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PROGRESS EVALUATION OF BASS BASIN

May, 1967

AMG REFERENCE POINTS ADDED

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PROGRESS EVALUATION OF BASS BASIN

This report is planned to review the progressive results of exploration in the Bass Basin. Haemex commenced work in the Basin in 1960 and the following programme has been carried out by Haemex, and later Esso, in the following years -

Airborne Magnetometer Survey	completed	December, 1961
Marine Seismic Survey	"	May, 1963.
Geological Basin Survey L.C. Reed	"	October, 1964.
Esso Haemex Agreement	"	February, 1965.
Bass Basin Seismic Survey	"	May, 1965.
Bass No.1 Well	"	September, 1965.
East King Island Seismic Survey	"	October, 1965.
Bass No.2 Well	"	May, 1966.
East Bass Strait Seismic Survey	"	October, 1966.
Bass No.3 Well	"	April, 1967.

The "Exploration Programme" set out under Section 1 of the Bass Basin Agreement calls for renewal of the agreement after completion of three exploratory wells and the following report sets out a review of the results of the programme. In this manner it may serve as a guide to assess the programmes which Esso will propose as operative for the period of an extension.

I. PREVIOUS STUDY

Lyman C. Reed was retained as consultant for a complete basin study of our prospective basins. The Bass Basin work was carried out in association with A.S. Maureira, United Geophysical Corporation, from March to October, 1964.

The report subdivided the sedimentary sequence in the Basin into four units, attempted to assess the lithology and environment of each unit, although no stratigraphic evidence was available, and to state the main targets for exploration.

Some of the theses put forward have been proved incorrect by the results of drilling, but the basic geological history of the basin remains as postulated. Comments will be made on the types of exploration targets assessed by Lyman Reed in the light of the drilling results. Most comments and chapters in this text will be necessarily brief, as it is planned that Reed will review the results in detail during the next visit. However, the timing of this report will assist in our evaluation of the Esso programme.

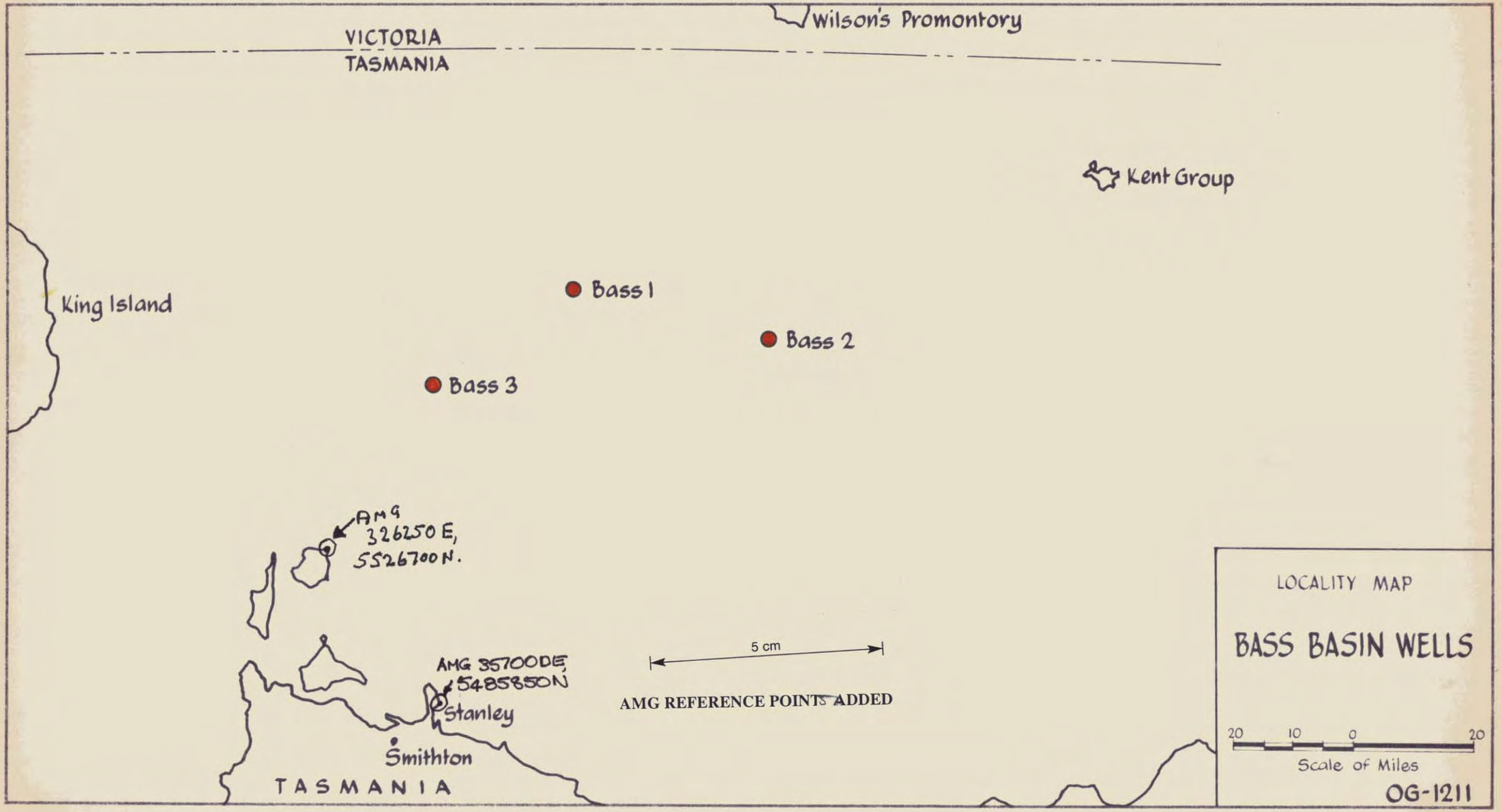
II. DRILLING PROGRAMME

Three exploration wells have been completed to date and in each case they were located on features outlined by the original Haemex survey and commented on by Lyman Reed.

Bass No.1 Well was planned to test the "limestone reefal buildup" in the young Tertiary Section. There was no structure present at this location and, after proving the existence of volcanic tuffite, the well drilled to 7717 ft. before being abandoned. The well provided useful stratigraphic information.

Bass No.2 Well was located on the closed structure, 40 square miles in area, with 250 ft. of closure at the Eocene Unconformity. Based on sixfold seismic survey in addition to our original lines, the structure was considered to have had growth during deposition. The well drilled through to basement but did not show any trace of hydrocarbons.

Bass No.3 Well was also located on the closed structure, faulted along the South West side, and having an aerial extent of 22 square miles. Vertical closure was estimated at 300 ft. at the Eocene Unconformity. The well drilled to basement and followed the prognosis except at the level of the basement reflector. The well was abandoned as non-productive, but did produce hydrocarbons from a formation test. Full details of the test are not available at this date.


VICTORIA
TASMANIA
Wilson's Promontory
Kent Group
King Island
Bass 1
Bass 2
Bass 3
AMG 326250 E, 5526700 N.
AMG 357000E, 5485850N
Stanley
Smithton
TASMANIA
5 cm
AMG REFERENCE POINTS ADDED
LOCALITY MAP
BASS BASIN WELLS
20 10 0 20
Scale of Miles
OG-1211

III. STRATIGRAPHY

During the initial review of the basin by L.C. Reed there was no basis for detailed discussion of the lithology of the units mapped by the seismic method. It is proposed to review the stratigraphic column of the basin as shown by exploration drilling, comparing facies changes where appropriate.

(a) Pliocene to Recent

There is no evidence of sediments of this age from the drilling results bearing in mind that cuttings are not studied above 700 feet subsea.

(b) Miocene

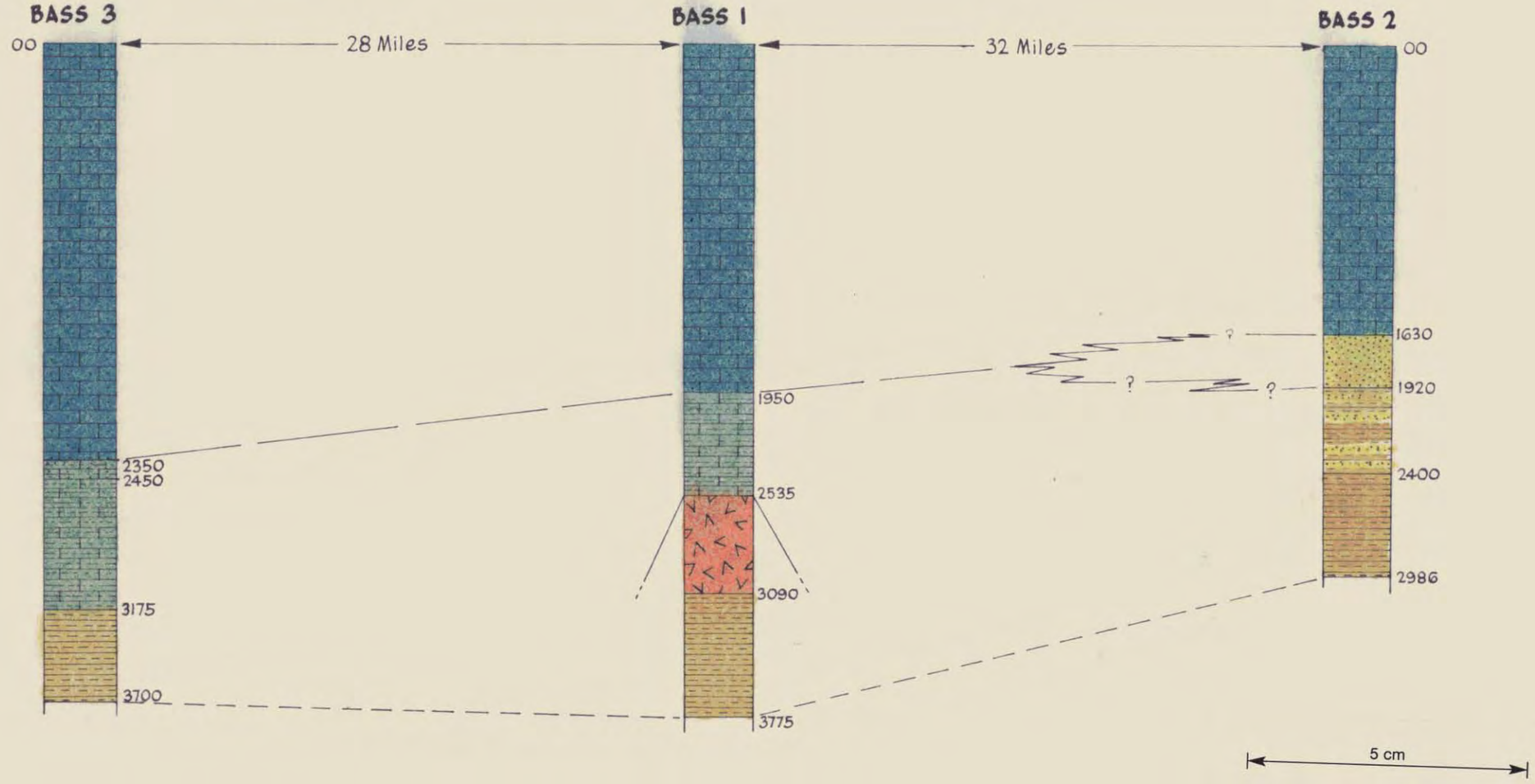
Calcareous marine sediments grading downward from calcarenite through marl and calcareous mudstone to mudstone facies. The calcarenite is tan, buff or light grey, in places sandy and with some porosity. Skeletal debris is common and the sediments are rich in foraminifera allowing subdivision into zonules by D.J. Taylor. Marl and mudstone are dense, soft, light grey to green, glauconitic, pyritic and sometimes carries carbonaceous materials.

Thickness

Bass No.1 Well	3775 ft.	includes 555 ft. volcanics.
Bass No.2 Well	2988 ft.	
Bass No.3 Well	3700 ft.	

MIOCENE FACIES

FIG. 1



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Bass 1 and 3 wells being located on either side of the depo-axis of the basin, but reasonably close to the axis, do not contain clastics at this level. Bass 2 is located on a fault block adjacent to the northeast flank of the basin. This basement ridge, composed of granite and meta sediments (Silurian) sourced material to be introduced into the shallow stable marine environment. The calcarenite grades down into buff-tan sand, glauconitic and clay-bonded, (derived from felspar), fine to medium grained with some granular material and loose fossil fragments. The age of these sands is Middle Miocene and they occur from 1,630-1,920 feet.

Volcanics

Bass 1 well was located on a seismic anomaly interpretted as reefal limestone at approximately 2,500 feet, the interpretation being based on velocity contrasts of the sediments, shape of the anomaly and the lack of magnetic expression. The well intersected 555 ft. of volcanic debris, best described as an agglomeration of basalt, weathered glassy material and some "bombs" probably indicative of a submarine cone deposit.

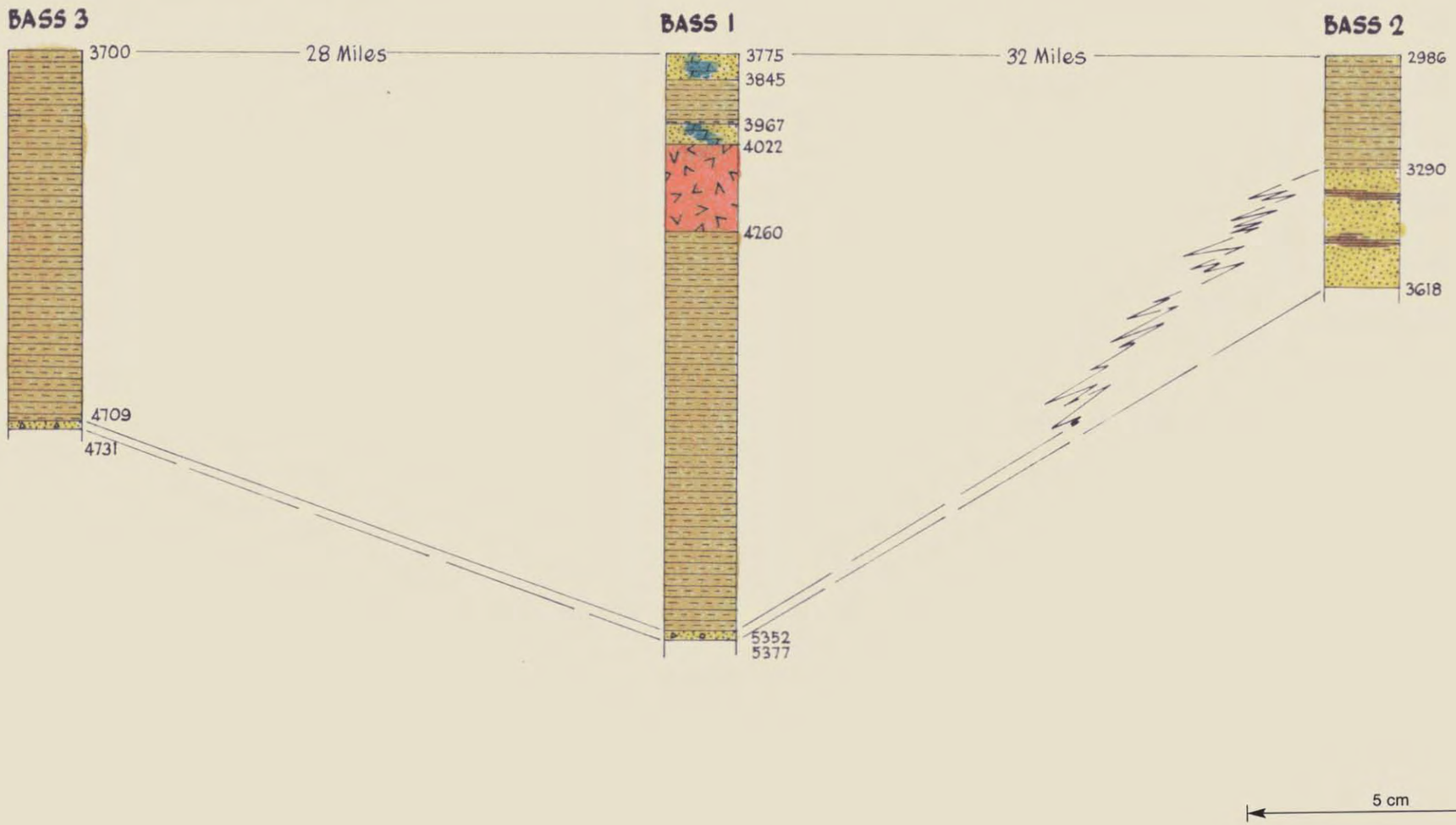
Facies variation within the Miocene is shown on Figure 1.

(c) Oligocene

Argillaceous facies dominated deposition in the Oligocene. Mudstones are bluish grey, soft with shell fragments. Bands of siltstone and dolomite are common throughout. Volcanics are present near the top of the section in Bass 1, 4,022-4,260 feet

OLIGOCENE FACIES

FIG. 2



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and the section is also unusual in the presence of dolomitic sandstone overlying volcanics 3967-4022 ft.

A correlatable basal tuffaceous sandstone 30 feet thick is mapped in Bass 1 and 3, but flankward, development of basal sands totals 328 feet including a few siltstone bands. The sandstone is buff, white to light grey with all gradations of grain size and in parts loosely consolidated. Interbeds of dolomite are common.

Thickness

Bass No.1 Well	1364 feet.	4% sand
Bass No.2 Well	632 feet.	50% sand
Bass No.3 Well	1031 feet.	3% sand

Facies variation within the Oligocene is shown on Figure 2.

(d) Middle-Upper Eocene

General lithology of the Upper Eocene unit in Bass Basin allows correlation to the Demons Bluff formation at Anglesea in the Otway Basin. This is in turn underlain by sandstone-shale facies, (the first appearance down section over the central part of the basin), which may be further subdivided by differing sandstone facies highlighting a hiatus in deposition. This hiatus may be mapped seismically being more apparent on basin flanks and will be referred to as a "Middle Eocene Unconformity". It is proposed that the term Demons Bluff, be used for the post unconformity section comprising the two formations.

Facies variation within the formation is shown on Figure 3.

Type lithology of the Demons Bluff formation is a brown-grey pyritic siltstone, dolomitic in part and containing lense-like sandy bands a few millimeters in thickness. Dolomite and limestone horizons are found in Bass-3. Type lithology is found in each of the three wells. There is an abrupt change at the base of the siltstone unit to massive sandstone, in places loose with gradations in grain size. The variation in this lower sand-shale section highlights differing environments prior to the marine influence becoming wide-spread over the basin.

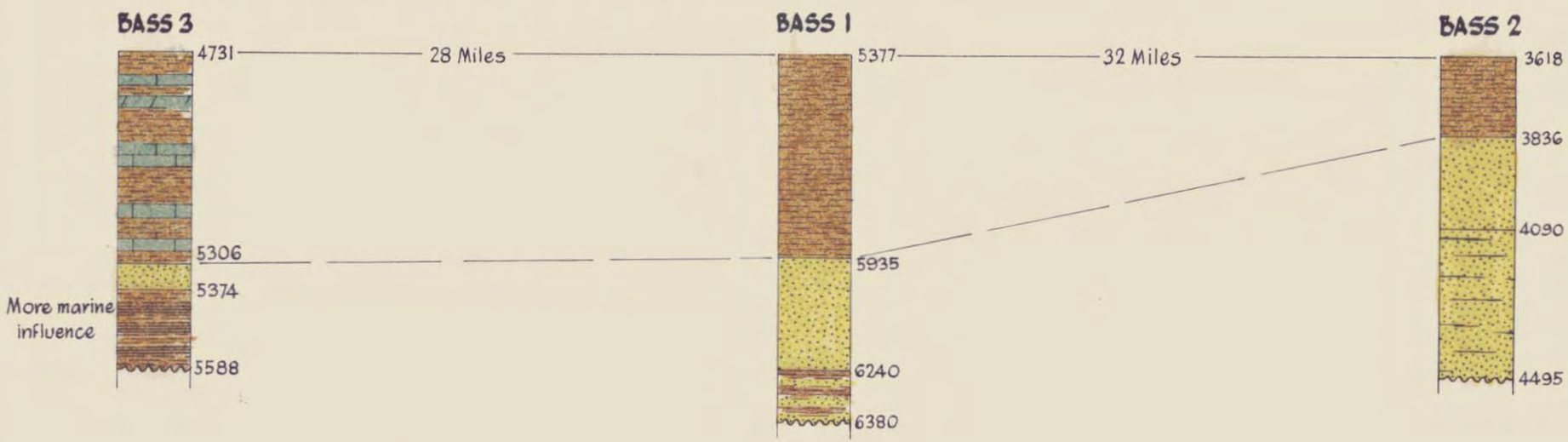
Bass-3 Light brown to green, glauconitic, silty, fairly well sorted; dolomitic, pyritic, sand-filled burrows, interbedded with shale.

Bass-1 Light grey to brown grey, fine to medium and then interbeds of brown shale and siltstone. Partly kaolinitic and conglomeratic, good porosity, fairly well sorted.

Bass-2 Grey-buff-white, fine to coarse, often loosely consolidated. Dolomitic cement, irregular angular to well rounded, pyritic. Coal becomes abundant.

MIDDLE - UPPER EOCENE (DEMONS BLUFF) FACIES

FIG. 3



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Thickness

	Total	Demons Bluff Type	Sand-Shale Facies
Bass-1	1003 ft.	558 ft.	445 ft.
Bass-2	877 ft.	218 ft.	659 ft.
Bass-3	857 ft.	575 ft.	282 ft.

Sand-Shale Ratio

Bass-1	Bass-2	Bass-3
3.4	18.8 (5.5)	0.5

Note: Figure in brackets includes coal and shale combined, Bass-2 being the only section to contain coal at this level.

(e) Pre-Unconformity (Eocene-Paleocene)

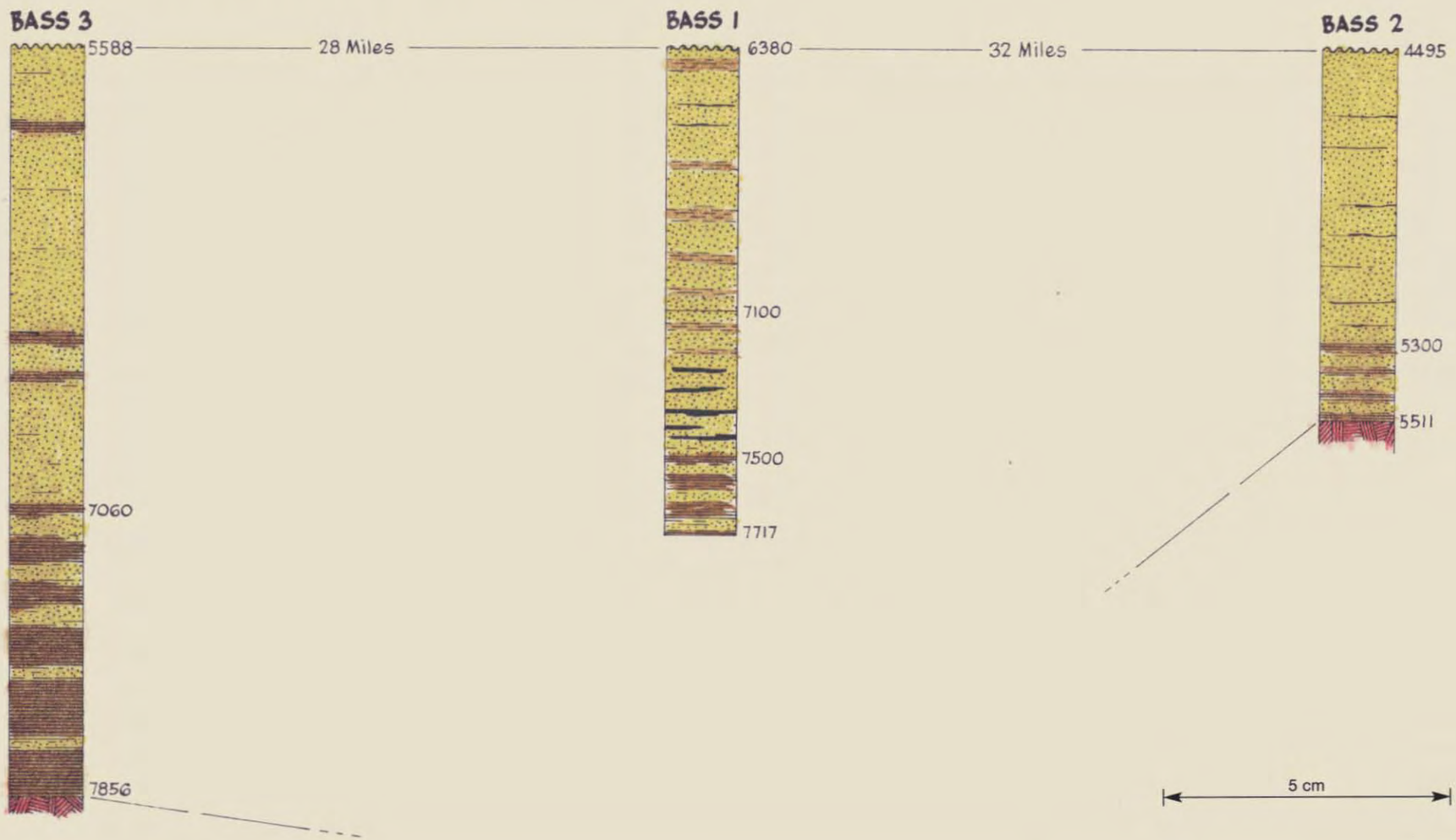
Similar lithology continues beneath the unconformity. There is contrast in the type of sand facies above and below the unconformity in Bass-3, but this is not always apparent. Bass-1 well did not go through to basement as it was located in the basin deep whereas Bass-3 was on a structural high but in the same position relative to the axis of deposition of the basin. There is a facies change in Bass-3 at 7060 feet, (water salinities, sand-shale ratio, type of clastic lithology, including dense mudstone shale and possibly tuffaceous sediments), and this is not found in Bass-1.

Bass-2 found a fore-shortened but complete Paleocene to Eocene section overlying basement but without significant facies change in the section. It is postulated that Paleocene will also be found in Bass-3 at 7060 feet as outlined above.

Facies variation within the formations is shown on Figure 4.

PRE - UNCONFORMITY FACIES

FIG. 4



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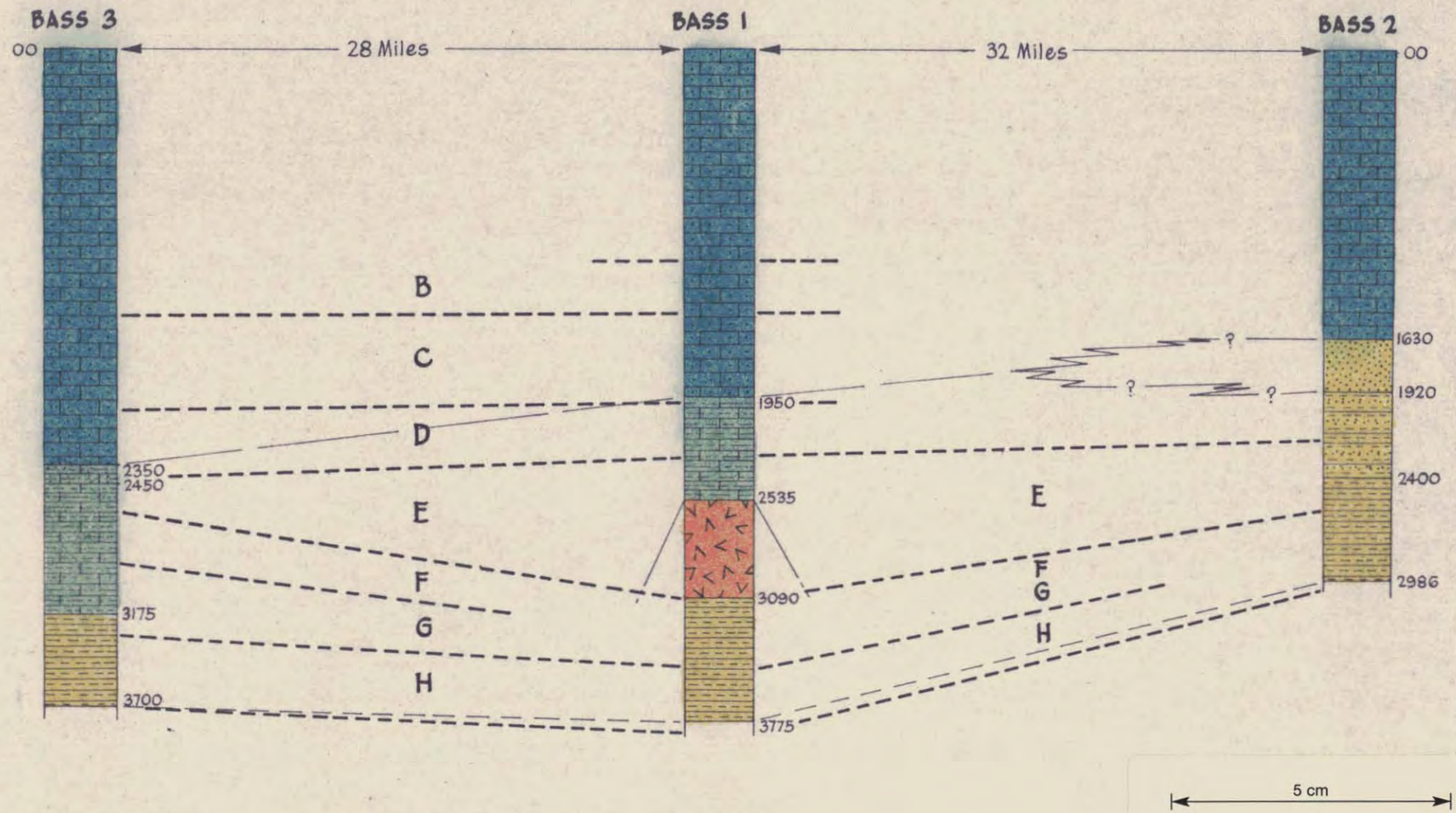
MIOCENE FACIES ~ PALAEONTOLOGY

FIG.5



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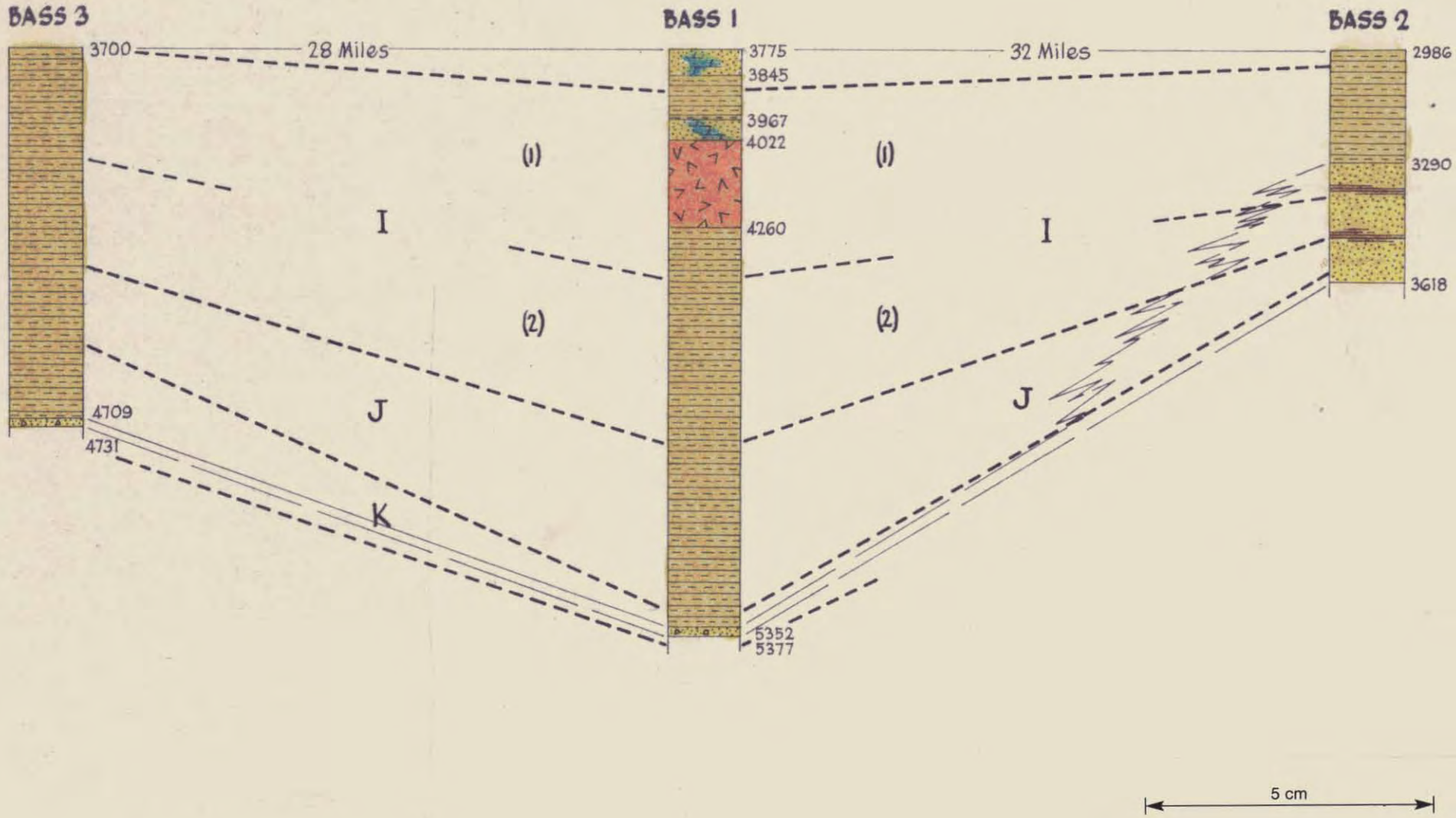
OLIGOCENE FACIES ~ PALAEONTOLOGY

FIG. 6



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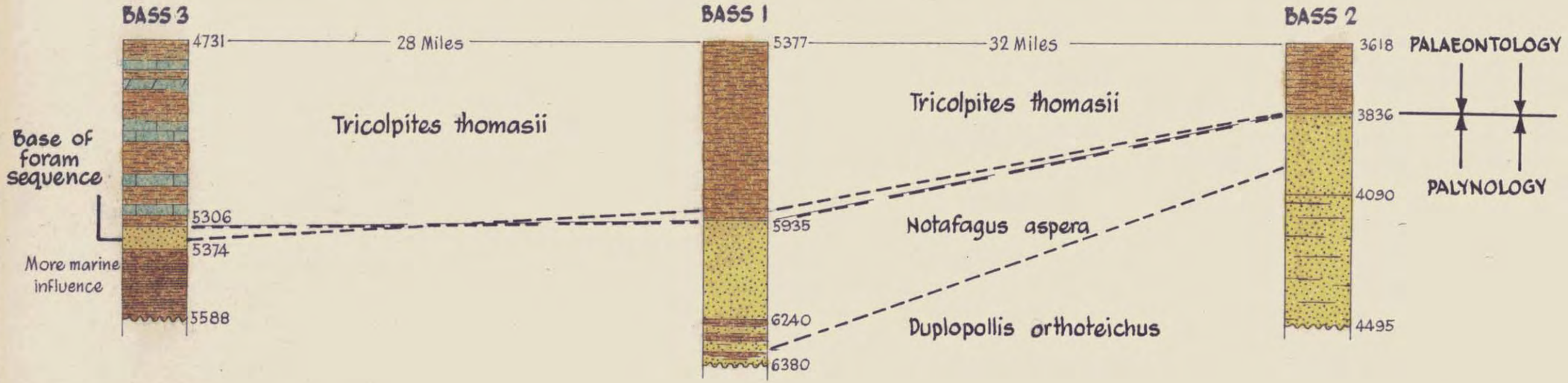
MIDDLE - UPPER EOCENE (DEMONS BLUFF) FACIES ~ PALAEONTOLOGY & PALYNOLOGY

FIG. 7



5 cm

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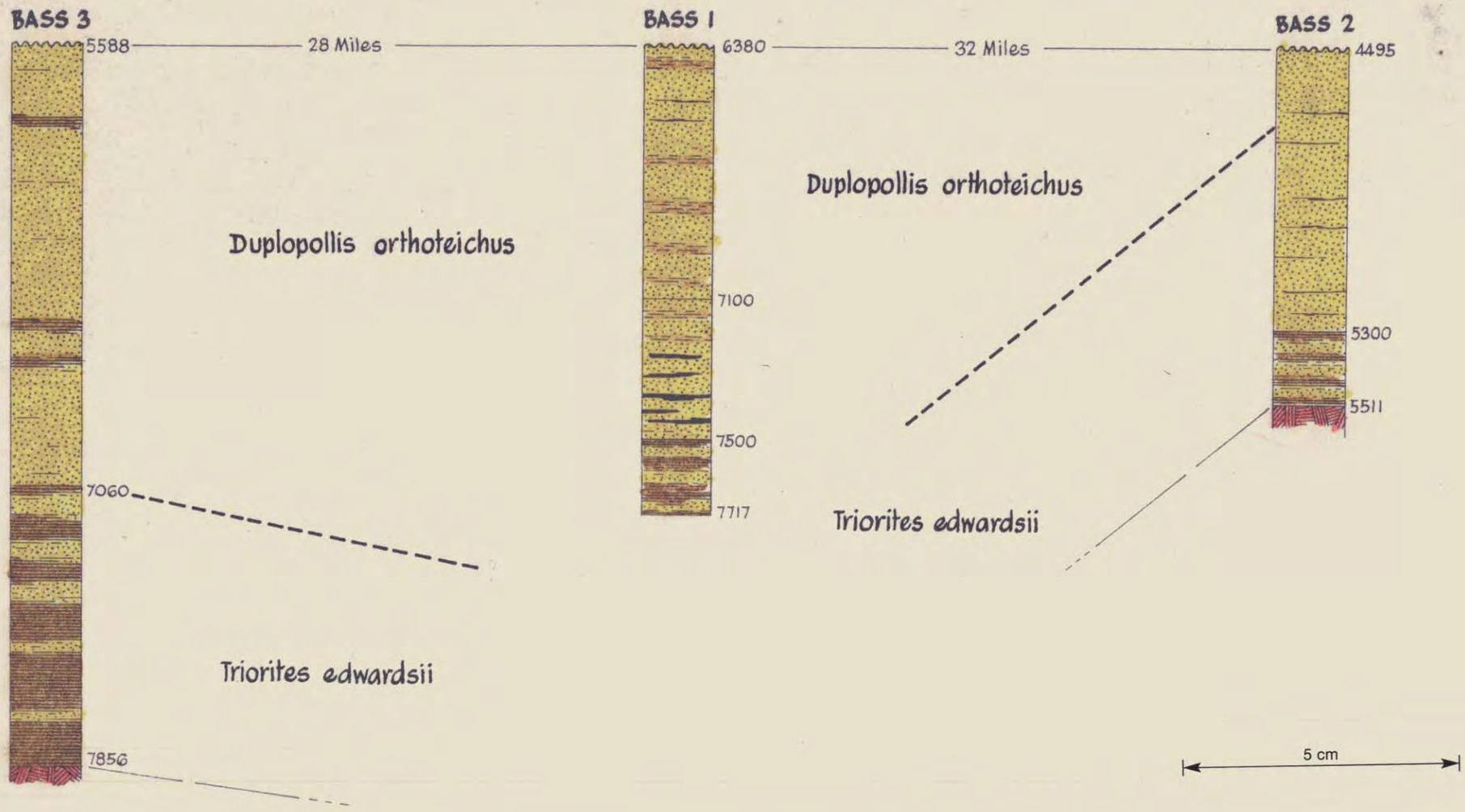
PRE - UNCONFORMITY FACIES ~ PALYNOLOGY

FIG. 8



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FORAMINIFERAL ZONE ~ BASS BASIN

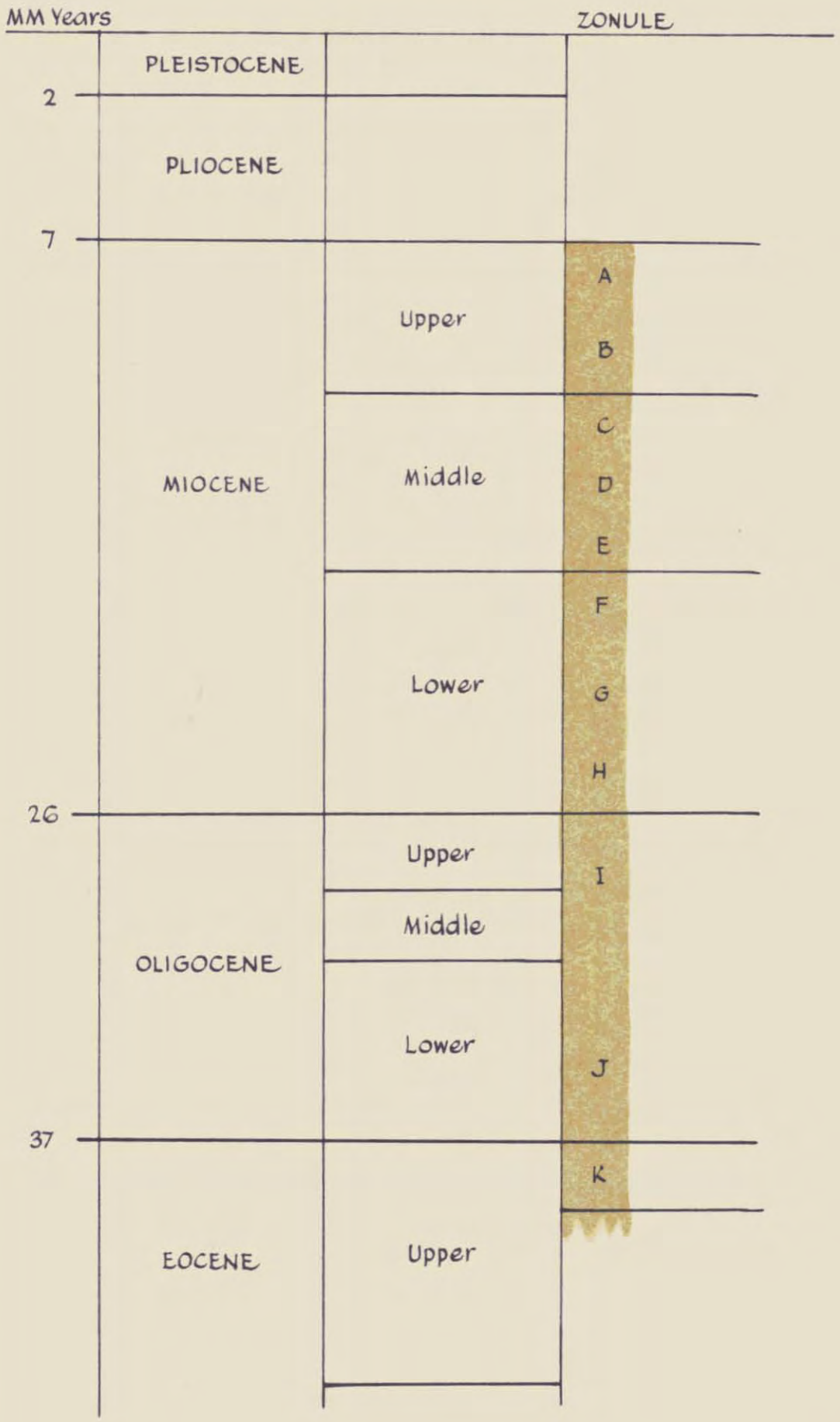

FIG. 9

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Thickness

	Total	Eocene	Paleocene
Bass-1	1337+ ft.	1337+ ft.	-
Bass-2	1016 ft.	220 ft.	796 ft.(?)
Bass-3	2268 ft.	1472 ft.(?)	796 ft.(?)

Sand-Shale Ratio

	Eocene	Paleocene
Bass-1	1.9 (1.5)	-
Bass-2	4.5 (2.0)	11.7 (6.9)
Bass-3	1.0	0.7

Note: Figures in brackets include coal and shale and attention is drawn to the complete absence of coal in the section at Bass-3.

(f) Basement

Differing basement types have been found in Bass-2 and 3 wells and the only significant comments have been drawn from petrological study.

The basal unconformity was cored in Bass-2 and showed a weathered soft greenish-grey spotted and veined rock with flow structure dipping at 20°. In thin section the rock is composed of finely crystalline clay minerals with relic textures of a glassy groundmass and large broken and euhedral phenocrysts. Fresh samples were not cored and lithology had changed to a bedded grey-green sediment in the bottomhole core. This was identified as a bedded tuff composed of devitrified glass, chlorite

and felspar with contacts to silty mudstone. A total of 399 feet of basement rock was drilled. There is no basis for correlation of the rock type with the surrounding area. The depth to basement tied closely to the seismic record. A tentative age dating as Mesozoic has been given by comparison with the Tasmanian dolerite activity.

Basement has been interpretted at 7856 feet in Bass-3 from drilling time and electric log character. The upper section, with slower seismic velocity than the overlying sediments is a black, vitreous dense rock, vughy and with flow(?) structure. The bottomhole core is dense chert of microcrystalline silica with magnesite-siderite recrystallisation. The rock is very dense, fractured with carbonate veining. The Department of Mines, Tasmania, have cut preliminary sections and prefer to group both rock types as cherts. In either case comparable rocks such as chert, dolomite and spilitic lavas are found in the Cambrian in northwest Tasmania.

IV. PALAEONTOLOGY (Based on D.J. Taylor's reports).

D.J. Taylor has proposed a zonule classification in the Bass Basin wells. From the Lower Eocene to the Upper Miocene some 12 zonules have been defined. (Fig. 9). Recognition of the individual zonules is best in Esso Bass 1 and Esso Bass 3, particularly in the Eocene and Oligocene.

The classification is based on the distribution of foraminifera, and in general diagnostic species can be recognized in each zonule. Apart from the age dating provided by the foraminifera, the relative amounts of benthonic and planktonic species have been used as a guide to the environment.

In Bass 3 the first indication of marine conditions is in the lower part of the Upper Eocene. Non marine conditions are, however, observed in equivalent levels in Bass 1 and 2. This seems to indicate a marine embayment in the area of Bass 3 extending into a non marine environment during the earliest Upper Eocene. During Upper Eocene time "barred basin" conditions are invoked but periodic breaching of the barrier must have occurred because both planktonic and benthonic faunas are observed in Esso Bass 3.

Benthonic fauna is abundant during Oligocene time indicating that shallow water prevailed. Planktonic fauna is also observed in the Oligocene. Considerably more planktonic fauna is observed in Bass 3 than in the other two wells. Therefore it appears that the above mentioned barrier was still effective but occasional marine incursions occurred. The marine effect was greater in the area of Bass 3.

Shallow water open shelf sedimentation is indicated in all three wells during Lower Miocene times. During the Upper Miocene considerable shallowing of the seas is postulated, as foraminifera are almost absent and the only fossils present are bryozoa. The bryozoa are highly fragmented and this could be a result of heavy wave action.

In summary, there appears to have been a barrier in the western side of the basin, and during marine incursions the water movement was from west to east. Incursions were common during Upper Eocene and Oligocene times. The abundance of planktonic fauna in Bass 3 and the sparseness in Bass 1 and Bass 2 indicates that the overflows extended over the basin but not with such great strength on the north-east side.

V. PALYNOLOGY

The combined efforts of Dr. M. Dettmann and E.P.R. Co. Group have provided successful zonation of the Eocene-Paleocene-Upper Cretaceous sand/shale sequence in the Gippsland Basin. This is not complete as the Duplopollis orthoteichus zone needs further subdivision in the first instance and some effort will also be made to break down the Triortis edwardsii zone. (Fig. 10).

Additional cores are being reviewed at the present time and to date we have not received any data from Bass 3. The following subdivision in Bass Basin is therefore preliminary.

There is good agreement between the Tricolpites thomasii assemblage in the Upper Eocene with the Demons Bluff lithology and foraminifera sequence. The Notafagus aspera assemblage does not have diagnostic species in Bass 1 but is interpretted from 5935 to 6314 ft. Pending further work the D. orthoteichus zone is taken from the base of N. aspera at 6314 ft. and this continues to total depth (7717 ft.). This zone includes the unconformity but further subdivision will be needed to better place this event in the time scale.

In Bass 2, T. thomasii is again found equivalent to the Demons Bluff formation from 3618 to 3838 ft. N. aspera was reported in a side-wall core at 3932 ft., but from this point down to the top, or last occurrence, of T. edwardsii at 4715 ft., has not been further subdivided. The N. aspera zone is therefore taken from 3838 ft. down to 3932 ft. and the interval 3932 to 4715 ft. is the D. orthoteichus zone. This includes the unconformity as is found in Bass 1 well and it is hoped

that further subdivision will be possible. The T. edwardsii zone extends from 4715 down to the base of the section at 5511 ft. and this interval was not found in Bass 1.

No spores or pollen were recovered from the basement rocks.

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PALYNOLOGY ~ BASS BASIN

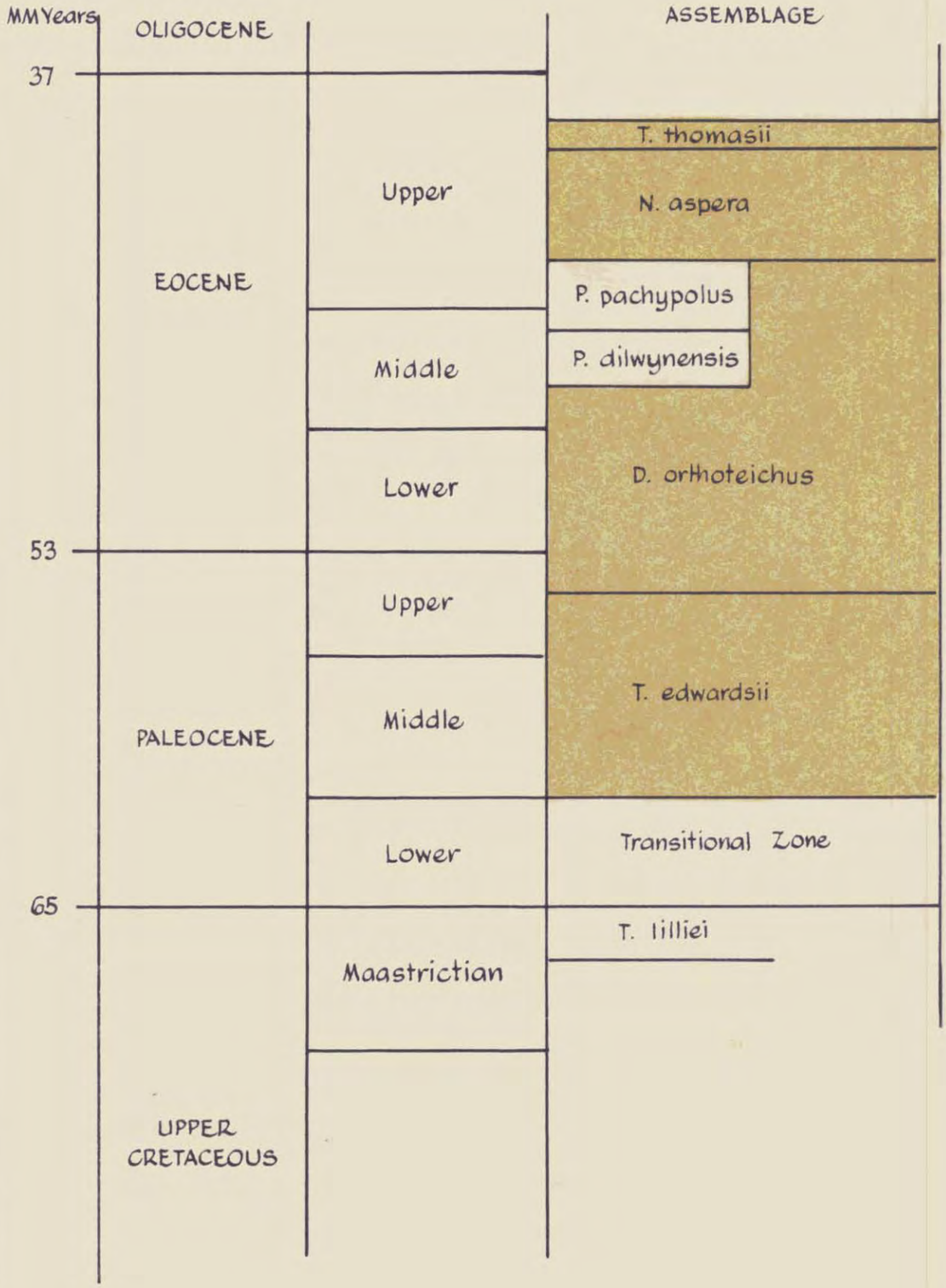

FIG. 10.

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VI. STRUCTURAL FEATURES.

The mileage in the initial seismic survey by Haemex has been doubled by the recent surveys by the operator. Most of the new shooting was sixfold C.D.P. in detailed areas and singlefold cover on basin flanks. Velocity surveys of each of the basin wells have allowed better correlation of the mapped horizons to stratigraphic levels. It is considered that the regional grid over the basin is sufficient to have outlined any major structural feature or target.

The most recent Esso seismic programme covered the whole of the basin and the final compilation for the subsidy report provides the basis for the following discussion.

Seismic mapping is possible on basement around the flanks of the basin, the Middle Eocene Unconformity, top of the Eocene (Demon's Bluff) and the top of the Oligocene. Isopach maps were prepared for the thickness of the Oligocene and the Demon's Bluff units.

The structural map, Middle Eocene Unconformity, is included on the geological base as the mapped horizon to best illustrate the structural features of the basin. (Fig. 12).

Bass 2 and 3 wells were drilled on structural targets with evidence of growth during deposition and seismic mapped closure at all levels. Four leads remain in the whole of the basin and under the circumstances they do not appear to be attractive targets. They are -

(A) A broad but flat closure near the junction of lines B2, B21 and EB9. Faulting is interpretted and the depth to the unconformity is 5250 ft.

(B) Structural lead on line ES40 - seismic turnover is mapped and closure inferred. Additional shooting would be needed. The depth to unconformity is 5750 ft.

(C) A small closure at the intersection of lines B5 and ES66 is fault controlled on the SW side. Depth to unconformity is 5750 ft.

(D) Esso infer that the Eocene unconformity is present over the Mornington to King Island ridge but this is subject to debate, depending on the interpretation. As such they have mapped closures at (ES56 - B22) and the end of line ES81. The depth to the unconformity is 1750 ft.

Closures mapped at A and D extend to the top of the Demons Bluff formation with less structural closure. The flat turnover at B is mapped as a broad nosing at this level with no up-dip closure.

The only evidence of structure at the Oligocene level is at A, but this is close to a centre of volcanic activity (cf. Bass 1).

Basement

The structural map on the basement has not been included in this report as we differ on the interpretation of the SE part of the basin. It is considered that the massive fault complex mapped by Esso with depth of sediments is 11,000 ft. is part of the intra-basement complex. The shape of the Tertiary basin is considered to be more regular with even dip slopes evident in the records.

The structures drilled at Bass 2 and 3 reflect the influence of basement. Each shows thinning of sediments over the basement fault block and may best be interpretted as sedimentary draping as inferred by Lyman Reed. Similar conclusions cannot be applied to the A, B and C areas as basement has not been interpretted due to lack of character or depth of overlying sediments.

The nosing features in the basement on the NW flank of the basin have not provided draping prospects as thought previously. Additional shooting did not indicate closure in the sedimentary section. One fault closure lead exists on the main basement fault on this flank of the basin (Area E). It is interpretative at this stage, and would require additional shooting.

VII. IMPORTANT SEDIMENTARY UNITS

The evaluation of the original basin study has shown that the only valid target is associated with the pinchout of sands developed around the margin of the basin and from porosity-permeability variations within the sands. A significant part of this margin is fault controlled and therefore significant fault traps may be associated with the sand developments.

It is unfortunate that the three wells to date are located approximately in a straight line and therefore provide linear data on sand-shale ratios, rather than an areal spread of values. The cross section of facies for the individual sedimentary units, Figures 1 - 4, show the marked increase in sand thickness on the NE side of the basin. This is also apparent in the upper part of the section where clastics are introduced into an area of carbonate deposition.

Esso have made source rock studies of the sediments and have advised that the dark brown silt stone shale facies of the Demon's Bluff is an excellent oil-prone source rock. Mudstone and shale of the Oligocene is gas-prone and not of comparable quality. It seems prudent to concentrate the search for suitable reservoirs in the pre-unconformity sediments, Demon's Bluff formation and the Oligocene sediments.

Isopach maps of the latter two units, based on the Esso seismic interpretation, are included as Figure 13 (Demons Bluff) and Figure 14 (Oligocene). It is not possible to compile a map for the pre-unconformity level, due to lack of basement data. Both maps tend to support the theory developed from foraminifera study that the open seas existed to the SW and extended into the basin through

the area between King Island and Tasmania. A similar pattern is found in the Otway Basin, where open sea Eocene facies at Apollo Bay relate to the ultimate encroachment into the Anglesea - Port Phillip Bay area.

The discovery of suitable sand reservoirs in the Eocene and Oligocene primarily means a study of the sediment source around the margin of the basin. It is probable that clastic material would be positioned on the flanks of the basin and not occupy a widespread distribution. This would appear to highlight two areas, namely along the NE and SE sides of the basin and on the extreme west and NW side of the basin, as being that part where granitic and quartzitic rocks predominate and therefore supply suitable detritus. The sediments along the north side of the basin (Strezlecki Group) and along the Tasmanian coast (older metamorphic rocks), would be subject to clay break-down and not likely to produce suitable reservoirs. Referring to the pre-unconformity sediments, which were formed soon after initiation of the basin, facies variation should also occur and be related to the above favourable provinces.

VIII. BASIN HISTORY

Drilling to date has confirmed Lyman Reed's prognosis that the formation of the basin commenced in early Tertiary. Prior to this date erosion had generally peneplained the area but with minor irregularities, which can be seen on the seismic record, probably due to differential weathering.

Fault breakdown, along NW to SE trends on the NE and SW sides of the basin took place in Paleocene time. The thickness of Paleocene in Bass 2 and 3, on either side of the depo-axis, is approximately equal, suggesting uniform down-warping at this stage.

Readjustment of the down faulted basin in the form of small block movements, close to the boundary faults, took place in the Eocene with considerable variations in thickness over the basin. Due to the absence of basement reflectors, the thickness variations cannot be mapped with the seismograph. Depositional hiatus took place during the lower to middle Eocene throughout the basin. This is evident on the seismic record and from lithology. The unconformity dating by palynology is by no means finalised, but suggests middle Eocene in the area of Bass 1 and lower Eocene at Bass 2. This may be interpretted as a transgressive time unconformity or that the Bass 2 well is located on a readjusting block which was subject to erosion down to the lower Eocene sediments. The latter view is supported in that truncation is evident on the seismic record on the flanks of the basin.

Post unconformity deposition commenced in the middle Eocene with sand shale facies of non marine origin. Marine influence is apparent at this stage in Bass 3, suggesting access to marine conditions on the SW side of the basin.

The group of sediments middle Eocene to basement has been referred to as a deltaic complex and possibly part of the Latrobe Valley. The shelving out of Latrobe facies on the Flinders Island basement ridge indicates that the southern boundary fault (Foster Fault) was the principle control of deposition areas in Latrobe Valley time. It is preferable to think of the Bass sequence as being clastic fill, perhaps with minor deltaic areas, from many source areas into a slowly subsiding land locked basin. Marine conditions tended to encroach from the west as the basin filled.

"Barred basin" anerobic deposition took place in upper Eocene with the deposition of Demons Bluff formation. Comparable thicknesses are found in Bass 1 and 3 but a marked decrease and thickness in Bass 2 is due to its position on the east flank of the basin (and possible structural movements also) but the Bass 3 well also shows increased evidence of marine incursions and this supports postulation of marine environment west of the Bass Basin.

Transgression commenced in the Oligocene and spread throughout the basin from west to east. D.J. Taylor shows evidence in comparing the environments of the wells. The water depth became shallower in Middle to Upper Miocene with the deposition of calcarenite facies and bryozoal fragments.

Volcanic activity was present throughout basin development. There is evidence in the basement in Bass 2 whereas the Paleocene sections in Bass 3 have the appearance of tuffaceous origin. Tuffaceous sandstone is also present in the basal section of the Oligocene and tuffite, an agglomeration of volcanic glass, etc. were found in the Upper Oligocene and Lower Miocene. The latter are part of the widespread "limestone buildup" mapped with the seismograph and also possibly equates with the shelf

reefs mapped by Lyman Reed. Most of these volcanics are of basic nature and do not have widespread effects in the surrounding sediments. Some additional levels of basic flows can be interpretted from the seismograph, but a more serious problem exists in the presence of tuffaceous material reducing permeability in the sandstone facies. This problem does not appear to exist on the east flank of the basin (Bass 2).

Hydrocarbons

Bass 1 and 2 wells were extremely disappointing in that the only indications of hydrocarbon shows was a background gas reading on the chromotograph with minor peaks, due to coal.

Bass 3 showed a similar range of background values with minor gas peaks at 6400 ft. and 6740 ft. The "show" at 6740 ft. was confirmed on the logs and a formation test in the interval 6739 to 6744 ft. recovered 29 cubic feet of gas and 800 cc's of condensate. This represents the first hydrocarbons recovered from the basin.

Analysis of the Gas Shows

	No.1	No.2
Methane	77.8	80.2
Ethane	8.35	8.65
Propane	5.45	5.08
Iso-butane	1.80	1.21
N-butane	1.52	0.97
Iso-pentane	0.56	0.30
N-pentane	0.38	0.21
CO2	3.71	3.23
Nitrogen	1.85	1.82
Oxygen	0.045	0.045

IX. EVALUATION OF ORIGINAL STUDY

In his geological interpretation of the Bass Basin Lyman C. Reed delineated 22 features capable of trapping oil. They consisted on basin reefs, shelf reefs, drape structures and pinchout zones. At the time of this report in 1964, 1,691 miles of marine seismic had been shot by Haematite. Since that date Esso have shot an additional 1,642 miles of marine seismic and drilled 3 wells in the basin. No commercial oil or gas have been discovered.

Drilling and the additional seismic surveys have led to a different interpretation of the potential. This section will discuss the present interpretation with respect to the initial one by Reed.

Basin Reefs

Thirteen basin reefs were recognised by Reed. It was proposed that these reefs were individual limestone buildups on a limestone bank. This bank, and the reefal buildups, were dated as Oligocene and extended over the north-west side of the basin.

Magnetics, seismic velocities and the shape of the features supported the above interpretation. However, palaeontological evidence indicated that palaeotemperatures in the Bass region during the Tertiary would not have favoured the growth of reefs.

Esso Bass 1, located at shotpoint 61 on line B3, was drilled to test one of the reefs. Drilling showed that the reef was a Lower Miocene volcanic tuffite buildup. A sequence of shale, sandstone and siltstone underlies the tuffite and this did not support the limestone facies interpretation.

The other 12 features identified as basin reefs are most probably of the same nature and no further drilling was considered.

Shelf Reefs

Two shelf reefs are indicated in Reed's report. They are located on the north-east and south-west shelf of the basin. A thickness of about 500 ft. was indicated for each of the reefs. They were dated as being Oligocene.

These reefs were also interpretted on seismic evidence. The present seismic interpretation, in view of the stratigraphic evidence from the three wells, does not favour the presence of shelf reefs. Alternative theories could include tuffite and volcanic material to basement irregularity (differential weathering).

No drilling has actually been located on the shelf reef areas. However, present geological and seismic evidence indicates that they do not exist.

Drape Structures

In his report Reed indicated 5 drape structures. He described them as anticlinal structures developed in areas of basement highs. These features ranged in length from 10-20 miles and had a closure of 150-500 ft. within the Eocene.

Esso's additional seismic confirms the presence of these anticlinal features, but on a much smaller scale than indicated by Reed. Both Esso Bass 2 located at shotpoint 63 on line EK27 and Esso Bass 3 located at shotpoint 141 on line B3 were situated on anticlinal features which were draping over a basement high.

Marine seismic cover of the basin is comprehensive, and the present density of coverage is adequate to reveal any structures of worthwhile size. In potential regions the seismic loops cover areas of approximately 16 square miles. Therefore no further marine seismic shooting to locate structural targets appears necessary.

Pinchout Zones

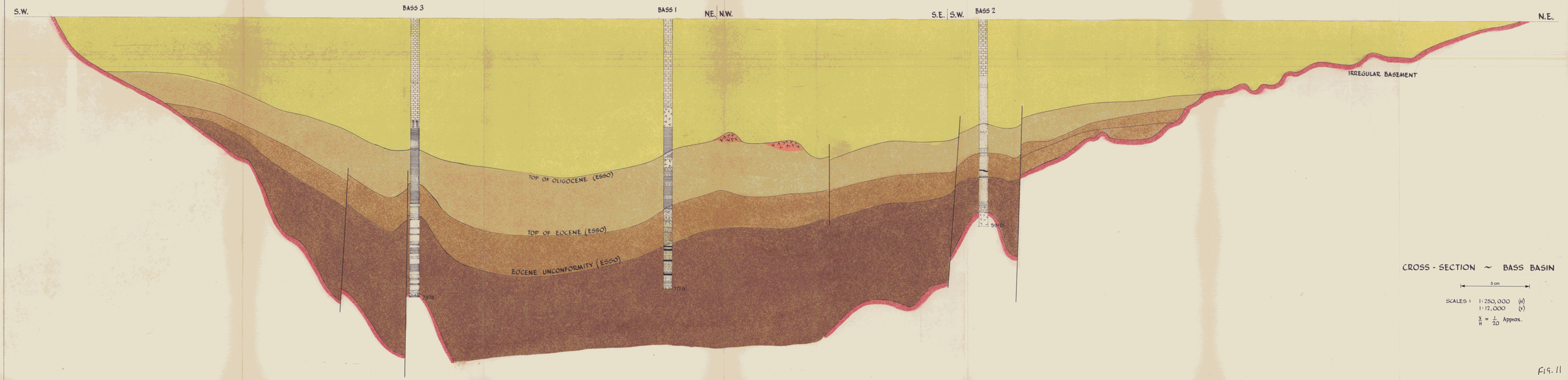
On the north-east and southern flanks of the basin, Reed delineated two areas of pinchout of sediments. Esso's work confirms the presence of these zones. In these two areas some 1500+ ft. of Upper Eocene sediments at the centre of the basin pinchout to zero on the flanks.

The additional seismic by Esso defines 3 more areas of pinchout. The first is on the far east side of the basin. Here a considerable amount of Eocene sediments thin out in an area which is structurally isolated. However, in this area, seismic records, particularly of basement are not good and the present interpretation should be warily treated.

The other two areas are on the western side of the basin, a southward projecting embayment between King Island and Tasmania and a northward trending wedge shaped trough formed by fault geometry in the Anglesea area. Both these pinchouts are smaller than the previous three. The one near Anglesea is defined much better than the King Island - Tasmania embayment.

If suitable porous and impervious beds are developed in any of these pinchouts they could be potential stratigraphic traps for hydrocarbons.

003040



CROSS - SECTION ~ BASS BASIN

5 cm

SCALES : 1:250,000 (H)
1:12,000 (V)

$\frac{V}{H} = \frac{1}{20}$ Approx.

Fig. 11

OG-1214

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Fig. 12

5 cm

BASS BASIN

STRUCTURE · MID-EOCENE UNCONFORM.

CONTOUR INTERVAL 250 ft.
STOCK OR SILL
SEDIMENTARY LIMITS
SCALE · 1 INCH TO 8 MILES

SOURCE · ESSO SUBSIDY REPORT · MARCH 1967

OG-1212

ANGLESEA
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
HOGAN GROUP
CURTIS GROUP
KENT GROUP
NARACOOPA
WHITEMARK
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
ULVERSTONE
DEVONPORT
BELL BAY
LAUNCESTON
BASS 1
BASS 2
BASS 3
A
B
C
D
E
ZERO EDGE OF UPPER EOCENE
ZERO EDGE PALEOCENE – LOWER EOCENE

OR-005

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FIG. 13

5 cm

BASS BASIN

ISOPACH · TOP OLIGOCENE TO TOP EOCENE

CONTOUR INTERVAL 250 ft.
AREAS OF VOLCANIC BUILDUP
SCALE · 1 INCH TO 8 MILES

SOURCE · ESSO SUBSIDY REPORT · MARCH 1967

OG-1213

ANGLESEA

WESTERN PORT

PORT WELSHPOOL

Wilsons Promontory

HOGAN GROUP

CURTIS GROUP

KENT GROUP

NARACOOPA

Bass 1

Bass 2

Bass 3

WHITEMARK

HUNTER ISLAND

THREE HUMMOCK ISLAND

SMITHTON

STANLEY

West Point

WYNYARD

BURNIE

ULVERSTONE

DEVONPORT

BELL BAY

LAUNCESTON

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Fig. 14

5 cm

BASS BASIN

ISOPACH · TOP EOCENE TO MID-EOCENE UNCONFORMITY

CONTOUR INTERVAL 250 ft.
STOCK OR SILL
LIMIT OF EOCENE
SCALE · 1 INCH TO 8 MILES

SOURCE · ESSO SUBSIDY REPORT · MARCH 1967

OG-1214

ANGLESEA
WESTERN PORT
PORT WELSHPOOL
Wilsons Promontory
HOGAN GROUP
CURTIS GROUP
KENT GROUP
NARACOOPA
BASS 1
BASS 2
BASS
WHITEMARK
HUNTER ISLAND
THREE HUMMOCK ISLAND
SMITHTON
STANLEY
West Point
WYNYARD
BURNIE
ULVERSTONE
DEVONPORT
BELL BAY
LAUNCESTON
THICK