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ESSO GIPPSLAND SHELF-1, VICTORIA

WELL COMPLETION REPORT

by

Esso Exploration Australia, Inc.

September 1965

CONTENTS

I. SUMMARY

(a) Drilling: The Esso Gippsland Shelf-1 was spudded on December 27, 1964 in the offshore Gippsland Basin; drilled to a total depth of 8701 feet and completed as a suspended gas well on June 5, 1965.

(b) Geological: The well penetrated a Tertiary section to 5378 feet and encountered an Upper Cretaceous section from 5378 feet to 8701 feet, total depth.

353 feet of gross gas column was logged in the top part of the Eocene Latrobe Valley Coal Measures which proved to be productive by subsequent tests. Minor hydrocarbon shows logged in the Upper Cretaceous section are considered to be non-commercial.

Three production tests were made through perforations opposite sandstones in the Latrobe Valley Coal Measures; one to confirm the gas-water contact and two for reservoir evaluation. On the first and lowermost test from 3809 feet to 3814 feet the well flowed gas at the maximum rate of 1.63 MMCFD and fresh water at the rate of 750 barrels a day. On the subsequent tests higher in the section the maximum flow rates were 6.85 MMCFGD plus 75 barrels of condensate a day and 5.36 MMCFGD plus 79 barrels of condensate a day.

The well represents two "firsts" for Australia: (1) first offshore well drilled; (2) first offshore discovery; and several "firsts" for the Gippsland Basin. (1) first significant production from the Latrobe Valley Coal Measures; (2) first occurrence of a porous sandstone member in the Gippsland Limestone; (3) first occurrence of porous sandstone members in the Upper Cretaceous section; and (4) the first occurrence of a Mesozoic section younger than the Strzelecki Group.

A new and unknown sandstone section some 369 feet thick was encountered in the lower part of the Gippsland Limestone. The areal extent of this section is as yet unknown. Otherwise the lithology of the Tertiary sequence was largely as anticipated.

II. INTRODUCTION

Esso Gippsland Shelf-1 was drilled very near the crest of a closed anticline mapped from seismic data. The objectives were to ascertain the stratigraphy and to test any prospective reservoirs on the structure.

Expected stratigraphy and structure within the Cretaceous section was not as predictable from seismic work as was the Tertiary section. Therefore, obtaining stratigraphic and structural information and evaluating the petroleum possibilities of this Cretaceous section was a further objective of the drilling programme.

III. WELL HISTORY

(1) General Data

(a) Well name and number - Esso Gippsland Shelf-1

(b) Name & Address of Operator - Esso Exploration Australia, Inc.
G.P.O. Box 4249,
SYDNEY, N.S.W.

(c) Name & Address of Tenement Holder - Haematite Explorations Pty. Ltd.
500 Bourke Street,
MELBOURNE, C.1, VICTORIA.

(d) Details of Petroleum Tenement - Petroleum Exploration Permit No. 38 issued by the State of Victoria and covering an area of 4450 square miles. Subsequent farm-in by Esso Exploration Australia, Inc. from Haematite Explorations Pty. Ltd.

(e) District - Offshore Gippsland, Eastern Victoria waters. Sale 4 mile sheet.

(f) Location - Latitude 38°16'41"S
Longitude 147°42'45"~~S~~ E

(g) Elevation - Permanent Datum: Mean Sea Level
Rotary Table: 31 feet above mean sea level.

(h) Total Depth - 8701 feet.

(i) Date Drilling Commenced - December 27, 1964.

(j) Date Drilling Completed - May 31, 1965

(k) Date Well Suspended - June 5, 1965

(l) Date Rig Released - June 5, 1965

(m) Drilling Time to Total Depth - 154 days

(n) Status - Suspended gas well.

(o) Total Cost -

(2) Drilling Data

(a) Drilling Contractor - Global Marine Australasia Pty. Ltd.,
360 Lonsdale Street,
MELBOURNE, C.1., VIC.

(b) Drilling Plant

Make	National
Type	1625 DE
Rated Capacity	20,000' with 5" DP
Motors	Cummins VT-12-GA-30 for electric power.

(c) Derrick - 136' x 58' x 34' special design, galvanised, 1,000,000 lb. Hookload capacity.

(d) Pumps - (2)

Make	National
Type	G-1000-C Duplex
Size	7-3/4" x 16"
Motors	Dual electric independent drives from above motors.

(e) BOP Equipment

Make	Hydril	Hydril	Cameron Triple U
Size	20" (MSP)	13-5/8" (GK)	13-5/8"
Working Pressure (Psi)	12,000	5,000	5,000

(f) Hole Sizes and Depths (related to RT) -

36"	to	302 feet
26"	to	741 feet
17½"	to	3017 feet
12¼"	to	6109 feet
8½"	to	8678 feet
7-3/4"	to	8701 feet

(g) Casing and Cementing Details

Size	30"	20"	13-3/8"	9-5/8"
Weight	130/196 lbs/ft.	104/167 lbs.	54 lbs.	36/40/47 lbs
Grade	B	B	J-55 Butt	J-55 & N-80
Range	3	3	3	3
Setting Depth	284	687	2974	6081
Location of Shoe, Collar, Centralisers	Shoe 284'	Shoe 687' Collar 685' Angle Iron Central-isers at 218' 243'	Shoe 2974' Collar 2895' Central-isers at 2778' 2855' 2959' 2934'	Shoe 6081' Collar 6011' Central-isers at 923' 963' 1004' 1046' 1084' 3433' 3471' 3514' 3556' 3596' 3637' 3680' 3719' 3798' 3839' 5881' 6041' 6060'
Cement (Sks)	440 + 2% Cal.Chloride	1200 + 2% Cal.Chloride	2600	800+8% Gel + 3/10% HR-4
Cemented to	Ocean Floor	Ocean Floor	Ocean Floor	3244 (Bond Log)
Method Used	Displacement through DP	Displacement through DP	Two-Plug Displace-ment	Two-Plug Displacement

(h) Drilling Mud

Salt water with returns to Ocean Floor was used to drill to 741 feet prior to setting 20" casing. The remainder of the hole was drilled with a fresh water, Spersene, XP-20, Bentonite, mud with Caustic used for ph control and Barytes for weight material.

Mud and Chemicals Used

Item	Pounds	Item	Pounds
Magcophoss	1800	Magcogel	50,000
Caustic Sodas	24,416	Volclay	36,800
C.M.C.	750	Aquagel	209,500
Fine Nut Plug	3,250	Spersene	50,550
Halliburton Halad Containers	100	Chipseal	1,480
Halliburton CFR	100	Fibreseal	1,380
Salt Gel.	33,600	Coarse Nut Plug	2,000
Magobar Barytes	412,400	Medium Nut Plug	3,250
Cocal Barytes	149,800	Anhydrous Ca Cl_2	800
XP-20	26,650	Halliburton HR_4 Retarder	909

Weekly properties while drilling are summarised below:

	Jan 10-16	Jan 17 Jan 23	Jan 24 Jan 30	Jan 31 Feb. 6	Feb 7 Feb.13	Feb 14-20	Feb 28 Mar 6	Mar 7-13	Mar 14 Mar 20	Mar 21 Mar 27	Apr 25 May 1	May 2 May 8	May 9 May 15	May 16 May 22	May 23 May 29	May 30 June 5
Wt/Gal	9.4	9.5	9.7	10.0	9.9	9.7	12.1	12.1	11.6	11.5	11.3	11.1	11.3	11.3	11.3	11.1
Viscosity	42	43	45	52	55	40	50	53	55	53	50	42	40	45	43	41
F.L.	12	13	11	10	12.5	11.0	4.5	5.2	5.5	5.4	5	9	10	4.5	3.7	4.3
Filter Cake	2/32	2/32	2/32	2/32	2/32	2/32	2/32	3/32	2/32	2/32	2/32	2/32	3/32	2/32	2/32	2/32
% Sand		3/4%	1%	1%	½%	1%	½%	2%	1%	1%		½%	¼%	½%	½%	1/3%
% Solids		10%	12%	13%	8%	6%	10%	14%	15.5%	16%		11%	9.5%	13%	13%	14%
Ph	9.5	8.0	9.0	9.2	8.5	7.8	10.8	11.8	10.6	10.7	11.1	12	12.3	12.7	10.7	10.8
NaCl	5,000	6,100	6,700	9,000	9,500	9,200	4450	4620	3750	3350	4,300	5,150	5,200	4,100	4,200	5,450
App. Vis.		22	19	24	24	15	33	38	41	27	36	19	19	27	25	19
Plas. Vis.		15	18	16	19	13	32	34	40	25	34	19	18	26	24	19
Yield		12	9	16	17	10	4	9	4	4	3	0	1	1	1	0
Init. Gel.		12	7	9	10	9	4	4	3.7	4.5	2	3	3	3	3	3
10 min Gel.		26	35	43	32	30	5	6.5	6	7	4	9	4	6	5	4
Rmf & Temp.		0.55 @ 67°			0.55 @ 66°	0.55 @ 78°				1.0 @ 60°				0.55 @ 66°	0.63 @ 70°	0.77 @ 65°
Cal.				180	160	200	200	180	188	153	240	300	220	170	220	240
ALK				0.15			0.5	0.8	0.32	0.38	0.5	0.3	0.6	0.6	0.2	0

(i) Water Supply - Fresh Drilling Water was transported to the Glomar III by the M/V Point Coupee from Port Welshpool. Salinity of this water was less than 700-800 ppm chloride.

(j) Perforation Record - Three Zones were perforated for production testing through 9-5/8" Casing. The Zones perforated were 3492-3497, 3752-3756 and 3809-3814 feet. Schlumberger Magna-jets 1-11/16" Through-tubing guns were used exclusively and a density of perforation of 1 shot per foot was used.

(k) Plugs

Depth	8497-8697	6620-6820	5980-6180	3350-3820	205-330
Cement (sks)	70+4% HR4	70+4%HR4	80+4%HR4	190+2% Cal Chloride	50+2% Cal Chloride
Checked	No	No	No	Yes with 40,000 lb	Yes

(l) Fishing Operations - While cutting core No. 11 (4346-51) the well came in blowing gas. The 13-5/8" GK Hydril, Upper Cameron Iron Works Pipe Rams, and Lower Pipe Rams were closed and a weighted mud pumped which failed to control gas flow. The Blind Rams were closed on the drill pipe and drill pipe pulled in two. Next the well was cemented through the Kill Line. Later sea water and Gel Mud were pumped through the Kill Line. Another Cement Squeeze was performed through the Choke Line. Fish left in the hole included 130 joints of 5" drill pipe, (2) 7-3/4" OD Bumper Subs, Sub, (3) 7-3/4" OD Drill Collars, Sub, 65' x 6-3/4" DD Christensen Drag Bit. Top of the Fish was located 174 feet below the Rotary. A 13-3/8" Baker Model "C" Retrievable Bridge Plug was set on top of Fish.

The 16" Marine Conductor and 13-5/8" BOP Stack were pulled to the surface and reconditioned. Necessary repairs were made to the Rig. This equipment was re-run and landed on the Casing-head near the ocean floor and tested, after which the Retrievable Bridge Plug was then pulled. The Blowout Preventers were tested on the ocean floor with a Retrievable Test Tool.

A Rotary Shoe was used to dress the top of the Fish at 174'. A Bowen Overshot would not engage the 5" Drill Pipe on the first trip and the Fish required additional dressing with a Rotary Shoe. Schlumberger sinker bars would not pass the top of the Fish. The fishing string was backed off one joint above the overshot and pulled to the surface where the string was strap welded. The fishing string was then screwed into Fish and the top joint and 52 joints of drill pipe backed off.

Open-end drill was run to the top of the Fish and mud circulated. The Fish was screwed into with the drill pipe and Schlumberger Sinker Bars run to 4263 feet. A free point indicator was run and indicated pipe to be free to 4250 feet. A string shot was used to back off the Fish at 2710 feet. The mud system was then circulated and conditioned and the Fish screwed into. Another string shot was run and the Fish backed off at 2925 feet. Thirty seven joints of drill pipe were recovered.

A fishing string of 5" drill pipe, (2) Bumper Subs, J-Joint and 15 joints of 7-5/8" wash pipe and rotary shoe was then run. A bridge was encountered at 2735 feet and the Fish washed over to 3549 feet. A back-off shot was then run to 3525 feet and the Fish backed off. The mud was then circulated and conditioned. Recovered fish was 20 joints of 5" drill pipe.

The Fish was washed over from 3525 to 3867 feet and the mud circulated and conditioned with the same string as described above. After washing to 4131 feet, loss of mud returns was experienced. This operation was temporarily suspended due to weather.

After waiting on weather the Fishing String was picked up and run in the hole and washed over the Fish to 4155 feet. Lost circulation material was added to the Mud System. An unsuccessful attempt was made to engage the J-Joint so the String was pulled to the surface.

A fishing String composed of a 7-7/8" x 6¼" Bowen Overshot, (2) Bumper Subs and 5" Drill Pipe was strap welded. This was run to the top of Fish at 3535 feet. A String shot was used to back-off at 4051 feet. Then a 12¼" Bit was run in the hole to 3187 feet where Cement was encountered; the hole was reamed to 4051 feet; the top of the 5" Drill Pipe Fish. After Mud conditioning the String was pulled to the surface.

Another Fishing String consisting of a 9-5/8" Rotary Shoe, six joints 9-5/8" Wash Pipe, 9-5/8" Control Bushing, two joints 9-5/8" Wash Pipe, Safety Joint, Washover spear and J-Joint and 5" Drill Pipe was made up and washed over Fish to 4347 feet. The Pipe was worked and pulled free. The Fish recovered included three joints of 5" Drill Pipe, two 7-3/4" OD Bumper Subs, Sub, one - 7-3/4" OD Drill Collar, Stabilizer, two 7-3/4" OD Drill Collars, Sub and 65 foot Core Assembly. A 12¼" Bit was then run to bottom of the original hole and the mud conditioned for further drilling. All Fish previously left in hole was recovered.

(m) Side-Tracked Hole - nil

(3) Logging and Testing

(a) Ditch Cuttings - Cuttings were taken over a normal shale shaker at ten foot intervals while drilling and five foot intervals while coring. All samples were logged and caught by the mud logging personnel under the supervision of Esso geologists and are representative of the labelled depth. Representative suites of cuttings are stored with the B.M.R., the Victorian Mines Department and with Esso in Melbourne.

(b) Coring - Original coring programme outlined cores to be taken at major formation changes, significant shows of oil and/or gas and routinely in conjunction with the requirements of the B.M.R. In general the original programme was complied with. Certain routine coring requirements were waived by the B.M.R. due to uniform lithology.

A total of twenty-one (21) cores, tabulated below, were cut in EGS-1 for a total footage of 476 feet. Recovery was 263.5 feet.

Christensen Coring Equipment was used exclusively with both drag type and diamond core bits.

Core No.	Interval Cored	Feet Cut	Recovery (feet)	Recovery (%)
1	1000-1028	28	14	50
2	1501-1528	27	10	37
3	2024-2037	13	5	38
4	2326-2352	26	21	81
5	2630-2655	25	23	92
6	2876-2896	20	10	50
7	3020-3050	30	9	30
8	3342-3385.5	43.5	7	16
9	3465-3513	48	2	4
10	3800-3825	25	Nil	0
11	4346-4351	5	2	40

Core No.	Interval Cored	Feet Cut	Recovery (feet)	Recovery (%)
12	4740-4760	20	12	60
13	5256-5274	18	15	83
14	5656-5685	29	29	100
15	6124-6139	15	2	11
16	6447-6460.5	13.5	13.5	100
17	6747-6773	26	23	88
18	7233-7251	18	18	100
19	7708-7731	23	23	100
20	8678-8693	15	15	100
21	8693-8701	8	7	88
		241		

Representative pieces of these cores are stored with the B.M.R., the Victorian Mines Department, and Esso in Melbourne.

(c) Sidewall Sampling - One run for sidewall cores was attempted using Schlumberger C.S.T. equipment. A total of 16 cores was attempted but only three samples recovered; at 3760, 5836 and 6015 feet. This poor recovery was due to the loose nature of the sands cored. These sidewall cores were used for core analyses.

(d) Electrical and Other Logging - (Appendix 5) - Wire line logging was carried out by Schlumberger Seaco. The following types of logs were run:

Induction Electric Log
Sonic Gamma Ray Caliper Log
Microlaterolog
Laterolog
Continuous Dipmeter
Cement Bond Log
Gamma Ray-Collar Locator.

A specially designed device was used in the majority of log runs to compensate for movement of the vessel while logging.

(e) Penetration Rate Log - A Drilling Time Log is included as part of the Composite Well Log, and also as part of Appendix 4.

(f) Gas Log - In addition to the continuous hot wire mud gas recorder, a chromatograph was used to detail mud gas shows. Cuttings gas was measured in a Waring blender and recorded. The cuttings were examined for stain and fluorescence. The gas log is included as part of the Composite Well Log and also as part of Appendix 4.

(g) Formation Testing - No conventional drill stem tests were run. See below for production tests.

(h) Deviation Surveys - These surveys were carried out with a Totco instrument and results are plotted on the composite log. The well had little deviation to 7200 feet increased to 5¼° at 7625 feet and was at 2-3/4° at total depth. Schlumberger deviation recordings taken in conjunction with the Dipmeter Survey indicated that no doglegs were present.

(i) Temperature Surveys - No temperature logs were run in EGS-1. A Cement Bond Log was used for casing cement bonding and cement top.

(j) Velocity Surveys - A velocity survey was run on May 22, 1965, by Western Geophysical Company. Results are included in Appendix 6.

(k) Other Well Surveys - Nil

(l) Production Testing - (Appendix 7) - Three intervals opposite the gas bearing sandstone within the Latrobe Valley Coal Measures were production tested through perforations and various chokes with the following results:

Zone No. 1 - Perforations from 3809 feet to 3814 feet with one jet shot per foot.

Flow Period	Time	Choke	Rate MMCFGD	Surface Flow Pressure psi	Fluid BPD
1	1 hr 55"	¼"	.69	1050	345 water
2	2 hr 35"	32.5/64	1.63	670	750 water

Extrapolated bottom hole pressure at 3810 feet was 1693 psi.

Zone No. 2 - Perforations from 3752 feet to 3756 feet with one jet shot per foot.

Flow Period	Time	Choke	Rate MMCFGD	Surface Flow Pressure psi	Fluid BPD
1	1 hr 2"	16/64"	.96	1350	17 cond.
2.	1 hr 5"	20/64"	2.475	1140	68 cond.
3	1 hr 2"	16/64"	2.54	1340	48.7 cond.
4	1 hr 25"	18/64"	3.67	1090	75 cond.
5	1 hr 17"	22/64"	4.87	920	74 cond.
6	2 hr 48"	28/64"	6.85	850	73.5 cond.

Extrapolated bottom hole pressure at 3750 feet was 1642 psi

Zone No. 3 - Perforations from 3492 feet to 3497 feet with one jet shot per foot.

Flow Period	Time	Choke	Rate MMCFGD	Surface Flow Pressure psi	Fluid BPD
1	2 hr 45"	3/8"	3.77	1200	57.6 cond.
2	1 hr 21"	3/16"	.985	1480	16.0 cond.
3	1 hr 51"	3/8"	3.86	1318	34.1 cond.
4	2 hr 48"	30.5/64"	5.36	1075	79.4 cond.
5	2 hr 24"	26.5/64"	4.92	1228	50.3 cond.

Extrapolated bottom hole pressure at 3350 feet was 1652 psi.

The first flow period of each zone represents the clean-up period.
The A.P.I. gravity of the condensate ranged from 65.8° to 81.4° from all tests.

IV. GEOLOGY

(1) History of Exploration

(a) Geological and Drilling - Onshore, exploration for various minerals, especially coal, has been going on in this region for about a century. In 1886, one bore was drilled to 224 feet for gold. Over 60 coal bores have been drilled in the area; their depths range from 200 to 2100 feet. Many shallow water wells have been drilled and also about half a dozen deep water bores, ranging from 1300 to 2000 feet.

Since 1924, about 100 test wells have been drilled in the region by Commonwealth or State Government agencies and by private firms. The largest concentration of tests, over 50, was around Lakes Entrance town. This included a 10 feet diameter shaft dug to 1156 feet.

An oil boom started in 1924 after a small oil and gas show in a water well from an Oligocene greensand aquifer. Small amounts of crude measurable in gallons were intermittently produced along with fresh water by over 30 individual Lakes Entrance field wells until the complete cessation of production in 1957.

Over 8,000 barrels total of asphaltic, 15.7° API crude were produced. Gas production, all methane, was insignificant.

Since 1954, drilling has been carried out in the onshore portion of the basin by Woodside, Frome Lakes, and Arco. None of these operators found commercial accumulations, although some hydrocarbon shows were recorded.

Surface geological mapping of the Gippsland region, with emphasis on the Paleozoics, has largely been done by the Victoria State Mines Department and some by the Commonwealth Bureau of Mineral Resources. From data on the many old cable tool and rotary wells drilled in the basin, subsurface geological maps and sections have been prepared by previous operators.

(b) Geophysical -

(i) Gravity and Magnetics - The Bureau of Mineral Resources regional gravity covers the onshore Gippsland Basin; gravity anomalies and trends are correlatable with major regional structural features. Much of the basin has been covered by aeromagnetic work. The B.M.R. conducted most of the older work but a portion of the offshore basin was flown in 1962 by Aero Service for Haematite Explorations Pty. Ltd. These surveys gave a good approximation of the basin edges, though because of their largely reconnaissance nature, their value towards understanding details of the Gippsland Tertiary Basin is limited.

(ii) Seismic - Previous Control - Regional seismic control was obtained from the reconnaissance survey conducted by Western Geophysical Company for Haematite Explorations in 1962-1963. As a general rule, the seismic data quality was fair to good down to the first strong coal reflection; below this event mainly multiples were recorded. Where no strong coal reflection was present, deeper legitimate events were recorded, although these were generally discontinuous and weak. Western Geophysical Company carried out additional detail seismic work, subsidised by the B.M.R., for Esso prior to the spudding of EGS-1.

(2) Regional Geology

The small-sized Gippsland Tertiary-Mesozoic Basin lies within, and near the southern extremity of, the Paleozoic Tasman Geosyncline which stretched 2,500 miles at times through easternmost Australia from New Guinea to Tasmania. Tens of thousands of feet of Cambrian to Carboniferous sediments, metasediments, intrusives, and effusives are consequently exposed around its northern rim in Victoria. In addition Permian rocks are present in Tasmania to the southwest. Paleozoic rocks undoubtedly underlie all of the Gippsland Basin, at shallow depth near its margins directly below a thin Tertiary veneer, and at great depth, of the order of 20,000 feet, within the central Mesozoic graben area where a thick lower Cretaceous-Jurassic section intervenes and the Tertiary alone reaches a thickness of 7000+ feet.

Triassic sediments are known in Tasmania but the oldest Mesozoic beds recognised in Gippsland are of Jurassic age. Continental types of sandstone, arkose, siltstone, greywacke, mudstone, and minor amounts of coal were deposited during the Jurassic and Lower Cretaceous within a large graben or half-graben depression. Sediments of Upper Cretaceous age are apparently absent onshore. Locally, pre-Tertiary uplift and deformation was considerable and erosion occurred regionally for a long period. Weathering and angularity at the top of the Strzelecki Group are pronounced.

During Eocene time, gentle regional downwarp occurred in the basin, perhaps related to the start of foundering of an offshore Paleozoic land mass. Volcanism and flow occurred in the west followed by widespread limnic to paralic swamp conditions with the deposition of peat, clay, and much coarse continental sand. The great thickness and characteristics of the brown coal in the west suggests that the deposits were autochthonous. Large volumes of freshwater must have consistently debouched into the basin from the surrounding highlands since the Latrobe Valley Coal Measures contains only traces, in the east, of any carbonate or shells or marine fauna which would reflect more normal marine salinity. In the west, over 2,000 feet of the mainly continental Latrobe was deposited. A thinner but slightly more brackish sequence containing less lignite was laid down to the east and southeast. Uplift and gentle deformation took place after the Eocene; the Latrobe was then truncated severely.

The Gippsland Basin acquired its general present shape and morphology with the incursion of a near-constantly transgressing sea during lower Oligocene time from the east and southeast. This invasion was perhaps related to the final foundering of an old offshore land mass; it was likely at this time that the Balook High was formed compensatorily onshore in the west . The first truly marine rocks were laid down, the Lakes Entrance calcareous shale. A single important period of local shoreline or littoral sand deposition with winnowing action interrupted progressive shale deposition, during a brief halt in the transgression. Then came further onlapping and more shale deposition.

Shallow and quiescent marine conditions continued without major interruption through the Miocene into the Lower Pliocene with further slow transgression of the sea and overlapping deposition of marl and argillaceous limestone which became sandier towards the end of this time, as marine regression began, completing the full cycle. By mid-Pliocene, regional uplift, probably accompanied by gentle deformation and small-scale faulting, occurred. The sea then regressed rapidly to its present limits. Deposition of fluvial clays, sands, and gravels took place onshore from the Upper Pliocene to the Holocene.

Possibly during the post-Eocene erosional period, but certainly again during the Quaternary, large volumes of freshwater have gained ingress around the elevated edges of the Tertiary basin into all permeable horizons known onshore.

(3) Stratigraphic Table

Age	Name	Formation Top (R.T.)	(Ref. to M.S.L.)	Thickness
Miocene	Gippsland Limestone Formation	767	-736	2503+
Oligocene	Lakes Entrance Formation	3270	-3239	188
Eocene	Latrobe Valley Coal Measures	3458	-3427	1920
Upper Cretaceous	Unnamed	5378	-5347	3323+
Total Depth		8701		

Note: Lakes Entrance Formation lithological top of 3270 feet has been used in this report to coincide with the seismic mapping horizon. A paleontological disconformity however is present at 3084 feet. It is possible that the section from 3084-3458 feet should be included in the Lakes Entrance Formation. Additional control is needed to establish this formation boundary firmly.

(4) Stratigraphy

Note: No sample returns above 767 feet. Ocean floor sample consisted of shell fragments and fine to medium grained quartz sand grains.

(a) Gippsland Limestone Formation (Miocene) 767-3084 feet -

767-2615 Marl: light grey, medium grey to olive grey, very fossiliferous, soft, firm, massive, glauconitic, dense.

Limestone: light, medium to dark grey, skeletal, very fossiliferous, glauconitic, pyritic, fairly hard.

2615-3084 Sandstone: calcareous, light, medium to olive grey, made up of clear, white and light grey, coarse to very coarse, sub-rounded to rounded, fairly well sorted, quartz grains set in a calcareous matrix. Fairly friable with abundant fossils, and with fair porosity and permeability.

Limestone: sandy, or calcareous sandstone, but carbonate dominant.

Marl: as described above minor percentage.

3084-3270 (Possible Lakes Entrance Formation)
Marl: light olive, olive, medium to dark grey, very fossiliferous, very glauconitic, pyritic, slightly sandy - scattered random quartz grains.

(b) Lakes Entrance Formation (Oligocene) 3270-3458 feet -

3270-3458 Shale: calcareous, green-grey, olive grey, glauconitic, fossiliferous, pyritic, random quartz grains. This section is lithologically distinct from the section from 3084-3270 feet, and ties with the seismic top. It is possible, due to a Paleontological disconformity at 3084 feet, that the whole section between 3084 and 3458 feet is a single time rock unit.

(c) Latrobe Valley Coal Measures (Upper Eocene) 3458-5378 feet -

3458-5378 Sand: clear-milky-light grey, medium-granule, sub-rounded to well-rounded, fairly well sorted quartz (99%) grains, dominantly loose and unconsolidated; extremely porous, minor coal fragments, few muscovite flakes.

Sandstone: same constituents as above but generally very fine-medium, slightly dolomitic in places.

Coal: brown and black.

Siltstone: brown-grey, finely pyritic and micaceous, very carbonaceous.

Shale: (Minor), light, medium and brown-grey, argillaceous and dense, grading into siltstone as above.

(d) Unnamed Unit (Upper Cretaceous) 5378-8701 feet -

5378-5707 Siltstone: brown-grey, medium to dark grey and grey-black, carbonaceous, micaceous and pyritic.

Shale: green-grey, medium to dark grey, grading into siltstone as above.

Sandstone: light grey, very fine to medium, sub-angular to sub-rounded, soft, friable, carbonaceous, micaceous, slightly dolomitic in spots. Minor clean loose unconsolidated medium to coarse grains (quartz).

Coal: thin bands - brown-black to black.

5707-6755 Sandstone: light to medium grey and light green-grey and brown-grey, very fine to medium, angular to sub-rounded, fairly clean with quartz making up 95% of sandstone. Minor constituents are coal fragments, mica flakes and few lithic fragments.

Siltstone: brown-grey, carbonaceous and micaceous, finely pyritic, grading into shale as below.

Shale: medium to dark grey and green-grey, dense, carbonaceous and micaceous.

Coal: black, dense, with good conchoidal fracture.

6755-7020 Same lithology as for 5707 to 6755 feet, but sands are much coarser, up to granule and occasionally pebble conglomerate in grain size. The grains are also angular to sub-angular. Quartz still makes up about 95% of the sandstone.

7020-7260 As for 6755 to 7020 feet, but Kaolinitic matrix present in sandstones.

7260-8701 (T.D.) As for 6755-7020 feet, but matrix appears to be weathered feldspar. Quartz 85-90%, remainder feldspar (5-10%), coal fragments, trace of mica, dark rock fragments and pyrite.

The overall section from 5378 to 8701 feet is dated as Upper Cretaceous by palynology. Typical Strzelecki Group lithologies were not encountered in this well.

(5) Structure

The Esso Gippsland Shelf-1 was drilled on a local culmination along a regional anticlinal feature trending generally east-west. This trend appears to be genetically related to the onshore Balook High. Maximum closure along this trend is 1100± feet.

The local culmination or closure tested by the Esso Gippsland Shelf-1 is a near-symmetrical anticline approximately 15 miles long and 2 miles wide with steeply-dipping flanks. The structure is probably cut by a transverse fault. Maximum vertical closure on this particular feature, as mapped on the unconformity at the top of the Latrobe Valley Coal Measures, is 600± feet.

A structure map on the unconformity on the top of the Latrobe Valley Coal Measures was the primary basis for selecting the location. Continuous Dipmeter results confirm that the Tertiary section was encountered on or near the crest of the structure. The actual formation tops coincided closely to the seismic prognosis confirming the seismic structural picture.

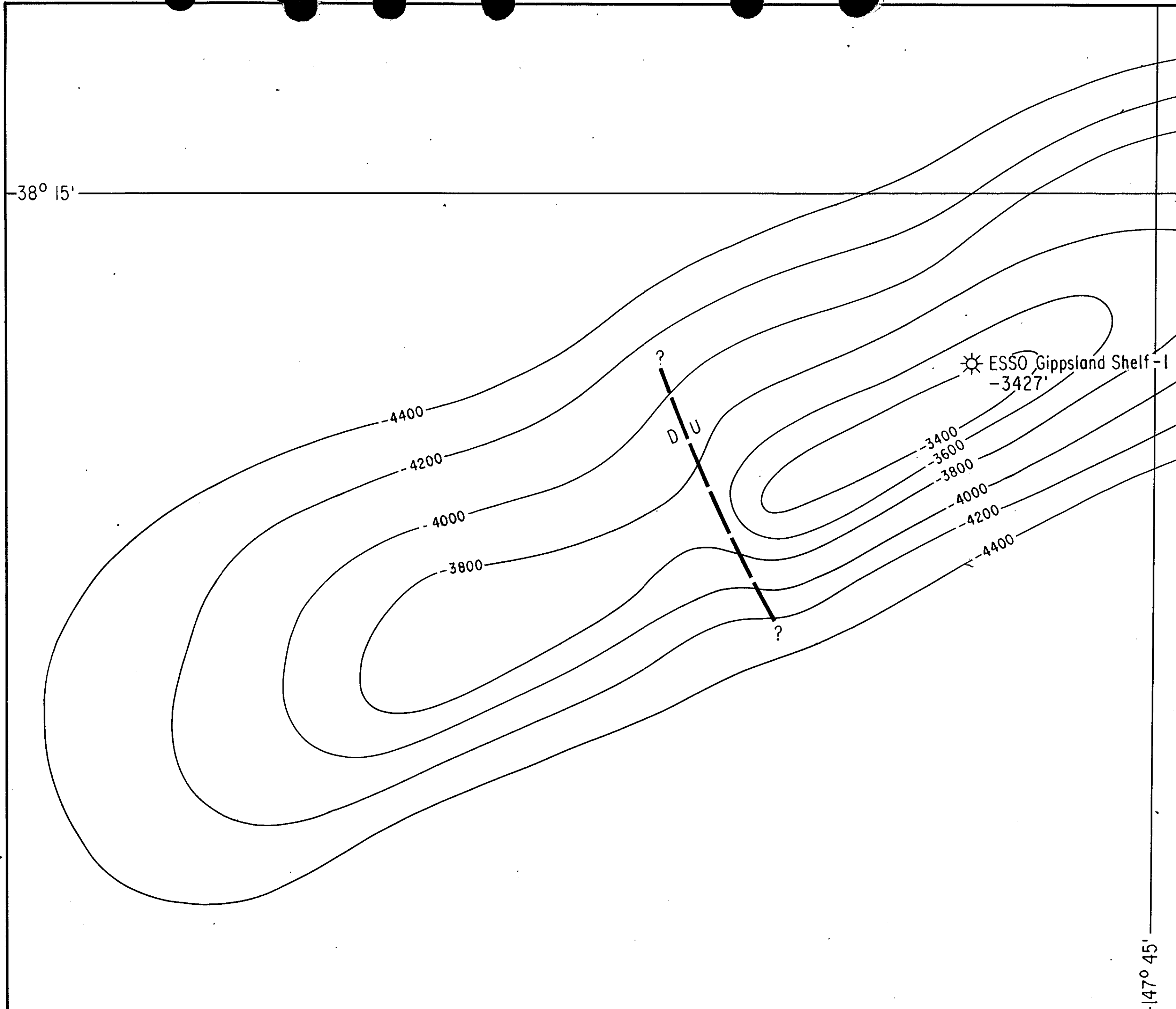
Structural configuration below the Tertiary, within the Upper Cretaceous section, is not well-known. Few valid seismic reflections were recorded in this interval. Dips from cores and the dipmeter survey suggest a possible regional dip of less than 10° generally between north-east and north-west in this section.

No faulting was evident in the well.

(6) Relevance to Occurrence of Petroleum

A gross section of 353 feet of gas column was encountered in the top of the Latrobe Valley Coal Measures in the interval from 3458 to 3811 feet. Subsequent production tests proved the gas column and established the gas-water contact. This is the first potentially commercial hydrocarbon reservoir found in the Latrobe Valley Coal Measures.

38 11 31 / 3780



ESSO EXPLORATION AUSTRALIA INC.

E.G.S. - 1 GAS FIELD

STRUCTURE CONTOURS ON TOP OF THE PRODUCING GAS SANDS

CONTOUR INTERVAL 200'

SCALE 1:100,000

1 0 2 4

MILES

8/15

Gas shows were logged by the mud logging unit in the sands from 5707 feet to 6030 feet. However, electric log analysis rules out commercial hydrocarbons in these sands.

Additional shows were logged below 7800 feet, some with fluorescence and cut, but all were deemed non-commercial. The best of these minor shows was in the interval from 7834 to 7846 feet and at 8687 to 8693 feet in Core No. 20.

The show from 7834 to 7846 feet is based on the mud gas detector, sample examination and log analysis. A maximum gas reading of 120 units was recorded in this section. The lithology is described from samples as follows:

> Sandstone: Light grey-brown, very fine to medium grained, angular to sub-rounded, fair sorting, poor porosity and permeability with a trace of interbedded brown-grey carbonaceous siltstone. A trace of light gold fluorescence was noted.

Log analysis indicates a slight hydrocarbon show. The porosity was calculated to be 19%.

The show at 8687 feet and 8693 feet is based on visual examination of cores. Brown oil staining was observed in a light grey, coarse to granule grained, angular, feldspathic sandstone with occasional pebbles and cobbles. The staining was erratic and limited to a 6-inch vertical interval in each case. The porosity from core analyses was 17%.

(7) <u>Porosity and Permeability of Sediments Penetrated</u>

Porosity and permeabilities were measured by Core Lab on the various cores and are included in the Appendix IV.

Log analyses generally confirmed the range of measured porosities. No cores of the loose gas sand in the Latrobe Valley Coal Measures were recovered, therefore log porosity values are the only ones available. The porosities range up to about 35% and it is obvious by their loose nature that the sands are extremely permeable.

The Gippsland Limestone sandstone member had porosities up to 36% and permeabilities to 2300 md on Core Analyses. Sandstones within the Upper Cretaceous section had porosities ranging up to 25% and permeabilities up to 300 md.

(8) <u>Contribution to Geological Concepts Resulting from Drilling</u>

Gippsland Shelf-1 was the first well drilled in offshore Gippsland water. The Tertiary section to the base of the Latrobe Valley Coal Measures was essentially as predicted prior to drilling with one exception. The calcareous sandstone unit from 2615 to 3084 feet within the Gippsland Formation had not previously been seen in onshore wells. Its areal extent is not yet known. The remainder of the section to the top of the Upper Cretaceous at 5378 feet was correlated without difficulty with the onshore section.

Based on paleontological control, the section from 3084 to 3270 feet could be included in the Lakes Entrance Formation. However, there is a good Electric Log and Sonic Log marker at 3270 feet that can be correlated with the onshore wells and which coincides with an extensive mappable seismic reflection. Calling this lithologic marker the top of the Lakes Entrance Formation is advantageous from a structural mapping standpoint. In addition, the Lakes Entrance top, based on the paleontology, would be difficult to pick on Electric Logs if the Gippsland Formation sandstone member was not present as is the case in the onshore wells. Additional well control will solve the problem, but for the present the E-Log marker is being retained as the top of the Lakes Entrance for practical usage.

The Upper Cretaceous section consists of sandstones, siltstones, shales and thin coal bands lithologically distinctly different from Strzelecki Group sediments seen onshore.

The very high percentage of quartz sandstone, the grain size, angularity, porosity and the relative lack of dark rock fragments and other lithic constituents is in marked contrast to the sub-greywacke type of Strzelecki sediments onshore. Structure within this Upper Cretaceous section is largely unknown at present. Although this section appears devoid of marine fauna, it is noticeable that formation water salinities are very high throughout the unit suggesting marine conditions of deposition.

V. REFERENCES

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APPENDIX 1 BASIC

P. K. Kenley
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Read 8-6-65

GIPPSLAND BASIN.

Geological Survey of Victoria

THE MID-TERTIARY FORAMINIFERAL SEQUENCE

~~ESSO GIPPSLAND SHELF No. I WELL.~~

BARRACOUTA - I.

by. David J. Taylor.

TAYLOR, D.J.

1965.

Unpublished Report 16 / 1965.

W 486
BARRACOUTA - 1 BOX

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INTRODUCTION

This investigation was conducted on behalf of ESSO Exploration Australia (the operator) and Haematite Explorations Pty. Ltd. (the permit holders). At their request the section has been examined in detail in order to establish a standard foraminiferal sequence for further correlation in the off-shore Gippsland area. The geological staffs of both companies gave the author considerable assistance and complied to requests regarding sampling.

Sample Detail: The well was drilled in 150 foot of water, some 15 miles south of the Gippsland coastline. Rotary cutting samples were submitted from the foot of the surface casing at 780 feet to total depth at 8,701 feet. Rotary cutting contamination was minimal between 780 feet and 4,300 feet apart from the interval 3,050 feet to 3,200 feet. Below 4,300 feet contamination was sporadically heavy down to 8,400 feet. It is noted that the 13⅜ casing was set at 2,974 feet and the 9⅝ casing at 6,081 feet. Much of the contamination below 4,300 feet came from the interval 3,400 to 3,500 feet where a "wash out" was noted on the "caliper log".

Eighteen cores were recovered and these were slabbed at the well site, so that a complete section of each core was received. The position of cores from 1,000 feet to 4,000 feet is shown on Fig.1.

The datum for all sample depths was the rotary table given as +31 feet M.S.L.. All depths discussed here are those shown on the submitted samples and no adjustment has been made on E-log interpretations etc.

All cores were sampled at 2 foot intervals and cutting samples were examined every 50 feet with reduction of sampling interval where necessary. Normal microfossil preparation techniques were employed. Prepared samples were exhaustively handpicked for foraminifera and other microfossils. If good faunas were found the fossils were sorted on to grid slides before specific determination of foraminifera was conducted. A comprehensive distribution chart of some 300 species was assembled and this was later abridged to the form shown on Fig.1. Where specific identity was dubious or new species suspected, species numbers were applied and representative specimens were mounted on species slides.

THE FAUNAL SEQUENCE

?

Cores 1 to 8 contained Tertiary foraminifera and the new species was recorded down to 3,800 feet. The new fauna at 3,800 feet is regarded as uppermost Eocene, so that the Tertiary foraminiferal sequence extends from above 780 feet (= first sample) to the vicinity of 3,800 feet. No older diagnostic faunas were found, although a sample of core 16 (sample interval 6,450-1 feet) contained a sparse fauna of minute, nondescript rotalid forms. This fauna was not found in any other of 10 samples examined from core 16.

In recent years several Tertiary sections in the Gippsland Basin have been studied in considerable detail by foraminiferal workers. Jenkins (1960) studied the Tertiary planktonic foraminifera in the Lakes Entrance Oil Shaft; a vertical, hand-sampled section. Carter (1964) built up a composite sequence, consisting of both outcrop and bore material from the Longford, Bairnsdale and Lakes Entrance areas. Carter's work is an application of his faunal unit scheme, which was based on the Aire Coast sections in Western Victoria (Carter 1958a). Wade (1964) has subsequently discussed the Tertiary planktonic foraminiferal zonation in southern Australia and has co-ordinated the work of Carter and Jenkins.

This previous work provided a firm basis on which to establish a foraminiferal sequence for the Gippsland Shelf No.1 Well. However Carter, Jenkins and Wade all use the first appearance of forms in evolutionary sequence. Theoretically this is the ideal approach as it is in the direction of evolution, that is "up-sequence". But sub-surface sections are drilled "down-sequence". Where rotary cuttings have to be used for biostratigraphic determination, the first appearance of a species is the only reliable point in its range, because of rotary cutting contamination. This first appearance is in fact the level of extinction of the species in the section. Obviously the "up-sequence" schemes have to be adapted to a "down-sequence" approach.

The author has been working on this problem for several years, especially in regard to the on-shore Gippsland Basin. A less empirical down sequence approach has been tested by using the range and points of fragmentation and bifurcation in a number of linearly evolving species groups. The planktonic series discussed by Wade (l.c.) can be utilized by this approach. The classic Orbulina universa lineage poses difficulties in that the globular shape provides almost maximum bouyancy and may be constantly recirculated as a mud contaminant.

Uvigerinid and bolivinid forms are common in the Gippsland Shelf sequence, though they are not common on-shore, apparently for environmental reasons. Vella (1964)has stressed the significance of linear development within these groups in the New Zealand Tertiary. Similar, though not identical, lineages are recognized in the Gippsland Shelf sequence and these lineages have been detailed. It is thought that the bolivinid and uvigerind lineages will be important factors in correlating subsequent Gippsland off-shore sections.

(i) Gippsland Shelf No.1 Tertiary foraminiferal sequence:-

Vertical distribution of species groups will be discussed down sequence with reference to summarized distribution of selected species as shown on Fig.1.

(a) Planktonic species - Little change in the Globigerina spp. till 3,400 feet where G.euapertura first appears coinciding with the virtual disappearance of G.woodi and G.apertura. G.euapertura clearly develops from G.ampliapertura and this latter form is present below 3,700 feet. The apparent lineage is G.ampliapertura -> G.euapertura -> G.apertura (s.l.). Jenkins (1960) shows that G.woodi replaces G.euapertura, and he includes (pers.comm.) G.apertura (s.l.) within G.woodi. Wade (1964) does not recognize G.woodi and uses G.apertura. The author feels that the two species can be distinguished and that G.woodi is not in the direct G.ampliapertura -- apertura lineage.

The closely related species G.linaperta and G.angiopora appear in association below 3,800 feet. In New Zealand the range of the latter extends higher than that of the former (Hornibrook, 1961).

Most members of Blow's (1956) Globigerinoides triloba - Orbulina universa bioseries are present in the sequence. Orbulina universa is present in cores 1 to 5, whilst O.suturalis is present in cores 6 and 7. Such a distribution would be anticipated. However below core 7 there is no verified recording of G.transitoria, G.bispherica or G.triloba, although Blow shows these species to be ancestral to O.suturalis and would be expected to occur below O.suturalis. As subsequent authors, including Carter, Jenkins and Wade, have substantiated Blow's bioseries, it can only be concluded that the lineage is interrupted in this section before the initial appearance of the mature form of G.triloba. The immature form of G.triloba (either G.triloba immatura or Globigerina woodi connecta Jenkins) is present below 3,080 feet.

Globorotalia spp. do not occur above 1,060 feet. The highest occurring species are mainly the keeled forms referable to G.menardii. G.mayeri is not present above 1,700 feet and G.barisanensis and G.conica is not above 2,300 feet. This is the specific distribution pattern shown by Jenkins (1960) and all these species are within range of Orbulina universa and O. sutularis. Wade (1964) places G.barisanensis and G.menardii moitumbida within the G. fohsi lineage so that the latter replaces the former as is demonstrated in this section. The presence of G.lenguanensis near the top of the range of G.mayeri and well above the top of the range of G.barisanensis is consistent with the findings of Bolli (1957) in Trinidad.

Below 3,400 feet G.opima opima and G.extans are associated with the coarse pored G.testarugosa not present till 3,540 feet and becoming more abundant down the section. These three forms show a relative distribution in agreement with Jenkins (1960).

The Gippsland Shelf sequence reaches the top of the range of Chiloguembelina cubensis at 3,540 feet with rare Guembelitra sp. below 3,800 feet. Although this order of occurrence is similar to that in Trinidad and New Zealand, it is the reverse of Wade's (1964) observations for southern Australia.

(b) Bolivinid species - Four lineages of bolivinids are recognized in the sequence.

One lineage is within a group of elongate forms which exhibit thickening and initial widening of the test, accompanied by peripheral rounding and facial flattening. The ultimate form, Bolivina sp.2 is present down to 2,100 feet and its range overlaps the thinner, more tapered B. sp.8, which is recognized at 1,900 feet. B. sp.8 is not encountered below 2,700 feet. A probably related form, B. sp.12 occurs below 3,300 feet. There is an apparent gap in the lineage.

An outstanding element of the higher part of the sequence is a robust keeled bolivinid referable to Bolivinita, probably comparable with B.compressa of the New Zealand upper Tertiary.

This form is present down to 1,600 feet and a less strongly carinate form, B. sp.2, replaces it. The chambering of B. sp.1 and sp.2 is similar to that of Bolivina sp.2 and the less carinate nature of Bolivinita sp.2 suggests that the Bolivinita sp.2 -- sp. 1 lineage branches off at the fragmentation level (ie. 1,900 to 2,100 feet) of the Bolivina sp.8 -- sp.2 lineage. This Bolivinita lineage is obviously parallel to the B. quadrilatera lineage in New Zealand, but Hornibrook (1953, p.440) suggests that the New Zealand group were immigrants and he does not indicate development from a Bolivina stock.

Bolivina sp.1 is a compressed elongate form with carinate later chambers and raised sutural ribs. Below 1,500 feet, the broader, more triangular form B. sp.4 is present. A similar form, B.sp.9, with elongate ribs occurs below 2,300 feet. These three species are within a definite linear development. The range of overlap of species, though broad, is significant.

Below 3,540 feet, the Bolivina pontis to B.anastomosa group is recognized. The former is clearly distinguished below 3,800 feet. The development is similar to that described by Hornibrook (1961) and Vella (1964) from New Zealand. The highest appearance of B.anastomosa is stratigraphically lower than that recorded in New Zealand and slightly lower than other Gippsland Basin sections. Vella (l.c.) shows that B.affiliata is the descendant of B.anastomosa and that the lineage may be surviving as B.robusta. B.affiliata is not recognized in the Gippsland Shelf sequence, but the Bolivina sp.9 to B. sp.1 lineage exhibits similarities to B.robusta.

(c) Uvigerinids - Vella (1961 and 1964) has made an extensive study of New Zealand uvigerinid lineages. Vella's approach is to place the species of one lineage within a distinct higher taxon. This had lead to the erection of a number of new genera and sub-genera within the family Uvigerinidae. This is the modern taxonomic approach, yet Vella's proposed genera and sub-genera have not been generally accepted and probably require greater verification, especially with regard to apertural and internal chamber characteristics. Also Vella stresses the endemic nature of his species. For the above reasons, the author has refrained at this stage from using Vella's nomenclature. The author has generalized the generic concept of Uvigerina, but will attempt to place numbered species within Vella's lineages; that is within his proposed higher taxa.

The Hofkeruva (Trigonouva) group which are common throughout most of the Tertiary section. The first form encountered, Uvigerina sp.1, is elongate and moderately costate. Subsequent forms (down section) are U. sp.2, U. sp.4 and U. sp.8. The latter species is markedly triangular in cross-section and very similar to the New Zealand species "U".miozea. This form appears at 2,300 feet and is still present at 3,000 feet. The general shape and plate like costae of the large U. sp.9 suggests affinity with the New Zealand species "U".dorreeni. As U. sp.9 is present at 3,080 feet and U.sp.8 persists to at least 3,000 feet, then there is apparent disruption of Vella's (1961, Text fig.3) proposed lineage if U.sp.8 = "U".miozea and U.sp.9 ≐ "U".dorreeni.

U.sp.3, U. sp.7 and U.sp.10 are all hispid forms probably within the genus Neouvigerina as explained by Vella. The three Gippsland shelf species do not appear related.

(d) Gyroidinoides - a definite series of the G.zealandica group is recognized in New Zealand. G. sp.1 and G. sp.2 appear unrelated to this group. But below 2,200 feet there is a form, G. sp.3, which resembles G. subzealandica, whilst below 3,080 feet it is replaced by the more angular form G.sp.4 equaling G.zealandica (s.s.). This is the New Zealand order of occurrence although Hornibrook (1961) shows that the ranges of the two species overlap considerably.

(e) Cibicides - Lineages within this group probably exist in the section but have not been studied. Common species down to 2,700 feet include C.cygnorum, C.mediocris, C.subhaidingeri and C.vortex. C.victoriensis is not recorded till 1,500 feet and its presence below 3,080 feet may be due to contamination. C.vortex probably forms a lineage group as a C. 'vortex form B' can be distinguished below 2,400 feet. There is a marked change in the Cibicides fauna at 3,080 feet, with the appearance of C.brevolalis, C.perforatus and C.novozealandica. This change is anticipated from Carter's (1964) and other Gippsland sections.

(f) Elphidium - The order of occurrence of the five recorded species of Elphidium are of significance, as four of them retain the order as recorded by Carter (l.c.), although E. crespinae would be expected to range higher. The fifth species, E.arenea (syn. Discorotalia arenea Hornibrook), is a new recording for Victoria, but is of limited range in New Zealand.

(ii) Biostratigraphic units for Gippsland Shelf No.1 sequence:-

From the above discussion it is now possible to subdivide the sequence into a number of biostratigraphic units, which are comparable with previously established biostratigraphic units, but are not completely equivalent to previous schemes, as by necessity this scheme is a "down sequence" scheme. The biostratigraphic units applied are named zonules as they comprise associations of species of various foraminiferal groups and are intended only for purposes of local correlation.

Zonule A - ? to 1,060 feet: As samples were not collected above 780 feet, the top of this zonule is not known. The complete absence of Globorotalia spp. identifies it but this absence is probably due to environmental factors. The only species restricted to this unit is <u>Uvigerina</u> sp.1 which obviously develops from <u>U</u>. sp.2 in Zonule B.

<u>Zonule B - 1,060 feet to 1,700 feet</u>: The highest ranges of <u>Globorotalia acostaenasis</u>, <u>G.menardii moitumbida</u>, <u>miocenica</u> and <u>praemenardii</u> are within this interval, but these species could easily range higher in other sections. The related species <u>Bolivina</u> sp.2 and <u>B</u>. sp.4 overlap in range. <u>Bolivinita</u> sp.1 is associated with <u>Bolivina</u> sp.1 and characterizes this unit, although both species do occur rarely in the higher unit. The hispid <u>Uvigerina</u> sp.3 appears limited to this unit, and <u>Cibicides victoriensis</u> does not range above the base of the unit.

<u>Zonule C - 1,700 feet to 2,300 feet</u>: Marked by the highest appearance of <u>Globorotalia mayeri</u> and the limited appearance of <u>G.lenguaensis</u>. Within this unit is the fragmentation of the <u>Bolivina</u> sp.8 to sp.1 lineage with bifurcation to the primitive <u>Bolivinita</u> sp.2. The highest appearance of <u>Uvigerina</u> sp.4 overlaps <u>U</u>. sp.2 and the hispid form <u>U</u>. sp.7 does not range above the base of the unit. The ranges of such species as <u>Elphidium pseudoinflatum</u>, <u>Gyroidinoides</u> sp.2 and <u>G</u>. sp.3 extend upwards into this zonule and <u>Textularia</u> sp.3 appears limited to it.

<u>Zonule D - 2,300 feet to 2,700 feet</u>: Characterized by the highest appearances of <u>Globorotalia barisanensis</u> and <u>G.conica</u>. The two cores within this interval contain few <u>Orbulina universa</u>, though higher in the sequence this form is abundant. <u>Bolivina</u> sp.9 is restricted to this unit and clearly develops into <u>Bolivina</u> sp.4. The uvigerinid fauna consists mainly of the hispid <u>Uvigerina</u> sp.7 and the triangular <u>U</u>. sp.8. <u>Elphidium arenea</u> is restricted to this unit.

<u>Zonule E - 2,700 feet to 3,080 feet</u> has sparse faunas throughout, apart from obvious contamination below 3,050 feet. Except for <u>Haplophragmoides</u> cf. <u>paupera</u>, all species recorded occur higher in the sequence. However the zonule criteron is established

on core samples which contain Orbulina suturalis without associated O.universa. Just above this zonule, core 5 contains rare O.universa, whilst O.suturalis is more common. Thus 2,700 feet is taken as the level of initial appearance of O.universa.

Haplophragmoides spp. are common within the zonule.

A significant feature of this zonule is the presence of worn Lepidocyclina sp. Gypsina sp. and Amphistegina sp., with decayed fragments of bryozoa. The sediment is a sandy one and is not comparable with the typical Victorian lepidocyclinal limestones (ex. the Glencoe Limestone of Gippsland). Furthermore Carter (1964) demonstrates that Orbulina suturalis appears above and not in association with Lepidocyclina sp. in Victoria. It is considered that these Lepidocyclina and other larger foraminifera in these samples are derived.

Zonule F and G are missing in this sequence. As already stated the Globigerinoides triloba -- Orbulina universa bioseries is interrupted before the appearance of the mature form of G.triloba and is recommended with O.suturalis. The two significant missing events are the appearance (up sequence) of G.triloba and of G.bispherica. It is also noted that several bolivinid and uvigerinid lineages appear to be interrupted. Moreover fresh specimens of Lepidocyclina sp. and other larger foraminifera are not present, although they would be expected immediately below O.suturalis.

The absence of the expected Zonules F and G indicates a hiatus within the sequence.

Zonule H - 3,080 feet to 3,400 feet - Despite contamination down to 3,200 feet, the fauna is impressively different. Globigerina apertura, G.woodi, are still present with immature and dubious specimens of Globigerinoides triloba. At the top of and within the zonule, such forms as Cibicides brevolalis, C.perforatus, C.novozealandica, Uvigerina sp.9, U. sp.10, U.sp.11, Astrononion centroplax and Anomalinoides vitrinoda. Arenaceous species are common with Textularia spp., Dorthia spp., Haplophragmoides spp. and Karreriella sp. The appearance of Karreriella sp. and Haplophragmoides rotundata within the unit may be a biostratigraphic rather than a purely environmental feature, as these two species have not been noted at relatively higher levels in Gippsland sections.

Zonule I - 3,400 feet to 3,540 feet - Globigerina eurapertura is positively identified at 3,400 feet and G.apertura and G.woodi are both extremely rare. Globorotalia opima opima and G.extans are rare though important elements of the planktonic fauna. The benthonic fauna is similar to that of Zonule H, except for the presence of Vaginulinopsis gippslandicus and the arenaceous Vulvulina sp. (probably referable to the New Zealand V.granulosa). There is a rich arenaceous fauna.

Zonule J - 3,540 feet to 3,800 feet - A strikingly different fauna due to the small size of specimens when compared with the robust Zonule I fauna. The planktonic elements are similar to Zonule H apart from the presence of Globorotalia testarugosa and Chiloguembelina cubensis. There is a notable reduction in specimen size of the benthonic species which also occur in the two preceding zonules. Arenaceous species are rare. The highest occurrence of Bolivina anastomosa and the arenaceous Bolivinopsis cubensis are noted at 3,540 feet.

Zonule K - 3,800 feet to ? - Fauna generally similar to Zonule J, but mixtures of Globigerina eurapertura with the ancestral form G.ampliapertura and of Bolivina anastomosa with the ancestral form B.pontis, indicate specific fragmentation in these two lineages. This level also contains the highest appearance of the planktonic Globigerina angipora and G.linaperta as well as the rare occurrence of Guembelitra sp.

Below 3,800 feet - No new species were found below this level and all cores were barren of foraminifera. Foraminifera were found sporadically in cutting samples below 4,400 feet to 6,000 feet, but all species are referable to those found in Zonule H and I. Obviously these foraminifera are contamination, and the fact that *Vulvulina* sp. and *Vaginulinopsis gippslandicus* are present suggests that the contamination came from the vicinity of 3,500 feet.

CORRELATION OF GIPPSLAND SHELF SEQUENCE

(i) Biostratigraphic correlation with other Victorian sequences:

Comparison can now be discussed between the Gippsland Shelf No. 1 zonule scheme and the biostratigraphic schemes of Carter (1958 and 1964), Jenkins (1960) and Wade (1964). This comparison is summarized on Fig.1.

Zonule A - appears to be in a higher position than the top unit of either Jenkins' or Carter's schemes. In fact none of the proposed schemes have a defined top. The fauna of Zonule A is probably environmentally controlled.

Zonule B - is within Carter's definition of Faunal Unit 11 as it contains abundant planktonic fauna. The presence of *Globorotalia menardii moitumida* and *miocenica* with the highest appearance of *G.menardii praemenardii* within the Zonule and *G.mayeri* at its base, is indicative of Jenkins' *G.menardii moitumida* Zone (Zone 11).

Zonule C - the highest range of Jenkins' *G.mayeri* supports comparison with Jenkins' *G.mayeri* Zone (Zone 10). The occurrence of *G.lenguaensis* implies that this is also Wade's *G.mayeri* Zone.

Zonule D - the base of the Zonule is designated to be at the initial appearance of *Orbulina universa*, thus this unit corresponds with the defined base of Carter's Faunal Unit 11. This unit is the equivalent of both Jenkins' and Wade's _O.universa_ Zone and the presence of _Globorotalia conica_ and _G.barisanensis_ are in agreement with Jenkins' findings.

Zonule E - The presence of _O.suturalis_ without _O.universa_ is the criterion of Carter's Faunal Unit 10 and Wade's _suturalis_ Zone. This Zonule is probably within Jenkins' Zones 8 and 7. At this stage in the sequence, Jenkins' zonation is too subtle to be achieved in a normally drilled sequence.

Zonules F and G - missing in the Gippsland Shelf sequence, but if present would contain the events of Wade's _quadrilobatus quadrilobatus_ Zone (= Zonule G) and _bisphericus_ Zone (= Zonule F). Carter has three units (9 to 7) and Jenkins has 4 (7 to 4) in this biostratigraphic interval, but in view of Wade's findings, it is felt that only two units should be reserved in this down-sequence scheme. Carter diagnoses Faunal Unit 9 by the larger foraminiferal association (including _Lepidocyclina_) and clearly demonstrates its position relative to the planktonic sequence. The author considers the association as one of the benthonic markers of Zonule F.

Zonule H - the apparent absence of _Globigerinoides triloba_ but the presence of immature forms (?_Globigerina woodi immatura_) with _G.woodi_ is indicative of Jenkins' _G.woodi_ Zone. This Zone is the equivalent of Carter's Faunal Unit 6.

Zonule I - The highest appearance of _Globorotalia extans_ and _G.opima opima_ with the positive appearance of _G.euapertura_ equates this with Jenkins' _Globoquadrina dehiscens_ Zone (Zone 2). This is the equivalent of Faunal Unit 5, but Carter's main indicator, the adherent _Victoriella conoidea_ is not present in this sequence.

Zonule J - _Chiloguembelina cubensis_ without _Globigerina linaperta_ is the planktonic criterion of Carter's Faunal Unit 4.

Although Carter did not positively identify this unit in Gippsland, he suspected its presence and lately Hocking and Taylor (1964) have recognized it in limited areas. The highest appearance of Globorotalia testarugosa conforms with Jenkins lowest zone, but Zonule J probably represents a larger bio-stratigraphic interval than this zone. Jenkins recorded only 5 specimens of G.testarugosa at the base of his Lakes Entrance Oil Shaft sequence, suggesting that this was the extinction level of the species.

Zonule K - Carter's Faunal Unit 3 is at the top of the range of Globigerina linaperta so that Zonule K is probably at the top of Faunal Unit 3.

(ii) Correlation with Victorian Tertiary Stages:

Carter (1964) has shown the relationship of his faunal units to a revised Victorian Tertiary Stage Classification. As the Gippsland Shelf sequence zonules are equated with Carter's faunal units, then the zonules are made to fit the classification, although the author does not consider them to have any significance in discussion or future correlation of the sequence. For instance Carter differentiates the Mitchellian from the underlying Bairnsdalian on a faunal change which resulted from shallowing water. With regard to water depth, one would expect "facies step out" during mid-Tertiary times from the present on-shore to off-shore areas. As this is evident in the recognized Bairnsdalian (= Zonules D and ?C) it would be expected in the Mitchellian. Recognition of the Mitchellian can only be achieved by determining upper Miocene. Direct faunal correlation is not possible.

Crespin's (1943) stage classification for the Gippsland Basin appears to be a more workable one, but is dependent on facies without real biostratigraphic consideration. In the

Gippsland Basin, Crespin's work did not suggest time-transgressive sedimentation, whilst an application of Carter's faunal unit scheme did, as shown by Hocking and Taylor (1964). It is evident that Crespin's scheme is in reality a rock stratigraphic one and will be discussed later as such.

(iii) Intercontinental correlation:

The sequence can be discussed in terms of accepted world-wide division of the Tertiary period. Wade's (1964) thorough study of both the actual faunas and the massive literature, has placed the southern Australian plantonic sequence within the framework of the European Standard Stage Classification of the Tertiary. More recent overseas literature supports her contentions. Discussion on these matters will be limited to comment on the Gippsland Shelf sequence.

Following Wade's evidence, Zonule K is obviously at the top of the Eocene, Zonule J is lowermost Oligocene, whilst Zonule I occupies the rest of the Oligocene (Chattian). Glaessner (1959) and Wade (1964) both argue that Carter's Faunal Unit 6 can be correlated with the Aquitanian (lowermost Miocene) on its relative position in the planktonic sequence and thus the Oligocene/Miocene boundary is below the general emergence of the distinct "Globigerinoides form". Zonule H is considered as basal Miocene.

The absence of Wade's quadrilobatus quadrilobatus Zone (= Zonule G) and bisphericus Zone (= Zonule G) indicates the absence in the sequence of most of the lower Miocene (Burdigalian). Wade places her suturalis and universa Zones within the Helvetian and her "mayeri" Zone within the Tortonian. Thus Zonules E to C are middle Miocene. Wade's mayeri Zone is equated with Bolli's (1957) mayeri Zone, which marks the highest appearance of Globorotalia mayeri and the incoming of G.lenguaensis. The top of Zonule C is marked by the highest appearance of G.mayeri and the presence of G.lenguanensis. Therefore Zonules B and A are probably within Bolli's menardii Zone and are taken to represent the upper Miocene.

From studies of Carter, Jenkins and Wade, it can be concluded that a marine Tertiary sequence is present from the upper Eocene to at least the middle Miocene in southern Australia. In the case of the Gippsland Shelf No.1 Well a sequence has been shown which extends from the uppermost Eocene to highest Miocene, with a break during the lower Miocene.

(iv) Trans-Tasman correlation:

The proximity of New Zealand would suggest that correlation should be attempted with the Gippsland Shelf sequence. Jenkins (pers.comm.) is currently working on a correlation between the New Zealand Tertiary planktonic sequence and that of the Lakes Entrance Oil Shaft. At this stage comment is premature, but certain features are obvious. It would appear from the descriptions of Hornibrook (1961) and Vella (1964) that Zonules K and J contain Whaingaroan planktonic and benthonic faunas. A characteristic planktonic species of the Whaingaroan is Globigerina reticulata which may be con-specific with Globorotalia testarugosa. Jenkins (1963) places the Whaingaroan astride the Eocene/Oligocene boundary, which is the already correlated position of Zonules K and J. Similarities also exist between the planktonic faunas of Zonule H and the Waitakian Stage which Jenkins (1964) suggests as the base of the Miocene.

Another correlation is the fact that the New Zealand upper Miocene is characterized by the entry of Bolivinita spp. of the B.quadrilatera Gp. Hornibrook (1958) points out that this event occurs slightly earlier in New Guinea. However the presence of Bolivinita sp.1 does correlate Zonule B with the Tongaporutuan Stage of New Zealand.

DEPOSITIONAL HISTORY

(i) Depositional environments:

The generic and specific content of the Gippsland Shelf foraminiferal sequence has permitted biostratigraphic break down but also gives some key to the depositional environment at the time of sedimentation, especially if all facies (bio and litho) are interpreted together. Detailed sedimentology has not been conducted on the sediments, so that a more complete story must await this work. The palaeoecological significance of the faunas in the zonules will be discussed in ascending order.

Zonules K and J (uppermost Eocene to lower Oligocene):
This is within a sandy interval which contains thin bands of carbonaceous material (lignite and/or brown coal). Only sporadic faunas are recorded, but, when present, specimens are fairly abundant. The outstanding feature is the small size of the specimens and the dominance of planktonic species. One thousand specimens were counted in each of three samples with regard to the planktonic/benthonic foraminiferal ratio. The results were: at 3,560-3,570 feet = 70% : at 3,730 to 3,740 feet = 83% : at 3,805 to 3,810 feet = 87%. Throughout the zonule the average size of specimens was less than .25mm. The benthonic fauna consisted predominantly of uvigerinids and bolivinids with a small percentage of arenaceous forms.

Such a high percentage of planktonic forms would suggest an open ocean environment, whilst bolivinid and uvigerinid forms are fairly dominant benthonic constituents of outer shelf deposits. These conclusions do not account for the nature of the sediment, nor the abnormally small size of individual specimens. The explanation is probably that the faunas are "displaced", in that the tests have been washed into an alien environment. The sediments suggest shallow water, marginal marine conditions (lagoonal or swamp). If this environment was separated from the sea by a narrow barrier, then any marked sea-level rise (due to storms or abnormal tides) could cause flooding by marine waters. Strong on-shore winds would bring in the oceanic plankton and could cause turbulence on the sea floor, suspending empty benthonic tests as described by Murray (1965). Under such conditions Murray (l.c.) shows size sorting operates on the foraminiferal tests, thus accounting for the small specimen size in the faunas. The sporadic distribution of the faunas within the interval indicates that the marine connections were not constant throughout the interval. This contention is supported by the lack of any obviously endemic fauna, which would not be established if sea water was diluted by coastal run-off, when the cause of marine flooding desisted. Such conditions exist today in the lagoons on the Gippsland seaboard.

It should be recorded that the delicate tests and the fairly homogenous nature of the fauna does not indicate that it is reworked. The "displacement" is environmental and not stratigraphic, which is substantiated by previous discussions which show that the faunas are not misplaced in the Victorian Tertiary planktonic sequence.

Zonules I and H (upper Oligocene and lowest Miocene):

The sediment is a marl, glauconitic at the base, with a marked faunal change. Planktonic, arenaceous and lagenid species with robust species of Cibicides are the dominant elements. Even at the base of the interval the arenaceous forms reflect an absence of quartz sand as their tests are composed of smaller particle size material. Fairly shallow water conditions, open to the ocean are evident with slow sediment accumulation.

Zonule E (middle Miocene):

Calcareous sandstone with sparse arenaceous and miliolid faunas with occasional planktonic species. Obviously a shallow water swiftly accumulating sediment.

Zonule D (middle to upper Miocene):

Sand content decreases up the section, with marls and limestones present above 2,500 feet. With the decrease in sand the faunas are larger and the planktonic percentage increases as does the percentage of uvigerinid and bolivinid forms. A deepening of the depositional environment is suspected.

Zonules C and B (middle to upper Miocene).

Faunas and sediment similar to that at the top of Zonule D. Shelf conditions are indicated.

Zonule A (upper Miocene).

The sediments are mainly calcareous, but are richly bryozoal. The percentage of planktonic forms is reduced with a marked absence of Globorotalia spp. There is an increase of miliolid and arenaceous forms (virtually absent in Zonules C and B). Shallowing water is evident. The environment is probably an inner shelf one, but certainly not littoral.

Biohermal accumulations are not present within sequence.

(ii) The sequence of depositional events:

This is illustrated on Fig.2. for the Gippsland Shelf Tertiary foraminiferal sequence (from 3,800 feet to 780 feet).

The base of the sequence is of uppermost Eocene age. Sedimentation took place in a marginal marine environment (ex. lagoons) with periodic marine ingressions. During the Oligocene there was a general marine transgression covering the depositional area with shallow water. The fine grained nature of the marl and the formation of glauconite suggests slow sedimentation and isolation from sources of detrital material. This transgression was in fact a basin wide event which extended well into the present on-shore area (probable source areas). During the lower Miocene there was a hiatus which has not yet been recognized on-shore. Sedimentation was resumed in the middle Miocene with the deposition of sand and detrital limestone material. The limestone detritus contains worn bryozoa and larger foraminifera and is suspected to have been reworked from the Glencoe Limestone (refer Carter, 1964) of the Longford District. There was a gradual deepening of water during the middle Miocene, with an apparent reversal of the trend in the upper Miocene. The post Miocene history is not known due to lack of samples.

(iii) Palaeogeography:

Throughout this foraminiferal sequence the climate appears to have been a temperate one with current circulation as is today. This is the opinion of Wade (1964) for southern Australia. Reed (1965) on the study of the Heywood No.10 bore (western Victoria) feels that planktonic faunas described by Jenkins (1960) indicate warmer water conditions for Gippsland than those of western Victoria. Reed's conclusions are not borne out by the author's study of any Victorian Tertiary sequence, and certainly not in the Gippsland Shelf sequence, where the combined percentage of Globoquadrina dehiscens and keeled Globorotalia spp. is never more than 5% of the total planktonic fauna in any sample. There are inherent differences between the western Victorian and Gippsland mid-Tertiary faunas, but the author believes these to be palaeogeographic, as Hopkins's (1965) information does suggest that Bass Strait may not have been a "through-way" between the Otway Basin (western Victoria) and the Gippsland Basin during mid-Tertiary times. Reed's (l.c.) Fig.3 clearly shows that "west wind drift" currents moved south of Tasmania and that the Gippsland Basin would have been fed only by the "east Australian current" which also influences the west coast of

New Zealand. It has been already stated that the Gippsland Shelf faunas are strongly "New Zealandic" in aspect.

The direction of marine influence was from the south and east throughout the Gippsland Shelf Tertiary sequence.

GEOLOGICAL SETTING WITHIN THE GIPPSLAND BASIN

Jenkins (1960) has demonstrated a continuous sequence from lower Oligocene to probably upper Miocene in the Lakes Entrance area. Hocking and Taylor (1964, summarized on fig.4) show that the initial marine Tertiary transgression was of a diachronous nature, being oldest in the then structurally deeper parts of the basin and becoming progressively younger up the flanks of structural highs (ex. the "Baragwanath Anticline"). This transgression extended from the Eocene/Oligocene boundary to lowermost Miocene. Sedimentation on the "Baragwanath Anticline" probably took place only during lower Miocene and may not have covered the entire structure. In the other parts of the Gippsland Basin marine sedimentation apparently continued uninterrupted till upper Miocene and even Pliocene times. Thus on the "Baragwanath Anticline", two hiati are evident in marine deposition. They are (i) a hiatus from uppermost Eocene throughout most of the Oligocene (ii) a post-lower Miocene hiatus.

The Gippsland Shelf No.1 Well is drilled on the culmination of a seismic structure and the results of drilling do not alter any of the general interpretations. However foraminiferal evidence shows that marine influence commenced in the upper Eocene and continued throughout the Oligocene. But there was a hiatus during the lower Miocene and then marine sedimentation resumed in the middle Miocene and continued to at least the upper Miocene.

The "Baragwanath Anticline" and the "Gippsland Shelf Structure" are roughly parallel and their axes some 30 miles apart, yet sedimentation took place on them at different times. For instance lepidocyclinal limestones were deposited on the "Baragwanath Anticline" (as are seen at Brock's Quarry) at a time when a hiatus is evident on the "Gippsland Shelf Structure". Immediately following this, reworked lepidocyclinal limestone is present on the "Gippsland Shelf Structure" during a hiatus on the "Baragwanath Structure". Other differences are illustrated on Fig.2. It must be pointed out that Fig.2 illustrates only the differences between the two structures and is not intended to imply these features in any other part of the Gippsland Basin. The depositional environment has been drawn relative to sea level on the basis of information discussed here and on unpublished work.

Envisaging these two structures as vertically moving blocks (as on Fig.2), then the direction of movement must have been opposed throughout the period in order to account for differences in the Tertiary sequence on each structure.

With regard to litholigcal correlation within the Gippsland Basin, the following conclusion can be drawn on facies similarities.

The facies which contains Zonules K and J are almost identical to those of the sandy unit at the base of the Lakes Entrance Formation in the Lake Wellington Trough (Hocking and Taylor, 1964). This unit is the time equivalent of the Greensand and Colquhoun Gravel Members in the Lakes Entrance area, although the facies are slightly different due to thicker accumulations of glauconite in the latter, which the author regards as an "estuarine backwater".

The faunal elements of Zonules H and I are identical with those of Crespin's (1943) "Janjukian faunas" of the Gippsland Basin and especially of the Micaceous Marl Member of the Lakes

Entrance Formation in the type sections. Crespin's "zonal" foraminifera of her "Janjukian" is Cyclammina incisa (= Haplophragmoides cf. incisa) and the fauna is characterized by arenaceous species. This is one of the faults in Crespin's Stage classification as here "zonal features" are really facies features. Yet it enables us to quickly identify the facies of the Micaceous Marl. The author would place the top of the Lakes Entrance Formation at 3,080 feet in the Gippsland Shelf Well. The base of the Lakes Entrance Formation (sandy unit) is difficult to pick because it is a sand on sand contact with the top of Latrobe Valley Coal Measures and only cuttings are available, but it must be below 3,540 feet. Hocking and Taylor (l.c.) suspected intertonguing of this contact in the Wurruk Wurruk bore, but Carter (1964) gives evidence of erosion at this contact in Woodside No.2 well.

The calcareous sandstone (3,080 to 2,600 feet approx.) containing detrital limestone material is not known elsewhere in the Gippsland Basin but is here explained on structural grounds. It could be considered as a new member of the Gippsland Limestone. The rest of the section to 780 feet is regarded as a deeper water facies of the Gippsland Limestone. Its top is younger than that of the on-shore unit but this is obvious because of "facies stepping out".

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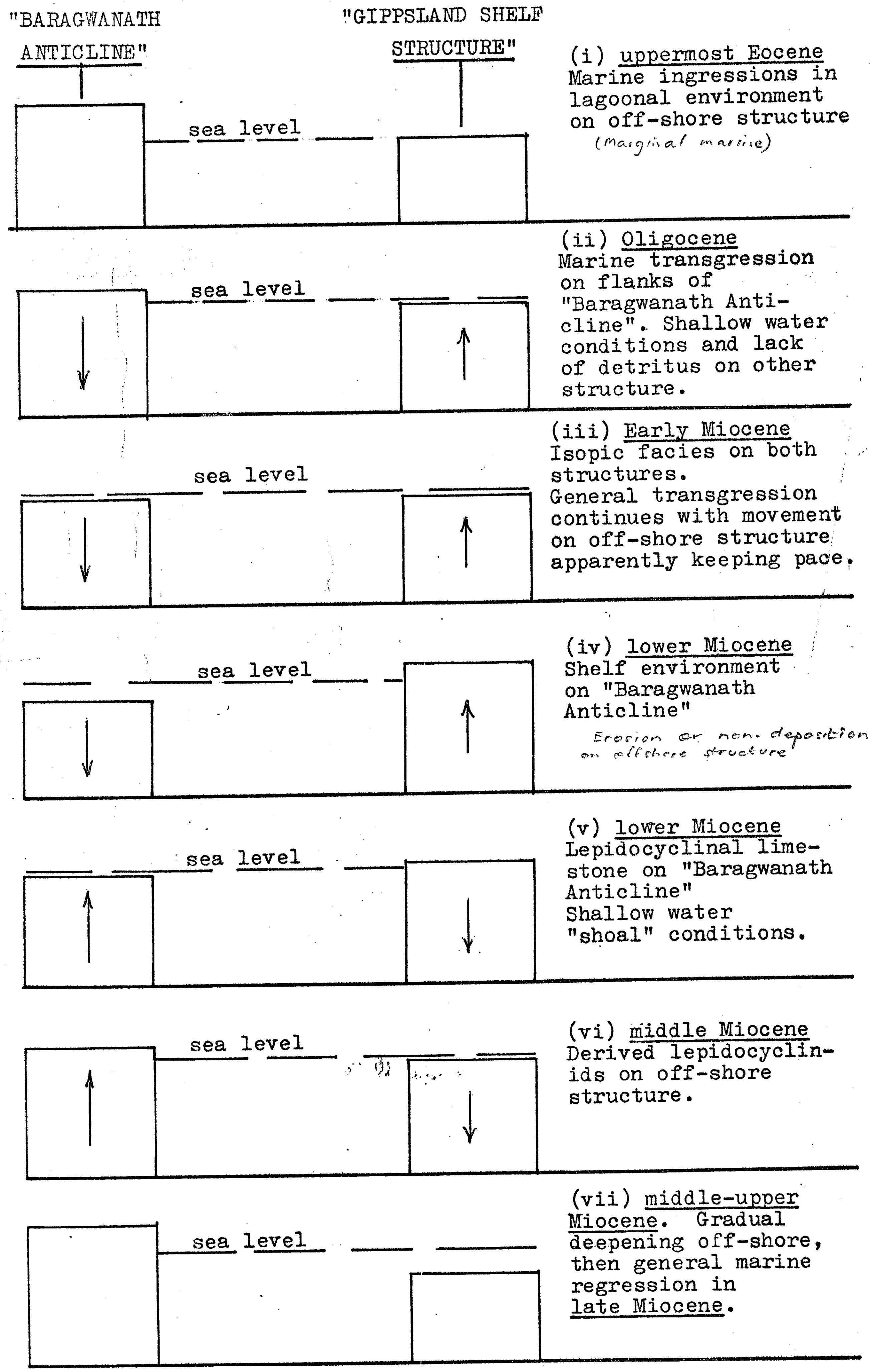


FIG.2 - DIAGRAMMATIC COMPARISON OF STRATIGRAPHIC AND ENVIRONMENTAL SITUATIONS ON BARAGWANATH ANTICLINE AND OFF-SHORE STRUCTURE DURING MID-TERTIARY.

PE900814

This is an enclosure indicator page.
The enclosure PE900814 is enclosed within the container PE902954 at this location in this document.

The enclosure PE900814 has the following characteristics:

ITEM_BARCODE =	PE900814
CONTAINER_BARCODE =	PE902954
NAME =	Barracouta 1 Distribution Chart Foraminifera (App 1.)
BASIN =	GIPPSLAND
PERMIT =	PEP38
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Barracouta 1 Foraminifera Distribution Chart. Figure 1 from Appendix 1, WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W486
WELL_NAME =	Barracouta-1
CONTRACTOR =	Geological Survey of Victoria
CLIENT_OP_CO =	Esso Exploration Australia Inc

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 2

26 pages 1/2
BARRACOUTA - 1.

BASIC

PALYNOLOGICAL EXAMINATION-ESSO GIPPSLAND NO. 1. WELL.

Plant remains present in Esso Gippsland Shelf Well cores 14,15,16,19,20 and 21 were examined, and the samples macerated by the hydrofluoric acid-Schulz solution method and the residues examined under the microscope for acid insoluble microfossils.

Core 14. 5656' - 5685'

Microfloras present include Proteacidites sp. a,b, andc, and Nothofagus species including Nediminuta Cookson. Upper and lower leaf surface cuticular fragments from angiosperm leaves were also common.

Core 15. 6124' - 6139'

Microfloras include Proteacidites sp. a and b; Cyathidites sp, Tseugaepollenites sp, Alesporites sp, and unidentified gymnosperm pollen.
Megaplant remains identified as Pagiophyllum sp. were compared in my preliminary report to P.Chambersi n.sp. (Douglas MS), from Arco Woodside Merriman No. 1. at 5070-5081 feet.

Core 16. 6447' - 6460.5'

Plant mega-remains from this core were tentatively identified in my preliminary report as sphenopsid stems or rhizomes.

Core 19. 7708' - 7731'

Microfloras include Lycopodiumsporites sp, Protracidites sp. a and b Triorites of Edwards; Rugulatisporites sp.

Core 20. 8678' - 8693'

No diagnostic microfloras were isolated.

Core 21. 8693' - 8701'

A very rich microflora was isolated from this core including Nothofagus cf. N.aspera, Nothofagus sp. a and b, Triorites cf. T. edwardsi, Regulatisporites sp., Ginkgocycadophytus SP., Triorites sp, a. Conifer pollens were most infrequent.

Age of the sediments.

Two main points can be made.

1. I can make no distintion in age between any of the samples studied.

2. A continental depositional enviroment is indicated by the apparent absence of marine microfossils.

In the preliminary report on core 14 I stated that the age of the sample was Lower Miocene-Upper Cretaceous, and all microfloras examined from subsequent cores fall into this catagory, although certain species, for example Rugulatisporites sp. indicate that an Eocene-Upper Cretaceous age is most likely for cores 19 - 21. Precise time ranges of many Victorian Upper Cretaceous and lower Tertiary microspores is not known. As no marine fossils indicating Upper Cretaceous age appear to have been found, and Western Victorian Upper Cretaceous sediments are predominantly marine, I think that the sediments intersected by cores 19 - 21 would be best regarded as Eocene or Paleocene in age.

John Douglas.
Geologist.

APPENDIX 5

GAS ANALYSIS

WELL: ESSO - GIPPSLAND SHELF No. 1

COMPONENT \ SAMPLE	Prod. Test No.3 Depth: 3492'-3497' Sample No.2 Flow Rate No.2 Separator Pressure: 610 PSIG Separator Temp: 46°F Date: 21st April, 1965 Time: 0806 Hours.
H, He	N.Dc
O+Ar	TRACE
N	2.0 %
CO	N.Dc
CO_2	0.55%
METHANE	85.9 %
ETHANE	5.78%
PROPANE	3.03%
ISOBUTANE	1.17%
BUTANE	0.52%
ISOPENTANE	0.62%
PENTANE	0.26%
DIMETHYLBUTANES	0.01%
3-METHYLPENTANE	0.08%
2-METHYLPENTANE	0.06%
HEXANE	N.Dc
HEPTANES AND HIGHER	TRACES
H_2S	N.Dc

← Incompatible

99.98

NOTES: 1) N.Dc - Not Detected

2) Composition of the gas, as above, is quoted for the sample on hand at the time of testing only.

3) Analysis by : J. Puchel on 4th May, 1965.

CONDENSATE ANALYSIS

2/6

WELL: ESSO - GIPPSLAND SHELF No.1,

SAMPLE: P. Test No.3; Depth 3492'-3497'; Sample No.2: Date 21. 4. 1965

SAMPLES DETAIL / COMPONENT	TIME: ? SAMPLE No.2 FLOW RATE No.1	TIME: 0740 SAMPLE No.2 FLOW RATE No.2	TIME: 1050 SAMPLE No.2 FLOW RATE No.3	TIME: 1550 SAMPLE No.2 FLOW RATE No.4	TIME: 2340 SAMPLE No.2 FLOW RATE No.5
	%	%	%	%	%
PERMANENT NON-HYDROCARBON GASES + METHANE	0.11	0.03	0.02	0.04	0.02
ETHANE	N.Dc.	0.11	0.02	0.03	0.03
PROPANE	0.32	3.37	3.06	2.48	3.17
I-BUTANE	3.78	8.07	9.53	8.32	8.69
BUTANE	4.75	6.85	8.51	7.07	7.64
ISOPENTANE	29.5	27.9	29.3	29.4	29.5
PENTANE	1.43	0.88	0.89	0.90	0.90
DIMETHYLBUTANES	1.49	1.14	1.15	1.27	1.21
2-METHYLPENTANE	6.65	6.23	6.02	5.84	5.94
3-METHYLPENTANE + CYCLOPENTANE	10.95	9.72	9.45	9.40	9.54
HEXANE	Dc.	0.35	0.33	0.37	0.28
3-ETHYLPENTANE + 2,4 DIMETHYL-BUTANE	3.28	2.55	2.18	2.43	2.38
3,3 DIMETHYLPENTANE + METHYL-CYCLOPENTANE 2,3 - TRIMETHYBUTANE	0.92	0.35	0.23	0.37	0.21
2,2 - AND 2,3 - DIMETHYLPENTANES + CYCLOHEXANE + METHYLHEXANES	5.75	9.52	6.82	9.92	9.60
HEPTANE	Dc.	D.c.	D.c.	0.37	0.27
2,2,4 - TRIMETHYLPENTANE + TETRAMETHYLBUTANES	0.32	0.35	0.19	0.22	0.23
TETRAMETHYLBUTANES + BENZENE	3.77	3.21	2.66	2.98	2.92
DIMETHYLHEXANES + METHYLCYCLOHEXANE + METHYLETHYL PENTANES	2.34	2.19	1.54	1.82	1.83
ETHYLHEXANES + DIMETHYL-HEXANES	4.36	3.55	2.79	3.30	3.49
DIMETHYLHEXANE + METHYL-HEPTANES + CYCLOHEPTANE	2.74	1.95	1.88	1.64	1.97
METHYLHEPTANES	2.91	1.75	2.75	1.59	2.05
OCTANE	D.c.	D.c.	D.c.	D.c.	D.c.
C9 ISO-ALKANES (TRIMETHYL- + ETHYL-) + TOLUENE	5.97	4.35	4.93	4.03	3.76
OTHER C9 AND HIGHER	8.70	5.55	5.78	6.20	4.34

NOTES:

1) N.D.c NOT DETECTED

2) D c. Detected but unable to estimate

3) a. Samples were supplied in loosely-sealed tin containers.
   b. Composition of condensates, as above, is quoted for the samples on hand at the time of testing only.

4) Ananlysis by: J. Puchel on 16th June, 1965.

GAS ANALYSIS

Well: Gippsland Shelf No.1

3/6

SAMPLE / COMPONENT	Test No.2 Flow 3 MMCF/D (4.87) Depth: 3752'-3756' Time: 1300 Hrs. Date: 12.4.65	Flow 3 MMCF/D (4.87) Separator Pressure 615 PSI Separator Temp. 62°F Time: 1315 Hrs. Date: 12.4.65
H1 He	Trace	N.Dc.
O+Ar	0.102%	0.09%
N	1.30%	1.50%
CO	N.Dc.	N.Dc.
CO_2	0.59%	0.83%
Methane	86.7%	87.1%
Ethane	6.15%	5.38%
Propane	2.83%	2.98%
Iso-Butane	1.00%	1.03%
Butane	0.447%	0.484%
Iso-Pentane	0.607%	0.490%
Pentane	0.018%	0.015%
Neo-Hexane	0.024%	N.Dc.
Other Hexane and Higher	0.238%	0.174%
H_2S	Nil	Nil

100.073

NOTE: 1, N.Dc. - Not Detected.

2, Analysis by: J. Puchel.

✓

4/6

CONDENSATE ANALYSIS

Well: Gippsland Shelf No.1

Sample: Test No.2, Depth: 3752'-3756', Flow Rate 3 MMCF/D,
Time 1300 hours, Date 12.4.65.

Sample Container: One gallon screw-cap tin.

COMPONENT	%	COMPONENT	%
N+O	0.01	2,2,3,3 - Tetramethyl Butane) Trimethylpentanes)	0.26
CO_2	N.Dc.		
Methane	N.Dc.	Benzene +2,2,4 Trimethy-pentane	2.69
Ethane	0.27	Methylethypentanes + Methy-cyclohexane	1.06
Propane	0.45	Ethylhexanes + Dimethyl-hexanes	0.69
Isobutane	8.97	Dimethylhexanes + Cyclo-heptane	1.10
Butane	7.39	Methylheptane	2.21
Iso-pentane	25.6	Octane	1.83
Pentane	0.92		
Dimethylbutanes	1.15	C_9-Isoaliphatics + Toluene+) C_8 Cycloaliphatics)	9.80
3-Methylpentane	5.78		
2-Methylpentane	9.32		
Hexane	0.48	C_9 Aliphatics + C_8 Aromatics +) C_9 Cycloaliphatics + Higher)	8.16
3-Ethylpentane) 2,4-Dimethypentane)	2.55		
3,3-Dimethylpentane + Methyl-cyclopentane) +2,2,3-Trimethyl Butane)	0.30		
2,2 and 2,3-Dimethylpentanes) Cyclohexane)	0.79		
Methylhexanes	6.22		
Heptane	2.01		

Additional characteristics: Results from F.I.A. Chromatography indicate ratio $\frac{\text{ALIPHATICS}}{\text{AROMATICS}}$ = 2 (approx.)

NOTE: 1, N.Dc. - Not Detected.

2, Analysis by : J. Puchel

5/6

GAS ANALYSIS

WELL: GIPPSLAND SHELF No. 1

Component \ Sample	From Perforations 3808' - 3815' ← 3809 - 3814
H & He	Trace
O & Ar	0.122%
N	1.30 %
CO	Nil
CO_2	0.59 %
Methane	86.70 %
Ethane	6.15 %
Propane	2.81 %
Iso-Butane	1.00 %
Butane	0.447%
Iso-Pentane	0.607%
Pentane	0.108%
Neo-Hexane	0.024%
Iso-Hexanes	0.138% 0·162
Hexanes	Trace
H_2S	Nil
	99.996

Analysis by: J. Puchel

6/6

Water Analysis

Altona Petrochemical Company Pty. Ltd.

A bulk sediment and water test was requested for each of the four dump tank samples.

Results were -

Sample	1	2	3	4
Rate No.	1	2	3	4
B.S. & W. % vol.	32	30	30	30.5

The above test is carried out by adding 50 mls. of toluene to 50 mls. of sample, shaking and then centrifuging. The B.S. & W. result is determined from the volume of separated water and heavier materials. In each case there were distinct layers of "clay", dark grey emulsion and water (in order of decreasing density). The hydrocarbon layer in each case contained considerable light emulsion. The percentage represented by the various layers were -

Sample	1	2	3	4
"Clay" (as vol. percent of the original 50 ml. sample)	7.5	8	7	6.5
Dark grey emulsion (as vol. percent of the original 50 ml. sample)	18.5	12	13	10
Water (as vol. percent of the original 50 ml. sample)	6	10	10	14
Emulsion in Hydrocarbon Layer (as % of the total 100 ml. volume in the centrifuge tube)	24	40	55	50

Additional tests to those previously reported have been carried out on the water sample submitted by you on April 6, 1965.

The additional results are -

Carbonate p.p.m.	6
Bicarbonate p.p.m.	540
Total dissolved solids p.p.m.	1,380

Results of water samples submitted previously on April 6, 1965.

cl	430 p.p.m.
cl as Nacl	710 p.p.m.
Ca	34 p.p.m.
Mg.	25 p.p.m.

APPENDIX 4

CORE, MUD AND CUTTINGS ANALYSIS

FOR

ESSO EXPLORATION AUSTRALIA INC.,

GIPPSLAND SHELF NO. 1 WELL

WILDCAT Barracouta-1.

VICTORIA, AUSTRALIA

BY

CORE LABORATORIES AUSTRALIA (VIC) LTD.

31st May, 1965

ESSO EXPLORATION AUSTRALIA INC.,
BOX 4047, G.P.O.,
SYDNEY. N.S.W.

ATTENTION: MR. A.A. PHILLIPS.

SUBJECT: CORE, MUD AND CUTTINGS ANALYSIS
GIPPSLAND SHELF NO. 1 WELL,
WILDCAT,
VICTORIA, AUSTRALIA.

GENTLEMEN:

A CORE LABORATORIES AUSTRALIA combination drill cuttings and core analysis unit was present at the site of the subject well during drilling operations from 767 feet to total depth of 8701 feet.

Using standard equipment plus a Programmed Hydrocarbon Detector (rapid sampling gas Chromatograph) the drilling fluid was monitored continuously for hydrocarbon content and the drill cuttings were checked at regular intervals for gas and oil content and lithology. All core analysis was performed by conventional procedures. The results of these operations are shown on the accompanying Grapholog and Coregraph. Core descriptions are shown on the Grapholog.

Hydrocarbon Shows and Core Analysis:
There were no shows of gas or oil from 767 to 3450 feet. From 3450 through 3800 feet we logged high mud gas readings consisting primarily of Methane with some Ethane, Propane, and Butane. Cuttings gas readings were generally low during this interval suggesting a highly permeable reservoir.

From 4800 to 6109 feet samples were generally poor and the gas increases in this interval might be worth further testing if found to be from sand sections. The gas increases from 6550 to 6575 feet and 7825 to 7860 feet appear to be significant and worthy of further investigation. All gas increases from 7860 feet to total depth appear to be of Coal and Siltstones origin.

Good oil fluorescence was only noted in one half foot from 8692½ to 8693. This sample gave an excellent cut in Carbon-tetra chloride however, core analysis indicated low permeability.

We sincerely appreciate the opportunity to have been of service and trust that the information furnished in this report and during drilling operations has assisted the evaluation of this well.

Very truly yours,
CORE LABORATORIES AUSTRALIA (VIC) LTD.

Joe B. McAdams

JOE B. MC ADAMS,
RESIDENT MANAGER

PE602711

This is an enclosure indicator page.
The enclosure PE602711 is enclosed within the container PE903915 at this location in this document.

The enclosure PE602711 has the following characteristics:

```
     ITEM_BARCODE = PE602711
CONTAINER_BARCODE = PE903915
             NAME = Barracouta 1 Completion Coregraph Log
            BASIN = GIPPSLAND
           PERMIT = PEP38
             TYPE = WELL
          SUBTYPE = WELL_LOG
      DESCRIPTION = Barracouta 1 Completion Coregraph Log
                    (from Appendix 4 WCR)
          REMARKS =
     DATE_CREATED = 30/09/95
    DATE_RECEIVED =
             W_NO = W486
        WELL_NAME = Barracouta-1
       CONTRACTOR = Core Lab (Australia) Ltd
     CLIENT_OP_CO = Esso Exploration Australia Inc
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE602712

This is an enclosure indicator page.
The enclosure PE602712 is enclosed within the container PE902954 at this location in this document.

The enclosure PE602712 has the following characteristics:

```
     ITEM_BARCODE = PE602712
CONTAINER_BARCODE = PE902954
             NAME = Barracouta 1 Grapholog
            BASIN = GIPPSLAND
           PERMIT = PEP38
             TYPE = WELL
          SUBTYPE = MUD_LOG
      DESCRIPTION = Barracouta 1 Grapholog (from Appendix
                    4, WCR)
          REMARKS =
     DATE_CREATED = 30/09/95
    DATE_RECEIVED =
             W_NO = W486
        WELL_NAME = Barracouta-1
       CONTRACTOR = Core Lab (Australia) Ltd
     CLIENT_OP_CO = Esso Exploration Australia Inc
```

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 5

BARRACOUTA-1
Page 1 of 2
BASIC

APPENDIX V

LIST & INTERPRETATION OF ELECTRICAL LOGS

Induction Electric Log

Run No.	Interval
1	687 - 1599
2	1400 - 3052
3	2974 - 4327
4	2976 - 6103
5	6086 - 7621
6	7421 - 8690

Micro Laterolog

1	687 - 2008
2	1800 - 3050
3	2976 - 4330
4	2974 - 6100
5	6087 - 7622
6	7422 - 8701

Sonic Gamma Ray Caliper

1	687 - 2011
2	1800 - 3039
3	2973 - 4318
4	2973 - 6092
5	6084 - 7612
6	7560 - 8685

Laterolog

1	2974 - 6100
2	6087 - 8701

Continuous Dip Meter

1	688 - 3049
2	2976 - 6100
3	6086 - 7620
4	7500 - 8685

Cement Bond Log

1	2604 - 5988
2	3100 - 3478

Gamma Ray Collar Locater

1	3000 - 5997

ELECTRIC LOG ANALYSIS

2/2

Gippsland Limestone

Interval	% Porosity	Rwa ohms	Fluid Content	Lithology
3040-3046	22	.03	Water	Sandstone
3046-3041	14	.03	Water	Sandstone
3143-3147	10	.035	Water	Limestone

Lakes Entrance

Interval	% Porosity	Rwa ohms	Fluid Content	Lithology
3290-3296	37	.225(?)	Water	Shale-marl

Latrobe Valley Coal Measures

Interval	% Porosity	Rwa ohms	Fluid Content	Lithology
3459-3467	30	3.8	Hydrocarbon	Sandstone
3467-3471	31	3.8	"	"
3471-3478	33	3.8	"	"
3527-3532	35	5.0	"	"
3544-3558	2	5.0	Tight	Dolomite
3564-3656	35	5.0	Hydrocarbon	Sandstone
3707-3718	32	8.0	"	"
3749-3759	28	8	"	"
3772-3778	28	7.5	"	"
3799-3803	35	8.5	"	"
3809-3815	30	9.0	Hydrocarbon/water	"
3846-3855	32	2.0	Water	"
3924-3932	27	2.0	"	"
4045-4068	28	1.6	"	"
4309-4318	26	1.0	"	"
5473-5496	25	1.5	"	"
5759-5799	30	1.9	Water/HC?	"
5935-5943	27	1.7	Water	"
6300-6311	26	.045	Water	"
6731-6757	24	.045	Water	"
7199-7261	20	.045	Water	"
7514-7570	20	.045	Water	"
7845-7854	19	.045	? H.C.	"
8281-8360	20	.045	Water	"
8660-8666	20	.045	Water	"

APPENDIX G

Pge 1 of 4

BASIC

DEPT. NAT. RES & ENV

PE903917

APPENDIX VI

VELOCITY SURVEY

ESSO GIPPSLAND SHELF NO. 1

by

K.A. Richards

A. INTRODUCTION

In anticipation of the short notice which would be given prior to the actual date of the velocity survey of Esso Gippsland Shelf-1, Esso entered into an agreement with Western Geophysical Co. in January 1965. In effect, Esso agreed to pay Western a standby fee on the basis that Western would furnish and maintain, at Sale, Victoria, the following equipment:

1. Two Model GCE101 Pressure Sensitive Well Geophones.
2. One S.I.E. P-11 Amplifier (12 channels) with Input Switching Unit, Test Oscillator, and Power Supply.
3. One Portable Camera (12 trace)
4. Necessary Batteries and Battery Charger
5. Portable Developing System
6. Two Blasters (Battery Type 300 volts)
7. Three Kaar TR 327 Radios (C.B. Type)
8. Two RC-5 Remote Control Units for Shooters Radio
9. Two TA-12 Amplifier Units for Radio Time Break Recording
10. Spare Parts for above.

In addition Western furnished one instrument operator and one marine shooter five days in advance of the actual planned shooting date. Western also chartered a fishing boat (approximately 50 ft. in length) from F.H. Stevens Pty. Ltd. to act as a shooting boat.

The survey was set up and then cancelled several times due to both operational problems on the Glomar III and bad weather. These cancellations added considerably to the cost of the survey.

B. SURVEY PROCEDURES

The survey was eventually carried out on 22nd May, 1965. Weather conditions were very marginal at the start and deteriorated even further during the course of the survey.

1. Shot Positioning

Prior to the start of the survey, buoys were placed on both sides of Glomar III at distances of approximately 1000 ft. and 1500 ft. from the well site. Glomar III was anchored with an approximately north-south orientation and the buoys were on an approximate east-west line passing through the well site. Due to rough weather, several of the buoys broke away, but they were replaced just prior to the survey.

A reference geophone was lowered 25 ft. below the water in the moon-pool and was used to record the water break.

It has been planned to shoot from the eastern shot points during the run into the hole and the western shot points on the way out. However, the Glomar III provided sufficient protection from the rough weather only for the 1000 ft. eastern shot point, thus this was by far the best shot point to use. In fact, during the survey the other shot points, especially on the west side, were considered to be too dangerous to shoot with such a small boat and improvised equipment.

All nine shots were thus taken from the 1000 ft. east shot point. Unfortunately the first shot destroyed the buoy at this location, and the distances had to be guessed by the shooter, a task which he performed remarkably well. Actual distances were calculated from the water break, which was our original intention, whether the buoy had remained in position or not.

2. Charge Size

It was intended to shoot 25 lb. charges from the 1000 ft. positions and heavier charges from the 1500 ft. positions. An attempt was made to use the 1500 ft. east shot point for a 50 lb. shot but conditions at the time proved too rough. The whole survey was thus shot with 25 lb. charges in the vicinity of the 1000 ft. east shot point.

3. Well Geophone Positioning

Schlumberger has been using a specially designed motion compensating device to keep logging tools from moving up and down severely with the motion of the drilling vessel. This device was used during the velocity survey and as far as could be judged, worked well. Schlumberger depths were used in the velocity survey.

4. Instrument Set Up

The seismic instruments were set up in a hold of the ship adjacent to the Schlumberger Lab. This afforded protection from the wind and spray but resulted in some communications difficulty, and interfered somewhat with the general operation of the Glomar III. Shots were fired in the normal manner.

5. Instrument Settings

Seven traces were utilised on the survey records. Traces (1) to (4) recorded the well geophone break. Trace (4) had the highest gain level followed by trace (2), then (1), then (3) which had the lowest. Traces (1) and (2) were recorded with a slightly higher filter setting than (3) and (4).

Traces (5) and (6) recorded the reference phone break. Trace (6) had a higher gain level than (5). Both had a high frequency filter setting. The time break was recorded on trace (7). The well geophone broke down and the reference geophone broke up.

C. RESULTS

Nine shots and a polarity check were taken (Fig. 1). Six levels were recorded, those being repeated were 3458 ft., 5372 ft. and 7550 ft. Copies of the records are included in the back of the report.

Fair and certainly reliable breaks were recorded at the 2500 ft. level on one run and at the 3458 ft. level on both runs. An apparently fair break was also recorded at the 4500 ft. level. Below 4500 ft. the signal to noise level was very poor and an obvious break could not be identified. However, the choice of a legitimate break narrowed itself down to two or three choices. Each possibility has been calculated and plotted on Fig. 2.

The noise level was high on all records and got worse as the survey progressed, due undoubtedly to the worsening weather.

The velocity survey results have been plotted on Plate I. The integrated Sonic Log curve has been tied to the 3458 ft. level and also plotted on Plate I. It is apparent that the 2500 ft. level falls very close to the subsequent curve. Also if velocity data from nearest land wells (e.g. Wellington Park-1) are used to tie the integrated sonic curve then they also give a close fit to the curve of Plate I. Thus we are confident that the integrated Sonic Log curve can be tied to an absolute time value using the 3458 ft. level.

Unfortunately there our confidence ends. Despite our grading of the quality of the 4500 ft. level record, this point falls so far off the curve that it cannot possibly be correct. There is a possibility that 4500 ft. was not the depth of the well geophone at this shot. Unfortunately this was one of the two depths at which Schlumberger was not checked by Esso personnel.

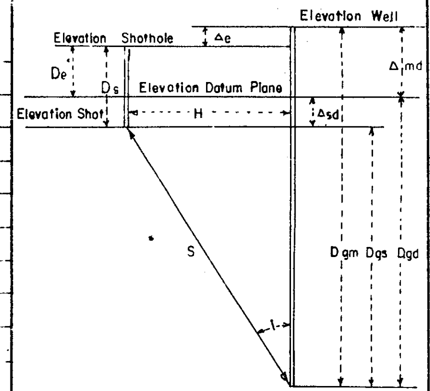
As stated above, the deeper levels have poor signal to noise ratios and two of three possible breaks can be chosen. The presence of two records at both the 7550 ft. and 5372 ft. levels helps narrow the choice considerably. One of the possibilities from the 7000 ft. and 7550 ft. level record falls close to the plotted curve so that in all probability a true break was recorded here.

D. CONCLUSIONS

1. The velocity survey was successful in tying the integrated Sonic Log into absolute time values.
2. The velocity survey was not sufficiently accurate to check the exactness of the correlation of each individual Sonic Log run.

	Shothole information:- Elevation, Distance & Direction from Well	Company	Well	Elevation (Derrick Floor)	Total Depth	LOCATION
	④ ③ ② ① E < 500 × 1000 × 1000 × 500 >	ESSO EXPLORATION AUSTRALIA INC.	GIPPSLAND SHELF NO. 1	31 ft.		Coordinates: Lat. 38°16'41"S Long. 147°42'45"E Section, Township, Range: County: Area or Field:

Record Number	Shothole Number	Time of Shot	Dgm	Ds	tus	tr	T Reading	T Polarity	T Grade	Dgs	H	∠ i	log cos i	Tgs	Δsd	Δsd/V	Tgd	Tgd Average	Dgd	Δ Dgd	Δ Tgd	Vi Interval Velocity	Va Average Velocity
9	2	1325	2500	0		0.167	0.334		F	2469	835	18°41'	$\bar{1}.9764$	0.316			0.316	0.316	2469	958			7807
1	2	1100	3458	0		0.216	0.463		F	3427	1130	18°15'	$\bar{1}.9776$	0.440			0.440	0.440	3427				7793
8	2	1310	3458	0		0.220	0.462		F	3427	1100	17°48'	$\bar{1}.9787$	0.440			0.440			1042			
7	2	1300	4500	0		0.211	0.644		F	4469	1055	13°17'	$\bar{1}.9882$	0.627			0.627	0.627	4469				7131
	Positive break identification was not possible on any level below 4500 ft. due to a reduction ~~in the signal~~ to noise level - However in most cases the choice of a break could be narrowed down to two possibilities - Because a statistical analysis of these possibilities is enlightening each has been calculated - For a further discussion read the accompanying report.																						
3	2	1135	5372	0		0.221	0.621			5341	1105	11°41'	$\bar{1}.9909$	0.608			0.608	0.611	5341	872			
"	"	"	"	"		"	0.720			"	"	"	"	0.705			0.705	0.702	"				
2	2	1125	5372	0		0.212	0.625			5341	1060	11°14'	$\bar{1}.9915$	0.613			0.613						
"	"	"	"	"		"	0.713			"	"	"	"	0.699			0.699			1628			
5	2	1215	7000	0		0.222	0.710			6969	1110	9°3'	$\bar{1}.9946$	0.701			0.701	0.701	6969				
"	"	"	"	"		"	0.799			"	"	"	"	0.789			0.789	0.789	"	550			
4	2	1155	7550	0		0.235	0.840			7519	1175	8°53'	$\bar{1}.9947$	0.830			0.830	0.846	7519				
"	"	"	"	"		"	0.910			"	"	"	"	0.899			0.899	0.894	"				
"	"	"	"	"		"	0.749			"	"	"	"	0.740			0.740	0.736	"				
6	2	1225	7550	0		0.204	0.869			7519	1020	7°43'	$\bar{1}.9961$	0.861			0.861						
"	"	"	"	"		"	0.896			"	"	"	"	0.889			0.889						
"	"	"	"	"		"	0.739			"	"	"	"	0.732			0.732						
10		1345	POLARITY CHECK - T.B. -DOWN; REFERENCE PHONE-UP; WELL PHONE - DOWN.																				



D_{gm} = Geophone depth measured from well elevation
D_{gs} = " " " " shot "
D_{gd} = " " " " datum "
D_s = Depth of shot
D_e - Shothole elevation to datum plane
H = Horizontal distance from well to shotpoint
S = Straight line travel path from shot to well geophone
t_{us} = Uphole time at shotpoint
T = Observed time from shotpoint to well geophone.
t_r = " " " to reference geophone.
Δe = Difference in elevation between well & shotpoint.
Δsd = " " " " shot & datum plane
$\Delta sd = D_s - D_e$
$D_{gs} = D_{gm} - D_s \pm \Delta e$; $\tan i = \frac{H}{D_{gs}}$
$T_{gs} = \cos i\ T$ = Vert. travel time from shot elev to geophone
$T_{gd} = T_{gs} \pm \frac{\Delta sd}{V}$ = " " " " datum plane " "
$D_{gd} = D_{gm} - \Delta md$
V_i = Interval velocity = $\frac{\Delta D_{gd}}{\Delta T_{gd}}$
V_a = Average = $\frac{D_{gd}}{T_{gd}}$

Surveyed by: Western Geophysical Co.
Date: 22/5/65
Weathering Data:

Casing Record
6081 ft.

4/4

BARRACOUTA - 1.

BASIC

Page 1 of 5.

(3 charts)

DEPT. NAT. RES & ENV

PE903918

APPENDIX 7

Production Tests

Zone No. 1 Perforated with one jet shot per foot from 3809'-3814'

(1) Clean-up Test Through Separator

Time - (1 hr. 55 mins.)	1630-1825 hours
Average Temperature	81.6°
Average Differential - Inches of W.C. (Corrected)	22.93"
Average Static Pressure	640 psig.
Range of Separator Pressure	640-670 psig.
Choke Size	1/8" Positive
Orifice Plate	1.0"
Range of Flowing Tubing Pressure	1050-1100 psig.
Fluid Recovery (Oil Meter Volumes)	
Rate per last hour of test	345.6 BPD
During test recovered 35.9 bbl of water (14.9 bbl out of formation)	
Gas Per Day	0.69 MMCF

(2) Production Test

Time - (2 hr. 35 mins.)	0825-1100 hours
Average Temperature	99.4° F
Average Differential - Inches of W.C. (Corrected)	9.71"
Average Static Pressure	441 psig.
Choke Size	32.5"/64
Orifice Plate	2.0"
Range of Flowing Tubing Pressure	670-750 psig.
Fluid Recovery - 750 BPD (Water with Trace of Distillate)	
Gas Per Day	1.63 MMCF

Zone No. 2 Perforated with one jet shot per foot from 3752'-3756'

(1) Clean-up Test

Time - (1 hr. 2 mins.)	1910-2012 hours
Average Temperature	55° F
Average Differential - Inches of W.C. (Corrected)	7.8
Average Static Pressure (Corrected)	597 psig.
Range of Separator Pressure	570-660 psig.
Range of Flowing Tubing Pressure	1350-1480 psig.
Choke Size	16/64"
Orifice Plate	1.50"
Fluid Recovery	
Rate per day at this Gas Rate	17 BPD
Rate per day/MMCF	17.7 BPD
Gas Per Day	0.96 MMCF/Day

(2)

Time - (1 hr. 5 mins.)	0503-0608 hours
Average Temperature	54.2°
Average Differential - Inches of W.C. (Corrected)	48.17"
Average Static Pressure (Corrected)	611 psig.
Range of Separator Pressure	630-740 psig.
Choke Size.	20/64"
Orifice Plate	1.50"
Range of Flowing Tubing Pressure	1140-1260 psig.
Fluid Recovery (Oil Meter Volumes)	
Rate per day at this Gas Rate	68 BPD
Rate per day/MMCF	27.5 BPD
Gas Per Day	2.475 MMCF

Cont'd...

(3)	Time - (1 hr. 2 mins.)	0608-0710 hours
	Average Temperature	45.9°
	Average Differential - Inches of W.C. (Corrected)	58.6"
	Average Static Pressure (Corrected)	567 psig.
	Range of Separator Pressure	560-650 psig.
	Choke Size	16/64"
	Orifice Plate	1.50"
	Range of Flowing Tubing Pressure	1340-1370 psig.
	Fluid Recovery (Oil Meter Volumes)	
	Rate per day at this Gas Rate	48.7 BPD
	Rate per day per MMCF	19.2 BPD
	Gas Per Day	2.54 MMCF
(4)	Time - (1 hr. 25 mins.)	0915-1040 hours
	Average Temperature	50.1° F
	Average Differential - Inches of W.C. (Corrected)	33.5"
	Average Static Pressure (Corrected)	583 psig.
	Range of Separator Pressure	580-660 psig.
	Choke Size	18/64"
	Orifice Plate	2.0"
	Range of Flowing Tubing Pressure	1090-1290 psig.
	Fluid Recovery (Oil Meter Volumes)	
	Rate per day at this Gas Rate	75 BPD
	Rate per day/MMCF	20.4 BPD
	Gas Per Day	3.67 MMCF
(5)	Time - (1 hr. 17 mins.)	1225-1342 hours
	Average Temperature	59° F
	Average Differential - Inches of W.C. (Corrected)	59.7
	Average Static Pressure - (Corrected)	603 psig.
	Range of Separator Pressures	630-670 psig.
	Choke Size	22/64"
	Orifice Plate	2.0"
	Range of Flowing Tubing Pressures	920-1000 psig.
	Fluid Recovery (Oil Meter Volumes)	
	Rate per day at this Gas Rate	74 BPD
	Rate per day/MMCF	15.2 BPD
	Gas Per Day	4.87 MMCF
(6)	Time - (2 hr. 48 mins.)	1512-1800 hours
	Average Temperature	68° F
	Average Differential - Inches of W.C. (Corrected)	17.65"
	Average Static Pressure (Corrected)	601 psig.
	Range of Separator Pressure	575-660 psig.
	Choke Size	28/64"
	Orifice Plate	3.0"
	Range of Flowing Tubing Pressure	850-1030 psig.
	Fluid Recovery (Oil Meter Volumes)	
	Rate per day at this Gas Rate	73.5 BPD
	Rate per day/MMCF	10.7 BPD
	Gas Per Day	6.85 MMCF

Zone No. 3 Perforated with one jet shot per foot from 3492'-3497'

(1) Clean-up Test Through Separator

Time - (2 hr. 45 mins.)	1915-2200 hours
Average Temperature	44.6° F
Average Differential - Inches of W.C. (Corrected)	34.3"
Average Static Pressure (Corrected)	614 psig.
Average Separator Pressure	635 psig.
Choke Size	3/8" Positive
Orifice Plate	2.0"
Average Flowing Tubing Pressure (Range 1200-1300 psig)	1260 psig.

Cont'd...

Fluid Recovery (Oil Meter Volume)
1900-1930 Fill Separator
1930-2200 hours - recovered 6.0 bbl in 2.5 hrs.

Rate per day at this gas rate	57.6 BPD
Rate per day per MMCF	15.4
(Seas rough. Tank gauges not accurate)	
Gas Per Day	3.77 MMCF

(2)

Time - (1 hr. 21 mins.)	0654-0815 hours
Average Temperature	48.9° F
Average Differential - Inches of W.C. (Corrected)	8.3"
Average Static Pressure (Corrected)	604 psig.
Average Separator Pressure	623 psig.
Choke Size	3/16" Positive
Orifice Plate Size	1.5"
Average Flowing Tubing Pressure (Corrected)	1484 psig.
(Range 1480-1490 psig)	
Fluid Recovery (Oil Meter Volumes)	
0654-0815 recovered 0.9 bbl in 1 hr. 21 mins.	
Rate per day at this gas rate	16.0 BPD
Rate per day/MMCF	16.2 BPD
(Seas rough. Tank gauges not accurate)	
Gas Per Day	0.985 MMCF

<u>Summary of Test - Best Period of Test</u>

Time - (45 mins.)	0730-0815 hours
Average Temperature	45.5° F
Average Differential - Inches of W.C. (Corrected)	7.7"
Average Static Pressure (Corrected)	607 psig.
Average Separator Pressure	617 psig.
Choke Size	3/16" Positive
Orifice Plate Size	1.5"
Average Flowing Tubing Pressure (Corrected)	1486 psig.
(Range 1485-1490 psig)	
Fluid Recovery (Oil Meter Volumes)	Use same rate as above
Gas per day	0.948 MMCF

(3)

Time (1 hr. 51 mins.)	0950-1141 hours
Average Temperature	40° F
Average Differential - Inches of W.C. (Corrected)	35.6"
Average Static Pressure (Corrected)	628 psig.
Average Separator Pressure	642 psig.
Choke Size	3/8" Positive
Orifice Place Size	2.0"
Average Flowing Tubing Pressure (Corrected)	1321 psig.
(Range 1318-1323 psig)	
Fluid Recovery (Oil Meter Volumes)	
0950-1141 recovered 2.63 bbl in 1 hr. 51 mins.	
Rate per day at this gas rate	34.1 BPD
Rate per day/MMCF	8.8 BPD
(Seas rough. Gauge not accurate)	
Gas per day	3.86 MMCF

<u>Summary of Test - Best Period of Test</u>

Time - (56 mins.)	1045-1141 hours
Average Temperature	41° F
Average Differential - Inches of W.C. (Corrected)	35.2"
Average Static Pressure (Corrected)	636 psig.
Average Separator Pressure	650 psig.
Choke Size	3/8" Positive
Orifice Plate Size	2.0"
Average Flowing Tubing Pressure (Corrected)	1321 psig.
(Range 1318-1323 psig)	
Fluid Recovery (Oil Meter Volumes)	Use same rate as above
Gas per day	3.89 MMCF

Cont'd...

(4)	Time - (2 hr. 48 mins.)	1515-1803 hours
	Average Temperature	36.2° F
	Average Differential - Inches of W.C. (Corrected)	15.0"
	Average Static Pressure (Corrected)	406 psig
	Average Separator Pressure	435 psig
	Choke Size	30.5"/64 Adjustable
	Orifice Plate Size	3.0"
	Average Flowing Tubing Pressure (Corrected) (Range 1075-1250 psig)	1110 psig
	Fluid Recovery (Tank Gauge Volumes)	
	During the test the Oil Dump Valve cut out Gas and fluid throttled through valve causing freezing in oil meter. Fairly accurate gauges taken on tank.	
	1515-1803 recovered 8.6 bbl of fluid	
	Rate per day at this gas rate	79.4 BPD
	Rate per day/MMCF	14.8 BPD
	Gas per day	5.36 MMCF

<u>Summary of Test - Best Period of Test</u>

Time - (28 mins.)	1735-1803 hours
Average Temperature	43°F
Average Differential - Inches of W.C. (Corrected)	17.0"
Average Static Pressure (Corrected)	417 psig.
Average Separator Pressure	446 psig.
Choke Size	30.5"/64 Adjustable
Orifice Plate Size	3.0"
Average Flowing Tubing Pressure (Corrected) (Range 1105-1115 psig)	1110 psig.
Fluid Recovery (Tank Guage Volumes)	Use same rate as above
Gas per day	5.69 MMCF

(5)	Time - (2 hr. 24 mins.)		2232-2456 hours
	Average Temperature		36.5° F
	Average Differential - Inches of W.C. (Corrected)		12.6
	Average Static Pressure (Corrected)		406 psig.
	Average Separator Pressure		437 psig.
	Choke Size		26.5"/64 Adjustable
	Orifice Plate Size		3.0"
	Average Flowing Tubing Pressure (Corrected) (Range 1228-1243 psig.)		1235 psig
	Fluid Recovery (Oil Meter Volumes)		
	Oil meter placed back in service. Separator was dumped manually during test.		
	2232-2317 hours - Fill Separator to low dump mark.		
	2317-0056 Recovered	3.46 bbl fluid	
	End of Test dumped to low d. mark	2.02 bbl fluid	
	Recovered in 1 hr. 39 mins.	5.48 bbl fluid	
	Rate per day at this gas rate		50.3 BPD
	Rate per day/MMCF		10.2 BPD
	Gas per day		4.92 MMCF

Contd...

Summary of Test - Best Period of Test

Time - (31 mins.)	0025-0056 hours
Average Temperature	35.8° F
Average Differential - Inches of W.C. (Corrected)	12.6
Average Static Pressure (Corrected)	416 psig.
Average Separator Pressure	445 psig.
Choke Size	$\frac{26.5}{64}$" Adjustable
Orifice Plate Size	3.0"
Average Flowing Tubing Pressure (Corrected) (Range 1238-1243 psig.)	1242 psig.
Fluid Recovery (Oil Meter Volumes)	Use same as above
Gas per day	4.92 MMCF

CORE DESCRIPTIONS ESSO GIPPSLAND SHELF-1

Core No. 1 1000' to 1028' Cut 28' Recovered 14'

1000-1004: Limestone: medium grey to light olive grey, finely crystalline, glauconitic, fossil fragments, soft argillaceous matrix.

1004-1014: Marl: medium grey to olive grey, dense, soft, glauconitic, very fossiliferous, with thin interbeds of limestone. No distinguishable dip.

Core No. 2 1501' to 1528' Cut 27' Recovered 10'

1501-1504: Marl: light grey, soft, few fossils, scattered crystals of calcite.

1504-1511: Marl: light grey, soft, few fossils, scattered calcite crystals more argillaceous than above. Poor porosity and permeability. No discernable dip.

Core No. 3 2024' to 2037' Cut 13' Recovered 5'

2024-2029: Marl: medium to dark grey, sparse glauconitic, firm, few scattered fossil fragments, calcite crystals, few pyrite grains. Poor porosity and permeability. No discernable dip.

Core No. 4 2326' to 2352' Cut 26' Recovered 21'

2326-2327: Marl: medium dark grey, few scattered glauconitic grains, abundant fossil fragments, tight, firm, no show.

2327-2327½: Limestone: medium grey, bioclastic, abundant microfossils and fossil fragments, in fine crystalline argillaceous matrix, tight, fairly hard, trace glauconite, no show.

2327½-2331½: Marl: as above, very abundant microfossils and fossil fragments, glauconitic.

2331½-2338: Limestone: as above, glauconitic, sparse to abundant, occasional thin argillaceous streaks.

2338-2340½: Marl: as above, abundant glauconite.

2340½-2343½: Limestone: as above, interbedded with thin marly streaks, abundant sponge spicules and echinoid spines.

2343½-2344½: Marl: as above.

2344½-2347: Limestone: medium grey, finely crystalline, slightly argillaceous, scattered small fossil fragments, trace glauconite, hard, dense, no show.

Core No. 5 2630' to 2655' Cut 25' Recovered 23'

2630-2646: Calcareous Sandstone: light olive grey, coarse to very coarse, sub rounded, white clear quartz, white calcareous matrix, abundant glauconite, friable, abundant fossil fragments. Fair permeability and porosity. No show.

2646-2653': Sandy Limestone: light olive grey, finely crystalline, abundant glauconite and fossil fragments. White clear quartz grains (10% to 40% of rock is quartz grains). Fair porosity and permeability. No show.

Corenno. 6   2876' to 2896'   Cut 20'   Recovered 10'

2876-2896': Calcareous Sandstone: light to medium grey, coarse to very coarse, sub rounded, light to clear quartz grains. Finely crystalline, bioclastic calcareous matrix, fair porosity and permeability. Slightly glauconitic, slightly brackish taste (sand 50% to 80% of rock).

Core No. 7   3020' to 3050'   Cut 30'   Recovered 9'

3020-3022½': Calcareous Sandstone: light to medium grey, clear white to cloudy, few tan, coarse to very coarse, sub rounded to rounded, fairly well sorted quartz grains in calcareous matrix, glauconitic and fossiliferous. Fair porosity and permeability. Grades into sandy limestone in bottom six inches, limestone is more glauconitic and fossiliferous and tighter.

3022½-3027': Calcareous Siltstone to Marl: medium to dark grey, olive grey, slightly glauconitic, fossiliferous, tight.

3027-3029': Calcareous Sandstone: to Sandy Limestone (Generally finer grained), fine to coarse, very poorly sorted quartz grains, light tan, very dirty, fossiliferous and glauconitic. No show, slight brackish taste. No apparent dip.

Core No. 8   3342' to 3385'6"   Cut 43½'   Recovered 7'

3342-3385½': Shale: calcareous, olive grey to medium grey, dense, soft, glauconitic, fossiliferous, (not abundantly), trace pyrite, and few random medium to coarse round sand grains throughout. No apparent dip; a few gas bubbles and some pitting on mud sheath. No other hydrocarbons.

Core No. 9   3465' to 3513'   Cut 48'   Recovered 2'

3465-3513': Coal: all brown, slightly dolomitic (?sideritic) with trace pyrite, very hard bottom three inches has two inch bands (lenses) of dolomitic (?sideritic) sandstone made up of medium to very coarse, sub rounded to rounded, fairly well sorted quartz grains set in a fine, brown grey to pale brown, dolomitic (?sideritic) sandstone matrix. This sandstone is tight and has no pore space at all. No fluorescence in core or stain or cut. However a hydrocarbon odour is present through the core. This part of the core is assumed to be the bottom two feet where the drilling ceased. The remainder of the core is probably loose, clean, unconsolidated medium to very coarse and granule quartz sand as in the coring cuttings, which washed away.

Core No. 10   3800' to 3825'   Cut 25'   Recovered 0

Core No. 11 4346' to 4351' Cut 5' Recovered 2'

4346-4351: Sandstone: loose unconsolidated, very fine to coarse, dominantly fine to medium, well sorted, sub-angular to rounded, clear and white quartz grains, no matrix. Quartz grains: 95% of the sample, rest calcite grains, coal fragments, glauconitic pellets, pyrite, few marl fragments. Few chunks brown to black coal. Possibly cavings from fishing operation. Gas reading on sample - eight units on high, zero units on low. Distinct hydrocarbon odour present when core fell out of barrel. No fluorescence or cut on sample.

Core No. 12 4740' to 4760' Cut 20' Recovered 12'

4740-4748: Sand: unconsolidated to slightly consolidated, medium to coarse grain, sub-angular to rounded, quartz making up 99% of sand - friable, non-calcareous. 1% Coal, muscovite flakes, few chert and quartzite fragments.

4748-4750: Sand: as above, but very fine to medium quartz grains.

4750-4750½: Gravel: quartz as above.

4750½-4751½: Sand: as 4740-4748 with thin coal bands.

4751½-4752: Coal: black to brown black, no fluorescence or cut, slight odour probably from coal.

Core No. 13 5256' to 5274' Cut 18' Recovered 15'

5256-5261: Sand: light grey to light brown grey, medium to coarse, sub-angular to sub-rounded, well sorted, friable, two streaks brown to black coal, calcareous.

5261-5262: Sand: as above but finer grained, thin laminations of brown coal, cross bedding of 10°, less porosity than top.

5262-5271: Sand: as 5261-5262, thin brown to black coal seams ½" thick, pyrite crystals. No fluorescence or cut, slightly salty taste.

Core No. 14 5656' to 5685' Cut 29' Recovered 29'

5656-5685: Siltstone and Shale: predominantly medium to grey, to light olive grey, light green grey, with thin beds medium to dark grey, brown grey micaceous, carbonaceous siltstone and thin laminated coal seams, some cross bedding, mostly flat, few stringers of thin grey fine sandstone, tight, pyritic, non-calcareous, coal one foot thick at 5661-5662, and 5679-5680, no fluorescence or cut.

Core No. 15 6124' to 6139' Cut 15' Recovered 2' (Core rabbit jammed)

6124-6139: Shale (Mudstone): medium grey, dominantly medium dark grey (olive grey), uniform, compact with abundant plant fragments, fair hardness. Bottom six inches: thin laminations of black coal in dark brown grey shale-mudstone: pyrite associated with coal; gas bleeding from coal. Abundant plant impressions on rough bedding surfaces (concentrated on bottom six inches interval). Interval similar to Otway Shale (?).

Core No. 16   6447' to 6460½'   Cut 13½'   Recovered 13½'

6447-6450: Sandstone: light grey to light brown grey, fine and medium grained, fairly well compacted, slightly argillaceous, micaceous, pyritic, occasional grains of glauconite, and sparse black coal fragments. Small scale cross bedding with dips to 5° (porosity approxminately 18%; permeability fair)

6450-6451: Argillaceous Siltstone: brown grey, contains abundant thin (to 1/16"), carbonaceous streaks and lenses, finely disseminated pyrite associated with coaly streaks, micro-micaceous, sparse pyritic nods to ⅛", irregular fracture. Coaly plant impressions on irregular bedding surfaces.

6451-6452½: Argillaceous Siltstone: as above with light grey to white irregular sandy to silty lenses to ¾" thick.

6452½-6460½: Siltstone: olive grey, argillaceous and micaceous, contains irregular brown to grey carbonaceous patches to ¾" thick, finely disseminated pyrite, irregular pyrite nodules to ¼" thick, contains vague discontinuous light grey fine grained sandy streaks to ½" thick. At 6453½, slickenslided interface dipping at 45° to the axis of core.

Core No. 17   6747' to 6773'   Cut 26'   Recovered 23'

6747-6748: Sandstone (quartzose): light grey to light grey green, fine grained, fairly well sorted, slightly argillaceous, micaceous, non-calcareous, contains fine black coal fragments and brown grey carbonaceous streaks - minor grains glauconite - finely disseminated pyrite (no dip). Porosity 16-18%; permeability fair.

6748-6750: Siltstone: olive grey, argillaceous and micaceous, thin irregular black coal streaks to ½" thick, and irregular brown to grey carbonaceous patches, irregular fine grained sand leneses and bands. Disseminated pyrite and nodules (to¼").

6750-6759: Sandstone: as above with abundant thin irregular coal streaks (slight petroliferous odour).

6759-6766: Sandstone: as above - predominantly medium grained, cleaner than above. Porosity 20%; permeability fair.

6766-6770: Sandstone: as above, predominantly coarse grained, cleaner than fine grained sandstone. Porsoity 20%; permeability good.

Core No. 18   7233' to 7251'   Recovered 18'

7233-7234½: Sandstone: (quartzose) light grey to light grey green, fine to coarse grained, granular. Predominantly coarse grained to granular. Very poorly sorted, kaolinitic matrix, flecks of mica throughout, pyrite, finely disseminated in fine fraction and as grains to 1/16", grains and flecks of black coal; porosity is 20 or 20%+, permeability good, drilling fluid stains completely through core. (Occasional grains dark grey mineral, fairly hard, chloritic??)

7234½-7240½: Sandstone: as above - alternating bands of medium to coarse grained sandstone and very coarse grained to granular sandstone to 4/5" thick. Finer grained material, more carbonaceous and dirtier, alternate bands outline cross-bedding dipping to a 10% with

5/7

respect to axis of core.

7240½-7246: **Sandstone**: as above, only predominantly very coarse grained to granular, irregular thin outlines marked by dark brown and black coal. (Plant impressions noted at 43'). Pebble of quartzite noted at 42½'.

7246-7249½: **Sandstone**: as above, with alternating very coarse grained and granular beds and finer grained bands, finer grained streaks, much more carbonaceous than micaceous. Dip to 10°.

7249½-7250½: **Sandstone**: as above, very coarse grained throughout, cleaner than finer grained interval.

7250½-7251: **Sandstone**: as above, granular, more matrix clay minerals, dark grey, altered grains (clay mineral), and a relative abundance of smoky quartz grains.

Core No. 19 7708' to 7731' Cut 23' Recovered 23'
Note: depth correction from 7712' to 7708'

7708-7709: **Siltstone-Shale**: medium dark grey to dark grey, carbonaceous, micaceous, dense, hard, finely laminated with light to medium grey, very fine sandstone-silstone. Pyrite common as nodules. Plant fragments.

7709-7710: **Sandstone**: light grey to pale yellow brown to brown grey, very fine to coarse, angular to sub-angular, with thin laminae of dark grey siltstone-shale, fairly hard, cross bedding, apparent dip 10°.

7710-7717: **Sandstone**: light grey to very light grey to light olive grey, fine to granular (coarser than 0.9-1.0 mm.), angular to sub-angular, very poorly sorted, fairly friable, non-calcareous, made up of 85-90% quartz. Rest feldspar (5-10%), pyrite, coal fragments (Chlorite?). Thin carbonaceous beds, very porous. At 7713', very well rounded black shale pebble. Apparent dip 20° at 7715.' Possible repeated graded bedding - fine to coarse going deeper.

7717-7721½: **Sandstone**: as for 7710-7717 but more thin, fine bands of siltstone, medium to dark grey, present. Dip 20°. At base few pebbles present and carbonaceous matter. Foreset bedding.

7721½-7722: **Sandstone**: as for 7710-7717 and broken fragments of pyrite and coal. Good gold fluorescence in two inch section which has strong yellow cut and hydrocarbon odour;

7722-7723: **Siltstone-Shale**: as for 77-8-7709. Very minor, very fine light grey sandstone, and carbonaceous.

7723-7724: **Sandstone**: as for 7710-7717.

7724-7726: **Sandstone**: consolidated gravel-pebble conglomerate, pale yellow brown to brown grey to brown. Friable extremely poorly sorted, dominant angular to sub-angular, but few with round pebbles of dark grey shale and quartzite. Higher feldspar per cent than previously, very high porosity, brown colour due to filtrate.

7726-7727: Sandstone: as for 7709-7710 with few coal bands.

7727-7730½: Sandstone: as for 7724-7726 with thin pyrite bands at 7727½' and 7729½'. Pebbles dominant at base.

7730½-7731: Sandstone: as for 7710-7717 but very much harder and denser. Possibly siliceous matrix. Thin dark grey siltstone bands, very low porosity.

Core No. 20 8678' to 8693' Recovered 15'

8678-8680: Siltstone (Argillaceous): brown grey, very tough and compact, contains irregular light brown grey kaolinitic sandy lenses to one inch thick, pyrite occurs finely disseminated and as irregular nodules to ¾" thick, black coal streaks to 1/16" thick and occasional fine flecks of black coal. Black coal plant impressions on bedding surfaces: micromicaceous, sparse, fine and medium angular grains of light grey to white quartz.

8680-8682: Sandstone: (Grit) light grey, conglomeratic; predominantly fine to medium grained with bands of coarse grains, angular to sub-rounded quartzose sandstone to six inches thick; occasional pebbles of ligh grey quartz and dark grey greywacke, sub-angular to sub-round, to ¾" diameter. Pyrite finely disseminated throughout and as small irregular nodules; abundant very light grey to white kaolinite in matrix; plugs porosity. Discontinuous brown grey, argillaceous-micaceous-carbonaceous streaks to ½" thick; biotite, tourmaline ?, muscovite, dark grey rock grains.

8682-8687: Conglomeratic Sandstone: light grey, angular, granules, pebbles and occasional sub-round cobbles of light grey and white quartz, light grey green, fine grained compact sandstone, dark grey to green greywacke and dark grey argillite, in a poorly sorted, predominantly coarse grained kaolinitic quartzose sand matrix. Pyrite disseminated finely and as irregular nodules, grains of dark rock fragments, tourmaline? and flecks of mica and black coal; very fine grained streaks outline small scale cross bedding to maximum dip of 10°; low effective porosity and permeability due to pluging by kaolinite.

8687-8687½: Conglomeratic Sandstone: as above - oil stained with good odour; abrupt light yellow cut; fluorescence on vertical 1/3 of core.

8687½-8692: Conglomerate: light grey, granules, pebbles and occasional cobbles of light grey and white quartz, grey green, and dark grey green greywacke, dark brown to grey with compacted pyritic argillite and light grey green, very fine grained well compacted (quartzitic?) sandstone in a poorly sorted quartzose kaolinitic sandy matrix (similar to above) (Flecks of biotite, etc.)

8692-8693: Conglomerate: similar to above- ocassional pebbles of quartz veined dark grey chloritic schist - and grey green well compacted argillite and white quartz, etc. as above - in matrix similar to above - only rock much more friable to crumbly (better porosity?) Good stain throughout, good strong odour when freshly broken, instant cut, light yellow, good light fluorescence.

Core No. 21   8693' to 8701'   Recovered 7'

8693-8694: Conglomerate: light and medium grey, granules to pebbles and cobbles of white and grey quartz, dark grey compact fine grained greywacke, light grey green shale in very poorly sorted kaolinitic sandy matrix (as in base of Core No. 20). Fluorescence not as extensive (small scale cross bedding dips to 10°), fluorescence with good cut as in No. 20.

8694-8697: Siltstone (Argillaceous): brown to grey, very tough and compact, very carbonaceous, containing abundant discontinuous and irregular streaks of black anthracitic coal - coaly plant impressions on bedding surfaces; bedding interfaces wavy and irregul (compaction phenomena) occasional shiny slickensided stylolite-like interfaces. Irregular pyrite nodules to ½" thick.

8697-8700: Siltstone: brown grey to light brown grey, very tough and compact, slightly argillaceous, very carbonaceous, irregular vein-like streaks of anthracitic coal to ¼" thick - pyrite finely disseminated and irregular nodules to ¾" thick, occasional light grey and white quartz grains, sub-angular, fine granule size. From 8699-8700 - irregular discontinuous lense-like bands of very fine grained light brown to grey kaolinitic micaceous sandstone. No. apparent dip.

PE903978

This is an enclosure indicator page.
The enclosure PE903978 is enclosed within the container PE902954 at this location in this document.

The enclosure PE903978 has the following characteristics:

ITEM_BARCODE = PE903978
CONTAINER_BARCODE = PE902954
NAME = Geologic Map
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = MAP
DESCRIPTION = Geological Map Gippsland basin Vic
REMARKS =
DATE_CREATED = 31/07/1965
DATE_RECEIVED =
W_NO = W486
WELL_NAME = Barracouta-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902953

This is an enclosure indicator page.
The enclosure PE902953 is enclosed within the
container PE902954 at this location in this
document.

The enclosure PE902953 has the following characteristics:

ITEM_BARCODE =	PE902953
CONTAINER_BARCODE =	PE902954
NAME =	Columnar Section
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	STRAT_COLUMN
DESCRIPTION =	Simplified Columnar Section of Post Paleozoic Rocks in Gippsland Basin
REMARKS =	
DATE_CREATED =	01/11/1964
DATE_RECEIVED =	
W_NO =	W486
WELL_NAME =	Barracouta-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902957

This is an enclosure indicator page.
The enclosure PE902957 is enclosed within the container PE902954 at this location in this document.

The enclosure PE902957 has the following characteristics:

```
     ITEM_BARCODE = PE902957
CONTAINER_BARCODE = PE902954
             NAME = Cross Section before & after drilling
                    Esso Gippsland Shelf
            BASIN = GIPPSLAND
           PERMIT =
             TYPE = WELL
          SUBTYPE = CROSS_SECTION
      DESCRIPTION = Cross Section before & after drilling
                    Esso Gippsland Shelf
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED =
             W_NO = W486
        WELL_NAME = Barracouta-1
       CONTRACTOR = ESSO
     CLIENT_OP_CO = ESSO
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE902955

This is an enclosure indicator page.
The enclosure PE902955 is enclosed within the container PE902954 at this location in this document.

The enclosure PE902955 has the following characteristics:

ITEM_BARCODE =	PE902955
CONTAINER_BARCODE =	PE902954
NAME =	Geological Cross Section A-B
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	CROSS_SECTION
DESCRIPTION =	Geological Cross Section A-B based on subsurface & seismic information
REMARKS =	
DATE_CREATED =	03/11/1964
DATE_RECEIVED =	
W_NO =	W486
WELL_NAME =	Barracouta-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902952

This is an enclosure indicator page.
The enclosure PE902952 is enclosed within the container PE902954 at this location in this document.

The enclosure PE902952 has the following characteristics:

ITEM_BARCODE =	PE902952
CONTAINER_BARCODE =	PE902954
NAME =	Time Depth Curve
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	VELOCITY_CHART
DESCRIPTION =	Time Depth Curve
REMARKS =	
DATE_CREATED =	01/09/1965
DATE_RECEIVED =	
W_NO =	W486
WELL_NAME =	Barracouta-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902956

This is an enclosure indicator page.
The enclosure PE902956 is enclosed within the container PE902954 at this location in this document.

The enclosure PE902956 has the following characteristics:

ITEM_BARCODE =	PE902956
CONTAINER_BARCODE =	PE902954
NAME =	Structure Contour Map
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	HRZ_CNTR_MAP
DESCRIPTION =	Structure Contour Map on Horizon at the Eocene Unconformity
REMARKS =	
DATE_CREATED =	03/11/1964
DATE_RECEIVED =	
W_NO =	W486
WELL_NAME =	Barracouta-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE602050

This is an enclosure indicator page.
The enclosure PE602050 is enclosed within the container PE902954 at this location in this document.

The enclosure PE602050 has the following characteristics:

ITEM_BARCODE = PE602050
CONTAINER_BARCODE = PE902954
NAME = Barracouta 1 composite well log
BASIN = GIPPSLAND
PERMIT = PEP38
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Barracouta 1 Composite Well Log
REMARKS =
DATE_CREATED = 30/05/65
DATE_RECEIVED =
W_NO = W486
WELL_NAME = Barracouta-1
CONTRACTOR = Core Laboratories
CLIENT_OP_CO = Esso Exploration Australia Inc.

(Inserted by DNRE - Vic Govt Mines Dept)

PE903911

This is an enclosure indicator page.
The enclosure PE903911 is enclosed within the container PE902954 at this location in this document.

The enclosure PE903911 has the following characteristics:

ITEM_BARCODE =	PE903911
CONTAINER_BARCODE =	PE902954
NAME =	Barracouta 1 Well History Chart
BASIN =	GIPPSLAND
PERMIT =	PEP38
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Barracouta 1 Well History Chart. Figure 4 from WCR
REMARKS =	
DATE_CREATED =	30/09/95
DATE_RECEIVED =	
W_NO =	W486
WELL_NAME =	Barracouta-1
CONTRACTOR =	
CLIENT_OP_CO =	Esso Exploration Australia Inc

(Inserted by DNRE - Vic Govt Mines Dept)