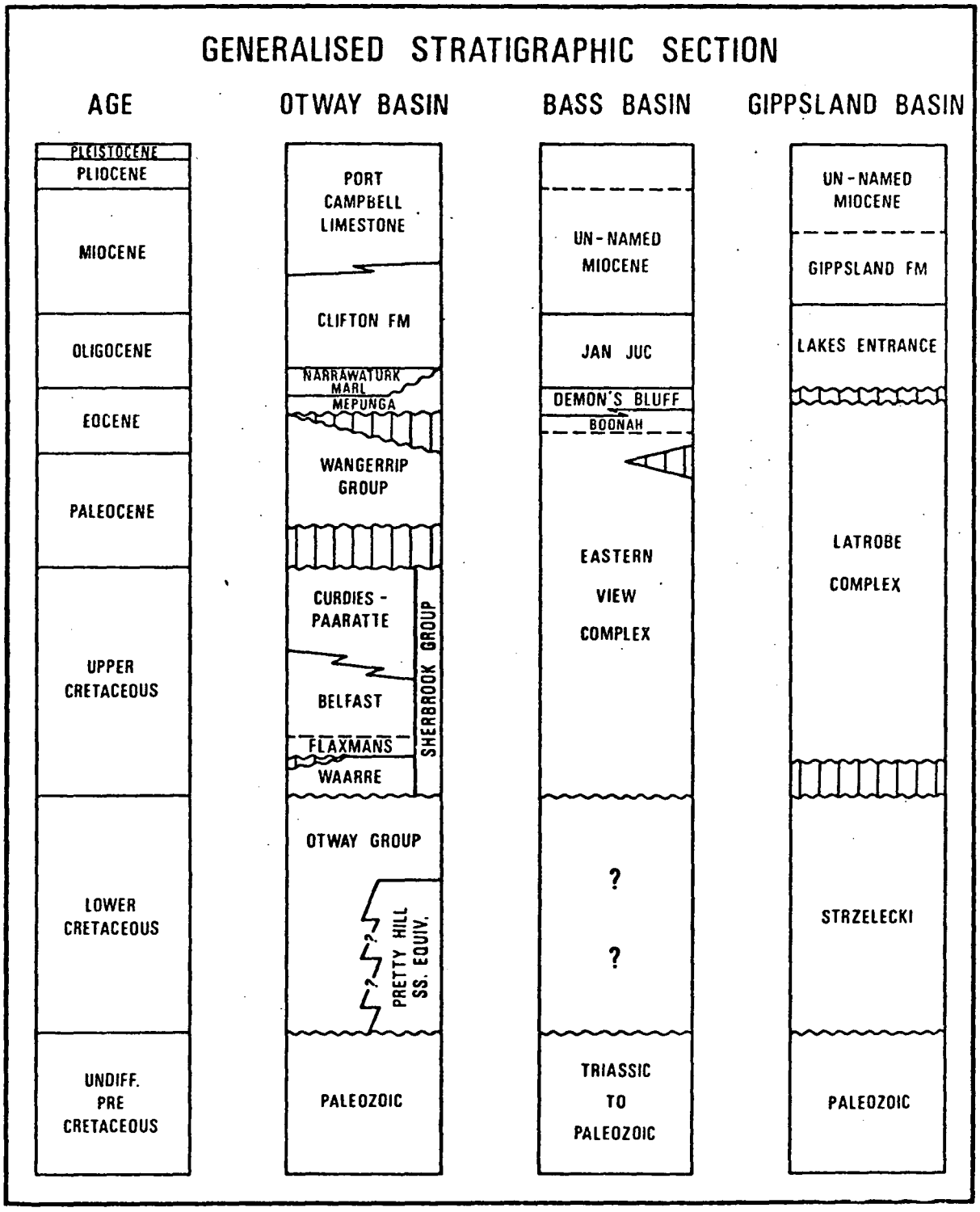
PLATE 2



Record No. 1974/155

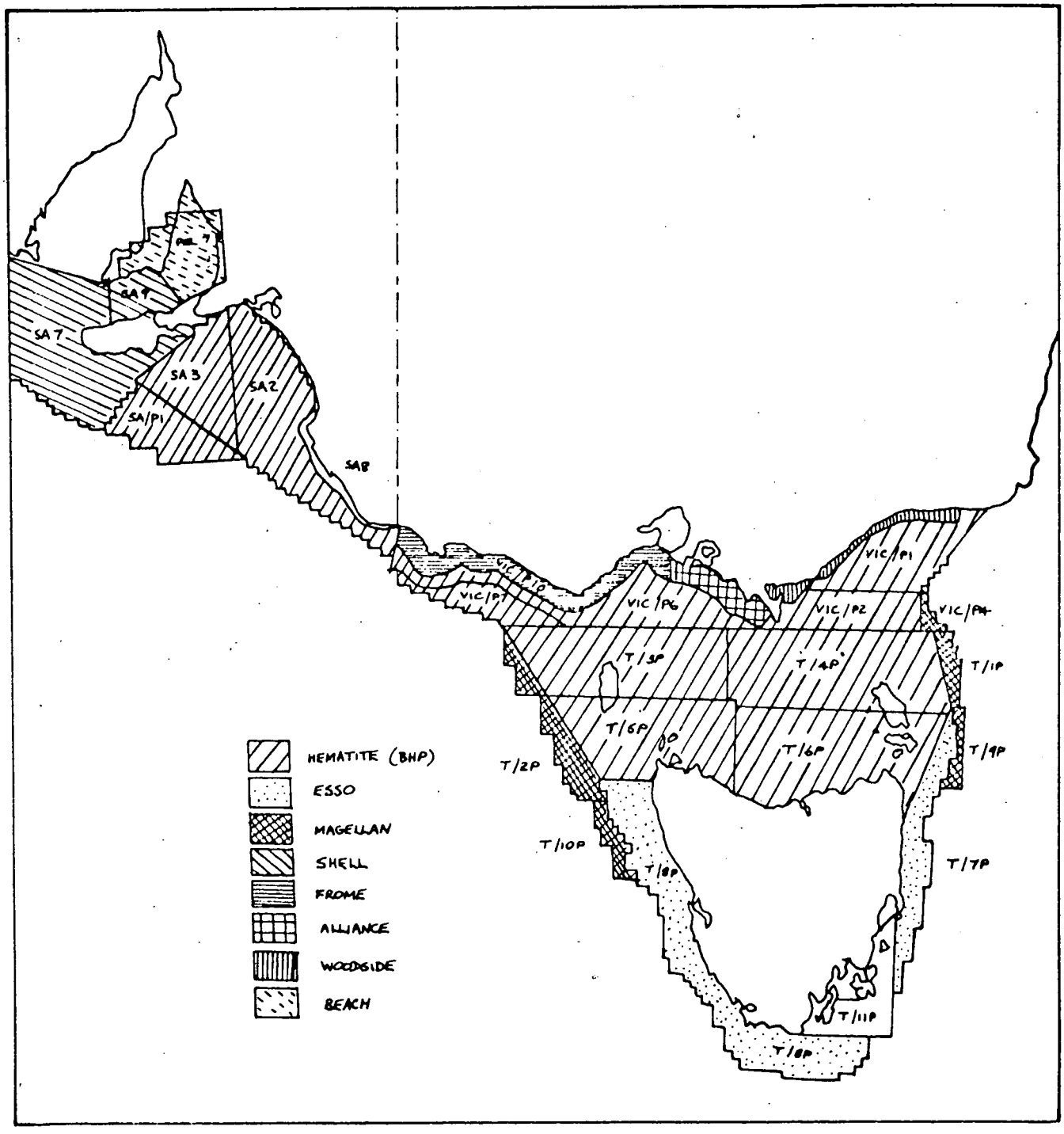
SEDIMENTARY BASINS

PLATE 3



Record No. 1974/155 (After Richards & Hopkins, 1969)

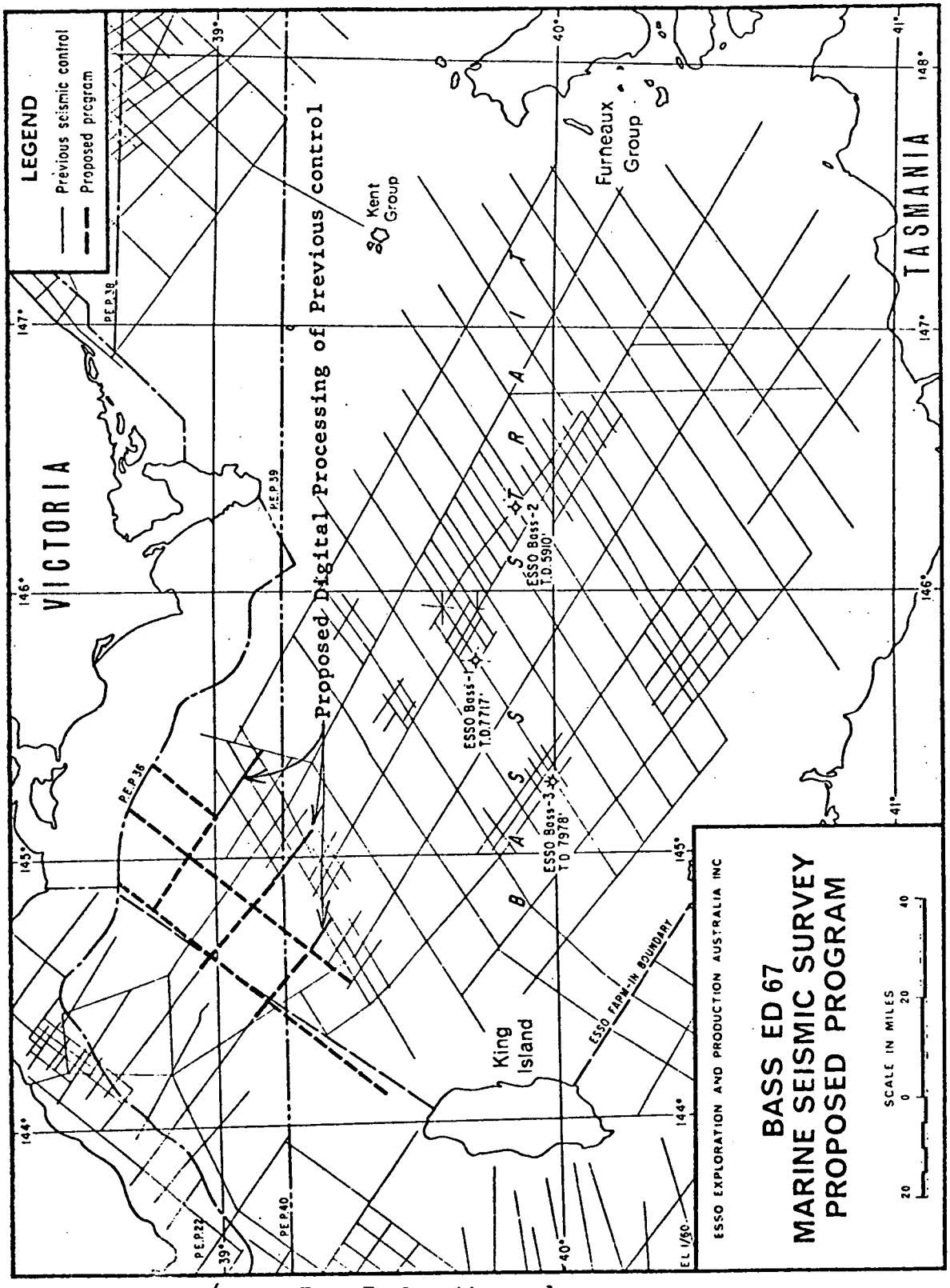
PLATE 4



Record No. 1974/155

PETROLEUM TENEMENTS (1972)

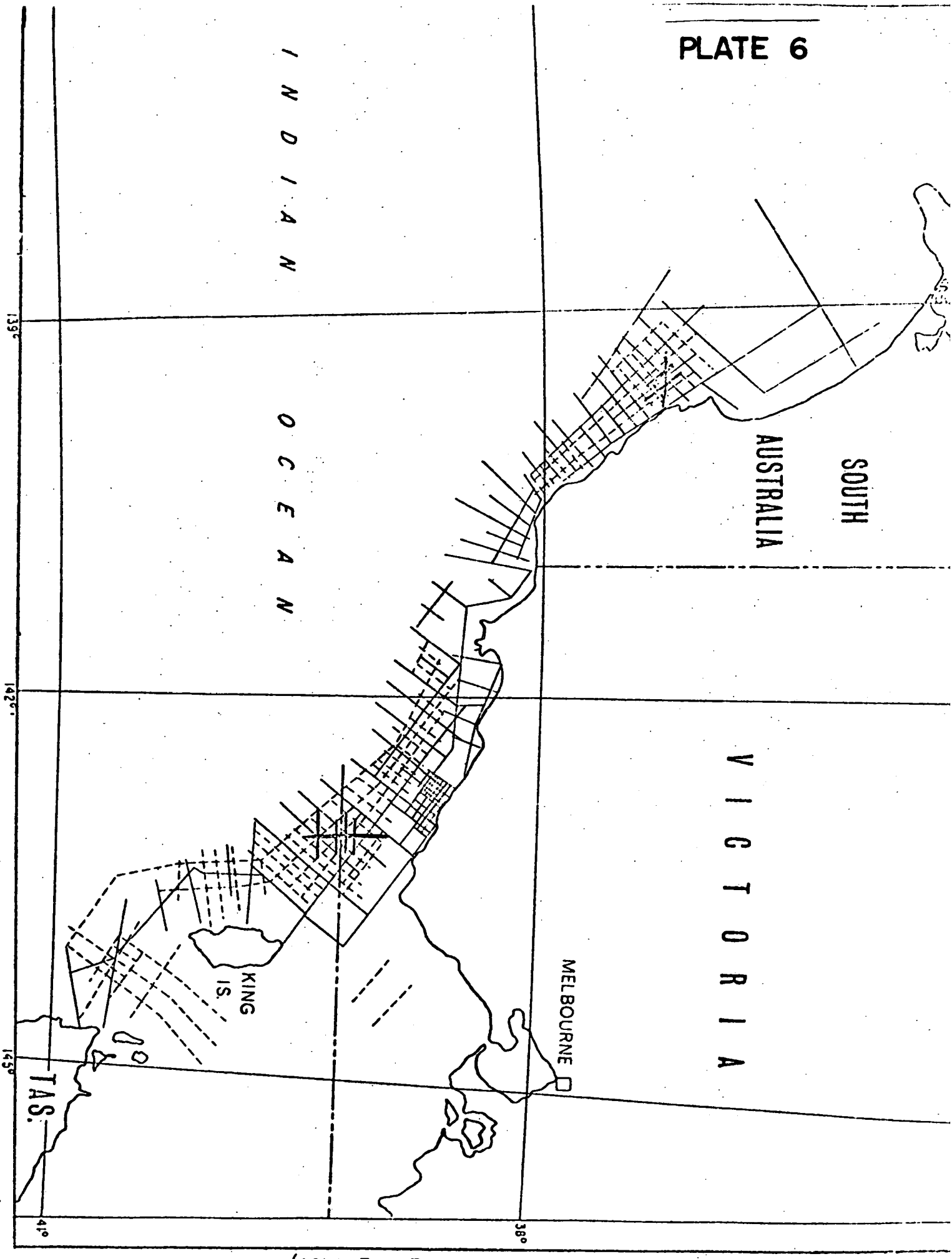
PLATE 5



Record No. 1974/155 (After Esso Exploration and Production Australia, 1967(b))

PREVIOUS SEISMIC TRAVERSES - BASS BASIN

PLATE 6

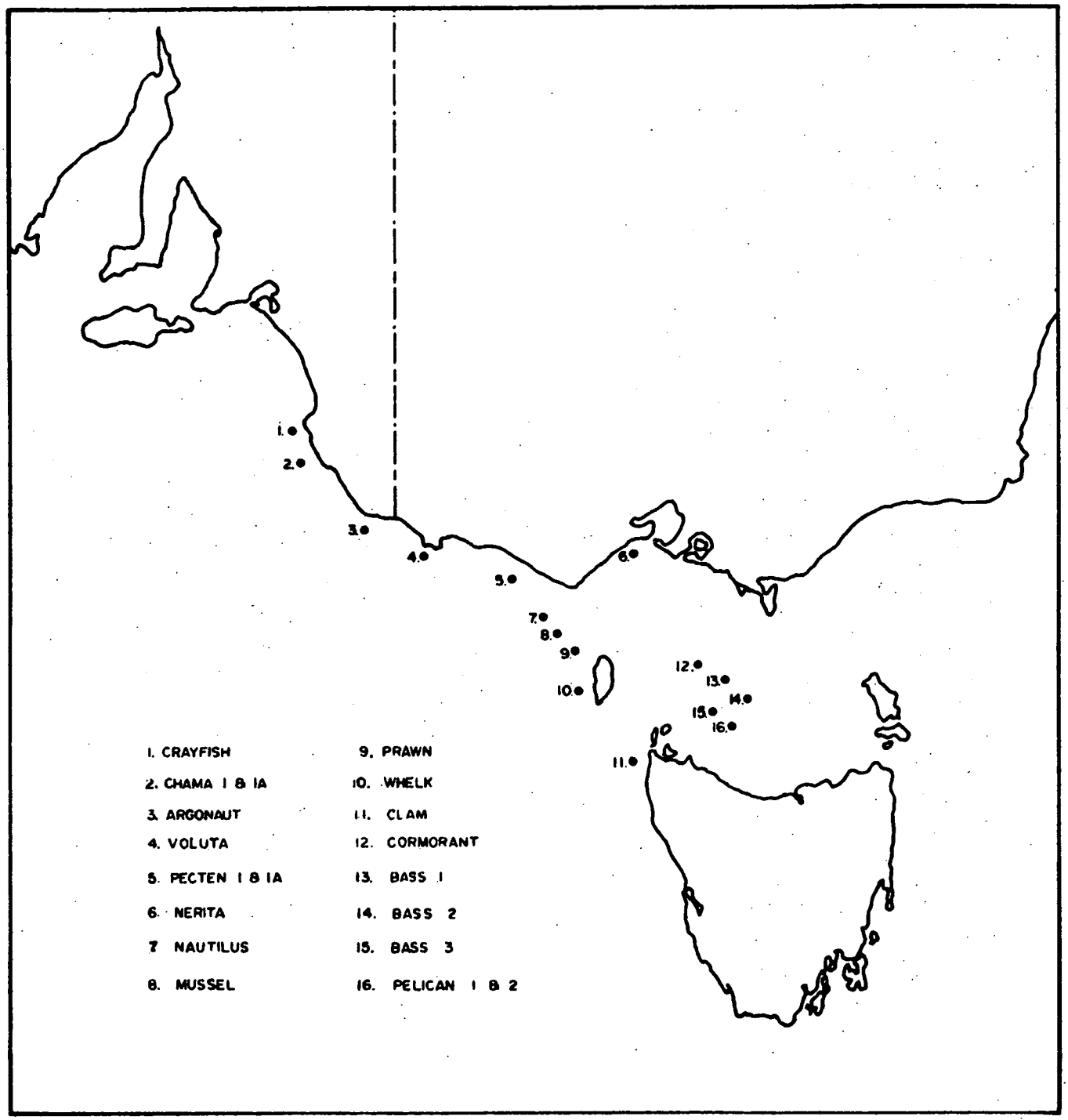


Record No. 1974/155

(After Esso Exploration and Production Australia, 1966 (b))

PREVIOUS SEISMIC TRAVERSES - OTWAY BASIN

PLATE 7



Record No. 1974/155

OFFSHORE EXPLORATORY WELLS