WCR PORT CAMPBELL-4 W484

PORT CAMPBELL

FROME-BROKEN HILL CO. PTY. LTD.

W484

FROME-BROKEN HILL COMPANY PTY. LTD.

WELL COMPLETION REPORT - PORT CAMPBELL NO. 4

SOUTHWEST VICTORIA

by

S. Benedek

OIL and GAS DIVISION

W484

80 Pages

FROME-BROKEN HILL COMPANY PTY. LTD. + ENCLOSURES

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Melbourne

November, 1964

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I SUMMARY

The Port Campbell No. 4 well was drilled in the central part of the Port Campbell Embayment of the Otway Basin to a total depth of 8,520 feet.

The well bottomed in the Lower Cretaceous Otway Group, after penetrating Tertiary and marine Upper Cretaceous sections.

Small quantities of crude oil and gas occurred in two zones in the Otway Group. The Waarre Formation sandstone, which was well developed over an interval of 561 feet, contained salt water.

II INTRODUCTION

Port Campbell No. 4 well was drilled by Frome-Broken Hill Company Pty. Ltd. in the central part of the Port Campbell Embayment to evaluate the petroleum potential of the Waarre Formation, which produced hydrocarbons further south in the Port Campbell No. 1 well, and to test the petroleum prospects of the uppermost porous sands of the Otway Group.

The well was sited on the northeast end of an anticline mapped by seismic work. The Commonwealth Government agreed to subsidise the drilling and testing of the well on a cost basis.

III WELL HISTORY

(1) General Data

(a) Well Name and Number:

Port Campbell No. 4

(b) Location:

Parish of Paaratte, Shire of Otway, County of Heytesbury.
Port Campbell 1 mile; Ref. 880470.
Latitude: 38° 32' 30" south; Longitude: 142° 58' 30" east.

(c) Name and Address of Tenement Holder:

Frome-Broken Hill Company Pty. Ltd.,
95 Collins Street,
MELBOURNE, C.1.

(d) Details of Petroleum Tenement:

Petroleum Exploration Permit No. 6, issued by the State of Victoria.

(e) District:

Southwest Victoria.

(f) Total Depth:

8,520 feet.

(g) Date Drilling Commenced:

June 10, 1964.

(h) Date Drilling Completed:

July 12, 1964.

(i) Date Well Abandoned:

August 26, 1964.

(j) Date Rig Released:

August 26, 1964.

(k) Drilling Time in Days to Total Depth:

33 days.

(l) Elevation:

Ground: 427 feet
Rotary Table: 440 feet

(m) Status:

Abandoned.

(m) Status (Cont'd):

Plugs set in 5½" casing as follows:

Cement plug 8,140 to 8,182 feet.
Cement plug 7,628 to 7,800 feet.
Cement plug 7,370 to 7,460 feet.
Cement plug 7,025 to 7,123 feet.
Cement plug 6,816 to 6,910 feet.
Cement plug 6,630 to 6,722 feet.
Cement plug 6,066 to 6,150 feet.
Cement plug 5,889 to 5,980 feet.
Cement plug 5,624 to 5,870 feet.
Cement plug 5,182 to 5,270 feet.
Howco DM packer 4,070 feet.
Cement plug 4,070 to 4,101 feet.
Cement plug 3,950 to 4,020 feet.
Cement plug 5 sacks across the top of 5½" and 13⅜" casing.

(n) Cost:

Drilling and Testing - £178,705 as at November 30, 1964.

(2) Drilling Data

(a) Name and Address of Drilling Contractor:

Drilling Contractors (Australia) Pty. Ltd.,
383 George Street,
SYDNEY, N.S.W.

(b) Drilling Plant

Make:	National
Type	Ideal 80-B
Rate Capacity with 4½" drill pipe:	12,000 feet

Motors:

Make:	Waukesha
Type:	Model LRDBSU
B.H.P.	526
Number:	3

(c) Mast/Derrick:

Make:	Lee C. Moore
Type:	136 feet
Rated Capacity:	700,000 lbs.

(d) Pumps:

Make:	Emsco	National
Type:	D850	G700
Size:	8¼" x 18"	8" x 14"

(e) Blowout Preventor Equipment:

Make:	Cameron	Hydril	Hydril
Type:	SS	GK	Accumulator
Size:	12"	12" flanged	
Series:	900	900	

(f) Hole Sizes and Depths:

(1) 20" conductor pipe set by hand.

(2) (i) Drilled $12\frac{1}{4}$" hole to 1,400 feet.
(ii) Reamed $12\frac{1}{4}$" hole to $17\frac{1}{2}$" hole to 1,355 feet.
(iii) Set $13\frac{3}{8}$" casing at 1,343 feet.

(3) (i) Drilled $8\frac{3}{4}$" hole to 8,520 feet.
(ii) Set $5\frac{1}{2}$" casing to ~~5,780~~ 8,182 feet.

(g) Casing Details:

Size:	$13\frac{3}{8}$"	$5\frac{1}{2}$"
Weight:	48 lbs.	17 & 20 lbs.
Grade:	H.40	N.80
Range:	2	2
Setting Depth:	1,343 feet	8,182 feet

(h) Casing Cementing Details:

Size:	$13\frac{3}{8}$"
Setting Depth:	1,343 feet
Quantity Cement Used:	1,100 sacks
Cemented to:	Surface
Method Used:	Single stage cementing, with plugs, by Halliburton cementing truck.

Size:	$5\frac{1}{2}$"
Setting Depth:	8,182 feet
Quantity Cement Used:	650 sacks
Cemented to:	7,000 feet (estimated)
Methods Used:	Single stage cementing, with plugs, using Halliburton cementing truck.

(i) Drilling Fluid:

The mud employed in Port Campbell No. 4 was a Spersene-bentonite-caustic soda system.

Details of additions and properties are covered in Appendix 8.

(j) Water Supply:

Water was carted for the well from the nearby Mosquito Creek. Salinity of this water averaged 350 ppm chlorides. A water well was drilled on site, but was unproductive.

(k) Perforation and Shooting Record:

All perforating was done with Schlumberger shaped charge equipment with 4" guns, at a density of 4 shots per foot.

The following intervals were perforated for testing purposes:

8	7,878 to 7,950	feet
7	7,418 to 7,460	"
	7,302 to 7,325	"
	7,235 to 7,254	"
4	5,947 to 5,970	"
9	6,404 to 6,444	"
10	5,874 to 5,903	"
	5,672 to 5,702	"
6	6,900 to 6,928	"
	6,691 to 6,696	"
5	6,722 to 6,731	"
	6,752 to 6,765	"
	6,555 to 6,601	"
4	5,942 to 5,947	"
	5,957 to 5,980	"
3	5,870 to 5,878	"
	5,878 to 5,903	"
2	5,263 to 5,267	" (mis-shot)
	5,271 to 5,281	"
	5,303 to 5,307	"
1	4,020 to 4,040	"

-134.1

The following intervals were perforated for isolation squeeze cementation purposes:

5,970 to 5,971	feet
5,946 to 5,947	"
6,444 to 6,445	"
6,403 to 6,404	"
6,554 to 6,555	"
4,100 to 4,101	"

The following intervals were perforated for isolation dry testing purposes:

10	5,992 to 5,993	feet
	5,847 to 5,848	"

(1) <u>Plugging Back and Squeeze Cementation Jobs</u> (see plate No. 4)

(a) Spotted 40 sack plug from 7,628 to 7,800 feet.

(b) Spotted 40 sack plug from 7,370 to 7,460 feet.

(c) Spotted 40 sack plug from 6,120 to 6,210 feet (drilled out).

(d) Halliburton DM squeeze packer set at 5,915 feet (drilled out).

(e) Squeezed 125 sacks through perforations 5,946 to 5,947 feet, 5,970 to 5,971 feet to 1,000 psi.

(f) Squeezed 75 sacks through perforations 5,946 to 5,947 feet, 5,970 to 5,971 feet to 1,400 psi.

(g) Squeezed 60 sacks through perforations 5,947 to 5,970 feet to 2,200 psi.

(h) Spotted 40 sack plug from 7,025 to 7,123 feet.

(i) Halliburton DM squeeze packer set at 6,365 feet (Drilled out).

(j) Squeezed 100 sacks in and out through perforations 6,444 to 6,445 feet, 6,403 to 6,404 feet and 5,947 to 5,970 feet to 1,500 psi.

(k) Squeezed 50 sacks through perforations 6,444 to 6,445 feet, 6,403 to 6,404 feet to 2,500 psi.

(l) Spotted 40 sack plug from 6,120 to 6,200 feet (drilled out).

(m) Spotted 30 sack plug from 5,817 to 5,903 feet (drilled out).

(n) Squeezed 50 sacks through perforations 5,672 to 5,702 feet to 2,850 psi.

(o) Squeezed 100 sacks through perforations 5,874 to 5,903 feet, 5,947 to 5,970 feet to 3,300 psi.

(p) Squeezed 50 sacks through perforations 6,404 to 6,444 feet to 2,500 psi.

(q) Spotted 25 sack plug from 6,816 to 6,910 feet.

(r) Spotted 25 sack plug 6,630 to 6,722 feet.

(s) Squeezed 50 sacks through perforations 6,554 to 6,555 feet to 2,800 psi.

(t) Halliburton DM squeeze packer set at 6,475 feet.

(u) Squeezed 75 sacks through perforations 6,404 to 6,444 feet to 3,100 psi.

(v) Spotted 25 sack plug from 6,066 to 6,150 feet.

(w) Squeezed 75 sacks through perforations 5,942 to 5,980 feet to 2,300 psi.

(x) Spotted 40 sack plug from 5,624 to 5,870 feet.

(y) Spotted 25 sack plug from 5,182 to 5,270 feet.

(z) Halliburton DM squeeze packer set at 4,070 feet.

(zA) Circulated 125 sacks behind $5\frac{1}{2}$" casing through perforations 4,100 to 4,101 feet.

(zB) Spotted 25 sack plug from 3,950 to 4,020 feet.

(zC) Spotted 5 sack plug across the top of $5\frac{1}{2}$" and $13\frac{3}{8}$" casing.

(m) Fishing Operations:

None.

(3) Logging and Testing

(a) Ditch Cuttings:

Cuttings samples were taken over a normal shale shaker for each 10 foot drilling interval. Bottom hole samples were circulated as required.

(b) Coring: (See Appendix 3 for Core Description)

The coring program specified the first core to be cut from the Pebble Point Formation, and thereafter at change of formation, or every 300 feet as required by subsidy regulations. Cores were to be cut also on the appearance of hydrocarbon shows or as required by wellsite geologist.

Twenty-seven cores were cut for a total footage of 428 feet. Recovery was 248 feet, or 58%. All cores were recovered with a Reed Kor-King barrel. Core diameter was $3\frac{1}{2}$".

(c) Sidewall Sampling: (See Appendix 3 for descriptions)

Sidewall cores were taken from various depths using Schlumberger C.S.T. equipment. Sixty cores were attempted and fifty-one samples were recovered.

(d) Electrical and Other Logging:

Logging was carried out by Schlumberger Seaco Inc., the engineer being Mr. I. Strecker.

Logs were run as follows:

Electrical Log	Microlog	Sonic-Gamma Ray Log
86 to 1,386 feet	1,346 to 3,512 feet	90 to 1,373 feet
1,346 to 3,514 "	3,312 to 6,462 "	1,346 to 3,500 "
3,314 to 6,055 "	6,262 to 8,498 "	3,300 to 6,040 "
5,855 to 7,906 "		5,840 to 8,490 "
7,706 to 8,500 "		

Laterolog	Continuous Dipmeter	Cement Bond Log
5,900 to 8,500 feet	2,000 to 3,826 feet	4,900 to 7,000 feet
	3,598 to 6,448 "	5,000 to 7,000 "
Caliper Log	6,448 to 8,485 "	
3,500 to 4,500 feet		

Scales of all the logs run, except the Continuous Dipmeter, were 1" = 100 feet, and 5" = 100 feet. The Continuous Dipmeter was recorded at scales 1" = 100 feet and 1" = 2 feet.

(e) Drilling Time and Gas Log:

A Geolograph continuous time-depth recorder was used during the drilling of Port Campbell No. 4, which recorded the time taken for each foot penetrated. A drilling time log was drawn up from the Geolograph records and is included in the Composite Log.

An Atlas continuous gas detector monitored the mud stream throughout the drilling, and the gas log obtained from this instrument is included in the composite graphic well log.

(f) Formation Testing:

Formation testing was carried out by Halliburton Limited, the engineer being Mr. B. O. Martin. Three open hole tests were carried out using a 5" Hydrospring tester with associated 5 position C.I.P. valve and $7\frac{3}{4}$" packer. Twenty-one tests were carried out in $5\frac{1}{2}$" casing using a $3\frac{7}{8}$" Hydrospring tester and $5\frac{1}{2}$" R.T.T.S. tool with a three position valve.

Details of these tests are shown in Appendix 5 and are summarised briefly as follows:

D.S.T. No. 1 - 4,943 to 4,985 feet.
Misrun. Packer failed to hold.

D.S.T. No. 2 - 4,963 to 4,985 feet.
Recovered 1,036 feet of water. Salinity: 9,900 ppm Cl. No hydrocarbons.

D.S.T. No. 3 - 5,005 to 5,062 feet.
Recovered 4,630 feet of water. Salinity: 10,600 ppm Cl. No hydrocarbons.

D.S.T. No. 4 - 7,878 to 7,950 feet.
Recovered 90 feet of rathole mud. No hydrocarbons.

D.S.T. No. 5 - 7,418 to 7,460 feet.
Recovered 280 feet of rathole mud and filtrate. No hydrocarbons.

D.S.T. No. 6 - 7,302 to 7,325 feet.
Misrun. Bottom portion of Hydrospring plugged.

D.S.T. No. 7 - 7,302 to 7,325 feet.
Dry test. No hydrocarbons.

D.S.T. No. 8 - 7,235 to 7,254 feet and 7,302 to 7,325 feet.
Recovered 1.5 bbls. of rathole mud. Bottom joint contained fine globules of honey coloured jelly-like hydrocarbon.

D.S.T. No. 9 - 5,947 to 5,970 feet.
Produced 160 to 190 M.c.f.d. gas and 215 to 240 b.p.d. water, muddy water and emulsified crude oil. The zone did not have proper isolation.

D.S.T. No. 10 - 6,404 to 6,444 feet.
Misrun. Test tool was plugged.

D.S.T. No. 11 - 6,404 to 6,444 feet.
Recovered 43.6 bbls. of water. Salinity: 13,500 ppm Cl. No hydrocarbons.

D.S.T. No. 12 - 5,874 to 5,903 feet.
Produced 159.9 M.c.f.d. gas, and 57 b.p.d. water and water-oil emulsion.

D.S.T. No. 13 - 5,672 to 5,702 feet.
Recovered 11.5 bbls. of water. Salinity: 13,200 ppm Cl. No hydrocarbons.

D.S.T. No. 14 - 6,900 to 6,929 feet.
Recovered 3.1 bbls. of water. Salinity: 10,500 ppm Cl. No hydrocarbons.

D.S.T. No. 15 - 6,691 to 6,765 feet.
Recovered 7.25 bbls. of water. Salinity: 11,200 ppm Cl., and trace of brown, waxy globules of oil.

D.S.T. No. 16 - 6,555 to 6,601 feet.
Misrun. No isolation behind casing.

D.S.T. No. 17 - 6,555 to 6,601 feet.
Recovered 21.5 bbls. of water. Salinity: 13,800 ppm CL. No hydrocarbons.

D.S.T. No. 18 - 5,942 to 5,957 feet.
Produced small flow of gas and recovered 3.5 bbls. of mud-oil emulsion.

D.S.T. No. 19 - 5,942 to 5,980 feet.
Produced small flow of gas and recovered 1.5 bbls. of mud-oil emulsion.

D.S.T. No. 20 - 5,942 to 5,980 feet.
Produced small flow of gas and swabbed 5 bbls. of water- oil emulsion and muddy water.
Salinity: 9,100 ppm Cl.

D.S.T. No. 21 - 5,870 to 5,878 feet.
Produced 85 M.c.f.d. gas and recovered 5 bbls. of oil and oil-water emulsion. Salinity: 13,600 ppm Cl.

D.S.T. No. 22 - 5,870 to 5,903 feet.
Produced 84 M.c.f.d. gas, and recovered from tubing 5.5 bbls. of 50% oil, 50% water.
Salinity: 14,500 ppm Cl.

D.S.T. No. 23 - 5,263 to 5,307 feet.
Swabbed 35 bbls. of water. Fluid level at 400 feet, did not change during swabbing. Salinity: 14,300 ppm Cl. No hydrocarbons.

D.S.T. No. 24 - 4,020 to 4,040 feet.
Swabbed 48.5 bbls. of water, salinity 17,500 ppm Cl. No hydrocarbons.

(g) Deviation Surveys:

Deviation surveys were carried out with the Totco instrument and in conjunction with the Schlumberger Continuous Dipmeter Survey. In general, deviation was less than 1° down to 3,500 feet, and less than $3\frac{1}{2}^{\circ}$ to total depth.

(h) Other Well Surveys:

A well geophone velocity survey was run by United Geophysical Corporation in the interval 1,000 to 7,900 feet. Sixteen velocity observations were made.

IV GEOLOGY

(1) Summary of Previous Work

(a) Geological:

No surface geological work has been carried out in the area since the drilling of Fergusons Hill No. 1 well. Earlier work has been reported in previous well completion reports.

(b) Geophysical:

Seismic work carried out in 1963 and 1964, and examination of previously obtained data changed the structural interpretation of the Port Campbell Embayment. Some faults which had been interpreted previously to compensate for dip variations, have been eliminated by the recent multiple coverage work, and a more definite control of structural interpretation was obtained. Port Campbell No. 4 was located on the culmination of the Waarre top horizon, and slightly north of the culmination of the Otway Group.

(c) Drilling:

The recently completed Sherbrook No. 1 well, abandoned at 5,434 feet, and Fergusons Hill No. 1 well, drilled to 11,633 feet, showed traces of hydrocarbon from the ~~lower portion of the Lavor Formation.~~ Otway Group.

The Victorian Mines Department had recently completed Mepunga No. 9 and No. 10 wells, but results of these did not affect the selection of the location for the Port Campbell No. 4 well.

(2) Summary of the Regional Geology

A large part of the surface in the Port Campbell Embayment is covered by alluvium and, to the north, basalt extends into the area of the embayment. East of Princetown, the Palaeocene Pebble Point Formation overlaps the Lower Cretaceous Otway Group at surface, and part of the Tertiary sequence is represented in the cliff section along the coast between Pebble Point and Warrnambool.

A considerable section of sediments occurring subsurface is not represented in surface outcrops, and the following summary of the regional geology of the Port Campbell Embayment includes information derived from wells.

Basement, as cut in the Fergusons Hill No. 1 well, is green to grey mica schist of probable Ordovician age. Overlying basement is the Otway Group. In the Fergusons Hill well this group was divided into Lower and Upper Beds. The Lower Beds are composed of regularly and thin bedded dark grey, hard mudstones, alternating with medium to green-grey, lithic greywackes. The Upper Beds consist of irregularly bedded light grey, soft mudstones, and light to medium grey, feldspathic greywackes. The Moonlight Head Beds, described by Baker (1950) are considered to be part of this sequence. On the basis of microflora, the age of the Lower and Upper Beds ranges from Valanginian or older to Albian.

The Upper Beds appear to grade upward into the Waarre Formation. The feldspar content decreases and the quartz content increases from the typical Upper Otway greywacke into the protoquartzite of the Waarre Formation.

Some medium to dark grey mudstones and siltstones, with carbonaceous material, are interbedded with the sandstones. The age of this unit is Albian-Cenomanian. Taylor (1964) considers the Waarre Formation to be a unit of the Otway Group, but in this report, for the sake of uniformity with the previous usage, we have shown the Waarre separate from the Otway Group.

Overlying the Waarre Formation are the Flaxmans Beds. These are composed of dark brown to green sandy siltstones, containing glauconite, chlorite and limonite; sideritic sandstones, and ferruginous oolitic rock. Baker (1963) believes that the Flaxmans Beds were deposited under marine conditions. The age of this unit is Cenomanian-Turonian. Overlying the Flaxmans Beds is the Belfast Mudstone which is composed of dark grey, glauconitic mudstones and siltstones. The sediments contain an abundant marine fauna and are of Turonian-Senonian age. This formation grades into the overlying Paaratte Formation which consists of dark grey, carbonaceous siltstones interbedded with quartz sandstones. No sharp contact exists between the Paaratte Formation and the overlying arenaceous sequence which has been generally considered in the past to be the Wangerrip Group. However, if the Pebble point Formation is accepted as the basal part of the Wangerrip Group (Baker, 1953), then the arenaceous section between the Paaratte and Pebble Point Formations constitutes a

separate unit. The lithology of this interval is quartz sands interbedded with minor carbonaceous and micaceous siltstones with common coal, pyrite and coarse, angular feldspar fragments. This unnamed interval, together with the Paaratte Formation, Belfast Mudstone and Flaxmans Beds, represent Upper Cretaceous deposition in the basin.

The Waarre Formation and the Upper Cretaceous sediments have not been identified at outcrop.

Above the unnamed arenaceous section is a sequence of coarse quartz sands and gravels with minor pebbles of metamorphic and igneous rocks. This sequence is regarded as being equivalent to the outcropping Pebble Point Formation of Palaeocene age, but it is difficult to define in wells.

Above the Pebble Point Formation the Wangerrip Group sequence continues in an arenaceous facies, but with the development of a prominent siltstone section in part.

The overlying Heytesbury Group is a carbonate sequence including fossiliferous grey marls, sandy in part, argillaceous limestone, and thin, hard, sandy limestones. The age of the rocks of this group ranges from Eocene to Miocene.

Along the coast, between Princetown and Childers Cove, broad, gentle folds have been mapped in the outcropping Heytesbury Group limestones. Fold structures determined from seismic survey have been interpreted to represent adjustment of sediments to faulting at depth. Faults having general northwest-southeast and northeast-southwest trends have been mapped from the seismic results.

(3) Stratigraphic Table Port Campbell No. 4

Group	Unit	Age	Subsurface Top (feet)	Thickness (feet)
Heytesbury Group	Port Campbell Ls.	Miocene	Surface	224
	Gellibrand Clay	Oligocene	237 (+ 203)	727
	Clifton Formation	Oligocene	964 (- 524)	50
	Unit 4	Upper Eocene	1014 (- 574)	279
Wangerrip Group	Unit 1	Eocene	1293 (- 853)	170
	Unit 2	Palaeocene	1463 (- 1023)	614
	Unit 3	Palaeocene	2077 (- 1637)	415
	Unit 4	Palaeocene-Danian	2492 (- 2052)	970
Unnamed Interval	Paaratte Formation	Senonian	3462 (- 3022)	551
	Unit 2	Senonian	4013 (- 3573)	380
	Belfast Mudstone	Senonian-Turonian	4393 (- 3953)	452
	Flaxmans Beds	Turonian-Cenomanian	4845 (- 4405)	127
Unnamed Interval	Waarre Formation	Cenomanian-Albian	4972 (- 4532)	360
Otway Group	Unit 1	Albian-Aptian	5332 (- 4892)	201
	Unit 2	Albian-Aptian	5533 (- 5093)	2987 +

Note: Figures in brackets refer to depths of the various formations related to sea level.

(4) Stratigraphy

Heytesbury Group — Surface to 1,293 feet.

Port Campbell Limestone — Surface to 237 feet.
Limestone, calcarenite, buff to light grey, very fine to fine grained, soft, fossiliferous.

Gellibrand Clay — 237 to 964 feet.
Marl; light grey to bluish grey, soft, fossiliferous, glauconitic.

Clifton Formation — 964 to 1,014 feet.
Sandy limestone; light grey to brown, glauconitic, with common coarse angular to polished, iron-stained quartz grains.

Unit 4	1,014 to 1,293 feet. Marl; light grey to bluish to green-grey, similar to interval 237 to 964 feet. Marl is sandy and glauconitic in parts with some thin interbedded limestones.
Wangerrip Group	1,293 to 3,462 feet.
Unit 1	1,293 to 1,463 feet. Sand; coarse grained, angular to polished, ironstained, unconsolidated, glauconitic, fossiliferous.
Unit 2	1,463 to 2,077 feet. Sand; clear to milky, coarse grained, angular to polished, glauconitic, pyritic, fossiliferous, with brown, micaceous, silty clay matrix and interbeds.
Unit 3	2,077 to 2,492 feet. Siltstone; dark grey to brown grey, sandy, glauconitic, chloritic, pyritic, micaceous, fossiliferous, with ankerite and dolomite bands or lenses. Interbeds of clear to white, medium to very coarse grained sand.
Unit 4	2,492 to 3,462 feet. Sand; clear to white, mainly clear, quartz, medium to very coarse grained, carbonaceous and pyritic, with fragments and pebbles of metamorphic and igneous rocks; interbedded with dark grey, ligneous, glauconitic siltstone. Towards the base carbonaceous material increases to form coal bands. The upper part of this interval is probably equivalent to the Pebble Point Formation.
Unnamed Interval	3,462 to 4,972 feet.
Paaratte Formation	3,462 to 4,013 feet. Siltstone; dark grey, carbonaceous, micaceous, interbedded with very fine grained light grey quartz sandstones. Pyritic and glauconitic in parts. Common thin streaks of coal. Coarse rounded grains of quartz occur

throughout the sequence. The top of this unit is not well defined, and is generally picked at the occurrence of the first dark siltstone below the overlying arenaceous section.

Unit 2 — 4,013 to 4,393 feet.
Sandstone; dark green, medium to very coarse grained, comprised of quartz, glauconite, chlorite, with minor pyrite and mica. Towards the base, the rock is oxidised, brown coloured, with abundant limonite.

Belfast Mudstone — 4,393 to 4,845 feet.
Siltstone-mudstone; dark grey, glauconitic, micaceous, carbonaceous, pyritic, fossiliferous.

Flaxmans Beds — 4,845 to 4,972 feet.
Sandy siltstone; dark grey to brown-grey, pyritic, fossiliferous. This unit is distinguished from the Belfast Mudstone by its generally coarser grain size, the occurrence of lithic fragments and the common oxidation of iron-bearing minerals.

Unnamed Interval — 4,972 to 5,332 feet.

Waarre Formation — 4,972 to 5,332 feet.

Sandstone; light to medium grey, clean, fine to coarse grained quartz, calcareous with minor feldspar and lithic grains, interbedded with some medium to dark grey carbonaceous siltstones. Taylor (1964) has suggested that the Waarre Formation be regarded as a unit of the Otway Group.

Otway Group — 5,332 to 8,520 feet.

Unit 1 — 5,332 to 5,533 feet.
Sandstone; greenish-grey, composed of quartz, feldspar, dark rock fragments, red grains and mica. Set in a chloritic and slightly calcareous matrix. The feldspar content which is generally angular to subangular, increases with depth. The sandstone is interbedded with greenish to light grey micaceous siltstones and mudstones.

Unit 2	5,533 to 8,520 feet. Sandstone; light grey to green-grey, mottled, interbedded with light grey carbonaceous and micaceous siltstones and mudstones. The sandstones are in part thick bedded and massive. Thin conglomerates occur in places. The sandstones are composed of feldspar, dark rock grains and minor quartz. Chlorite and mica are common and the rock is calcareous in parts.

(5) Structure

The present seismic interpretation in the Port Campbell area indicates that the Port Campbell No. 4 well was drilledin sediments deposited in a basement depression deepening to the southwest. Depth to basement is estimated from seismic to be about 17,000 feet. At the level of the Otway Group top, the well is located northeast of the culmination of an anticline striking northeast to southwest, the anticlinal trend being on the south and the downthrown side of a west-northwest/east-southeast fault. One seismic interpretation, based on variable quality reflection data, indicates a throw of the order of 1,000 to 1,250 feet on this fault, in the vicinity of the well. At the lower Tertiary level the well is on a structural nose between two faults trending as above, with a downthrow to the south. At the top of the Wangerrip Group stratigraphic horizon, the well is located on the west flank of a broad, gentle anticline centred west of Cooriemungle.

(6) Relevance to Occurrence of Petroleum

Fluorescence was observed on some sidewall samples from 5,899 to 5,965 feet. Formation tests revealed the presence of hydrocarbons in the following zones: 7,235 to 7,325 feet - traces of yellow jelly-like crude oil; 6,691 to 6,765 feet - trace of brown, waxy globules of crude oi; 5,942 to 5,980 feet - small production of crude oil and gas; 5,870 to 5,903 feet - small production of crude oil and gas. The significance of these hydrocarbon occurrences is that they occur in the Otway Group, which is generally considered to be of lacustrine origin. Each well which penetrated any appreciable thickness of Otway Group in the Port Campbell Embayment has indicated the presence of hydrocarbon in rocks of that group. Such wells were Flaxmans No. 1, Port Campbell Nos. 3 and 4, and Fergusons Hill No. 1. As the hydrocarbon traces occur in widely separated levels of the above formation, it can be concluded that these hydrocarbons are indigenous to the Otway Group.

(7) Porosity and Permeability of Sediments Penetrated

Core and cuttings samples were used to estimate porosities, and porosities were calculated from electric logs at the wellsite. Porosities of three samples from the Otway Group determined by the Bureau of Mineral Resources ranged from 10.4% to 14.3%, and permeabilities were nil.

Good porosities occur in the poorly consolidated sands of the Waarre Formation, and formation tests indicated the existence of good porosity and permeability in the green sand unit extending from 4,013 to 4,393 feet. Electric logs indicated high porosities and permeabilities for the Wangerrip Group, which is the principal aquifer in the basin.

(8) Contribution to Geological Concepts Resulting from Drilling

This well made two important contributions to the understanding of the geology of the basin. The first was that the sandstone section in the interval 7,210 to 8,115 feet of the Otway Group is correlatable with sandstones in other wells. This section is important because it proved to be hydrocarbon-bearing in the Fergusons Hill No. 1 and Port Campbell No. 4 well.

The second contribution is to the geology of the marine Cretaceous environment. Wells previously drilled in the deeper part of the Port Campbell Embayment penetrated a siltstone-mudstone facies representing the Belfast Mudstone. The Sherbrook and Fergusons Hill wells, towards the margin of the basin, indicated a sandy development of this sequence, and in the Port Campbell No. 4 well, the well defined green sandstone cut in the interval 4,013 to 4,393 feet is also believed to be a sandy facies of Belfast Mudstone type deposition.

SB:jm

S. BENEDEK

Melbourne,

November, 1964

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APPENDIX 1

PALAEONTOLOGICAL REPORTS

PLANT REMAINS, PORT CAMPBELL NO. 4 BORE

Core 14 (4,985 - 5,005 feet) Frome-Broken Hill Co. Pty. Ltd. Port Campbell No. 4 bore contained large megascopic plant compressions as well as smaller fragmentary compressions.

All the larger strap-like compressions so far examined are conifer leaves with cuticular anatomy comparable to the present day genus Agathis.

Briefly they may be described as:

Megascopic.

Broad strap-like leaves, venation parallel, apex rounded or bluntly pointed, method of attachment unknown.

Microscopic.

Adhering cuticles, one (lower and upper not distinguishable in fragments examined) slightly thicker than the other. Both divided into stomatal and non stomatal areas, stomata in rows, orientation of stomatal slit variable in regard to rows but rarely longitudinal, and most frequently transverse. Sub circular with longer diameter transversely orientated, often greater than 70 microns, smaller diameter averaging 60 microns. Subsidiary cells 4-6, encircling cells present, epidermal cells generally sub rectangular.

Remarks:

Leaves morphologically and anatomically similar to Agathis sp. have not been described previously from the Victorian Mesozoic, but occur at Moonlight Head and Mornington in outcrop sediments. (Douglas MS.) Cookson and Duigan (1951) have described similar specimens from Tertiary sediments (cf. Agathis yallournensis) but these differ in having essentially hypostomatic leaf cuticles.

The general leaf type is one which has a wide range through Upper Mesozoic and Lower Tertiary sediments in Victoria.

Maceration of core portions has yielded cuticular fragments, the greater majority of which are from sterile or fertile fragments of Agathis-like plants, or other members of the Araucariae.

Maceration of bore core from Frome-Broken Hill Port Campbell No. 1 bore at 5,705 feet has yielded similar Araucarian material, although in this latter sample it is not nearly so predominant as in the sample under discussion from Port Campbell No. 4 bore.

Microplankton remains from P.C. 1 5705 enabled Evans 1961 to give an Upper Cretaceous (Cenomanian) age for these sediments.

A description of the plant remains in both these cores is being undertaken in conjunction with Otway Basin studies.

3/7/64

JOHN DOUGLAS
Geologist

Reference:
A palynological report on Frome-Broken Hill Port Campbell No. 1 and 2 Wells, Victoria. Evans, P.R. Bur. Min. Res. Rec. 1961/63.

FURTHER EXAMINATION OF PLANT REMAINS F.B.H. PORT CAMPBELL NO. 4 BORE

Further examination of plant remains from Port Campbell No. 4 bore at 4,985-5,005 feet has yielded the following additional information.

The strap-like compressions described anatomically and physically in Unpublished Report 75/64 have been redescribed because it appears that two Agathis-like forms exist in the core, or different organs from one Agathis-like form are present. After any necessary revision and addenda complete diagnoses will be formally published on completion of the current work on Victorian Mesozoic plant compressions.

A. Compressions comparable with Agathis sp.

Description

Megascopic. leaves, isolated fragmentary, strap-like, linear spatulate, margins parallel, apex rounded, surface with longitudinal ridges. Lamina length (fragments only), maximum 65 mm. Lamina width (maximum) 12 mm.

Microscopic. Stem unknown
Leaf (hypostomatic) Cuticle regarded as derived from upper surface.

Cells rectangular sub rectangular, the former more confined to areas covering vein cells which form parallel but inconspicuous rows. Anticlinal walls heavily thickened, pitting prominent cells very seldom longer than 80 microns, average width about 28 microns.

Cuticle regarded as derived from lower surface

Cells divided into stomatal and non stomatal areas, stomata confined to bands parallel to the longitudinal veins, bands usually consisting of four rows of stomata, interior rows often tenuous, intermittent.

Vein cells strongly thickened, pitting prominent. Shape rectangular size comparable to rectangular cells of upper surface cuticle.

Stomata usually arranged with polar axis transverse vein direction, chamber about 50 microns in diameter. Inside walls of subsidiary cells, or outer walls of guard cells heavily thickened. Chamber generally oval, or oval rectangular in shape. Subsidiary cells usually 5 encirculating cells present.

Remarks

This species differs from all other Victorian Mesozoic Agathis-like forms in possessing hypostomatic leaf surfaces. It also differs in stomatal arrangement on the lower surface of the leaf. It is thus more comparable with the Tertiary forms described by Cookson and Duigan (1951) but differs slightly in vein cell elongation and stomatal arrangement. It is the only species so far obtained from this core with recognizable megastructure and well preserved microstructure.

B. Maceration cuticular material comparable with Agathis sp.

Description

Microscopic. Adhering cuticles, one (lower and upper not distinguishable in fragments examined) slightly thicker than the other. Both divided into stomatal and non stomatal areas. Stomata in rows of single stomata, separated by up to 12 vein or intervening cells. Intervening cells rectangular, pitting not prominent. Stomata orientation with polar axis transverse vein direction; chamber diameter about 50 microns. Subsidiary cells 4-6, encircling cells present.

Remarks

This cuticle has been previously discussed in my first report on the plant remains from Port Campbell bore No. 4 4,985-5,003 feet, but was wrongly attributed to the megascopic compressions common in this core. It appears at this juncture to be from a different species of Agathis-like conifer than the cuticle obtained from the compressions described above.

C. Maceration cuticular material comparable with:

1. Pagiophyllum sp.

Description

Conifer leaves, up to 5 m.m. long, narrow triangular, lower surface planar, upper with projecting longitudinal ridge (convex), margins entire.

Stomata not present on upper surface, which consists of longitudinal rows of rectangular-rounded cells arranged longitudinally, and much thickened in on outer surface. Lower surface of thinner walled cells with stomatal region commencing some distance from margin, but possibly absent over central strip running longitudinally. Stomata closely juxtaposed subsidiary cells 4-6, encircling cells present. Neighbouring stomata encircling cells often with a common anticlinal wall. Stomatal pit rectangular-oval stomatal complex including encircling cells averaging about 55 microns in diameter.

Remarks

Pagiophyllum type leaves, probably derived from Aranrcarian precourses have been found from a number of localities in Western Victoria, including F.B.H. Pretty Hill No. 1 bore at 2,736-2,738 feet, and Moonlight Head (outcrop samples). Although more than one form is probably present, the leaf described above does not appear to be present in older Victorian Mesozoic floras, and as far as is known is a good indicator of beds near the top of the Victorian non-marine Mesozoic section (Otway Group).

2. Elatocladus sp.

Description

Leaves narrow flat portions 5-6 long macerated, averaging 1 m.m. wide, margins sub parallel, apex pointed.

Cuticle regarded as upper consisting of sub-rectangular cells, anticlinal walls pitted, not obviously thickened, medium zone of longer, narrower cells probably representing position of main vein. Cuticle regarded as lower thinner, walls pitted, shape sub-rectangular, with stomata in two rows on either side of position of central main vein, stomata rows 2 stomata wide on each side.

Stomatal apertures invariably aligned parallel main vein (and leaf margins) stomata consisting of 4-6 subsidiayr cells and encircling cells. Stomatal complex 35-50 microns in diameter to outer margins of subsidiary cells.

Remarks

The name Elatocladus, applied to sterile Podocarpaceae-like conifer leaves is temporarily applied here until further comparison is made.

D. Maceration cuticular material considered to belong to dicotyledonous angiosperms.

Type 1. Provisional description

Adhering hypostomatic cuticles, cuticle regarded as derived from upper surface of leaf showing irregular-rectangular shaped cells surface area about 300 sq. microns. Anticlinal walls irregular with slight undulations, but in low power magnification appearing more or less straight. Walls (anticlinal) about 2 microns thick. Cuticle regarded as derived from lower surface ordinary cells similar to above, with exception of stomata (see below) and vein cells which are more elongated, and form an interlocking network. Stomata are apparently of paracytic type, with large subsidiary cells flanking thickened guard cells. Guard cells are kidney shaped, 19-25 microns long, and in expanded condition the distance from outer wall of guard cell to corresponding outer wall often reaches 20 microns. Stomatal frequency taken over an area with no major veins, averages 90 per sq. m.m. Orientation apparently irregular, but possibly with some relationship to vein arrangement.

Remarks

This and the following form provisionally described are the first angiosperm-like cuticles to be derived from the Victorian Mesozoic. Evans 1961 (Bureau of Min. Res. Records 1961/63) records Angiosperm pollen from the Port Campbell No. 1 bore in core 23 (5,700-5,708') which has been correlated with this PC4 material in my preliminary report. Further examination of the PC1 core 23 has revealed angiosperm-like remains from the 5,700-5,708' core, thus providing further evidence for correlation.

Type 2. Provisional description

Single cuticle, regarded as probably derived from lower surface of leaf. Cell shape irregular, except in vein areas where they are rectangular-spindle shaped. Veins arranged in network. Ordinary epidermal cell anticlinal walls irregularly sinuous, about 1 micron thick, surface area from 250-350 sq. microns. Stomata present, apparently irregularly orientated but possibly with some relationship to vein arrangement. Frequency over an area with no major veins, 170 per sq. mm. Guard cells kidney shaped, average size 24 x 1[illegible] microns. Subsidiary cells in paracytic arrangement.

Remarks

This form may readily be distinguished from the cuticle regarded as derived from the lower surface of leaf, Type 1 above in:

1. Ordinary epidermal cell anticlinal wall form.

These walls are much more sinuous in Type 2.

2. Stomatal frequency.

In Type 2 the stomata are almost twice as frequent. Numerous undescribed cuticle fragments have been isolated from this Port Campbell No. 4 bore core including some from conifer reproductive tissues, and other angiosperms apart from those briefly described above.

Correlation of Beds

This Conifer-Angiosperm flora may be an important unknown element in the evolutionary history of the Victorian flora, and is known elsewhere only from the Port Campbell No. 1 bore at 5,705 feet and Mepunga No. 7 bore at 3,227-3,239 feet (Core AS). Certain elements of the flora also occur in the Pretty Hill No. 1 bore at 2,736-2,738 feet, and in outcrop at Moonlight Head (see above).

John Douglas,
Geologist

PALYNOLOGICAL REPORT ON F.B.H. PORT CAMPBELL NO. 4 WELL

Spores, pollen, and microplankton obtained from core samples between 8520 feet and 4112 feet in Port Campbell No. 4 well form the basis of this report. The samples from between these levels in the well yielded microfloral assemblages that are identifiable with those reported previously (Evans 1961 and later, Dettmann 1963 and later) from other wells in the Otway Basin. However, the preservation of the contained microfossils is generally poor and their concentration in some of the samples (cores 8, 9, 20, 25, and 27) is extremely low. Moreover, several of the cores (16, 22, and 23) did not yield any plant microfossils.

The microfloral evidence detailed below and outlined in Table 1 indicates that the section between 8520 feet and 4112 feet in Port Campbell No. 4 well ranges in age from Aptian to Senonian. Succeeding horizons, which will be considered in a later report, contain microfloral assemblages suggestive of a Senonian or later age.

MICROFLORAL ASSEMBLAGES AND CORRELATIONS

Speciosus Assemblage (younger category): Extremely poorly preserved microfloras in which Dictyotosporites speciosus Cookson & Dettmann and Crybelosporites striatus (Cookson & Dettmann) are identifiable components were recovered from cores 26 and 27; core 26 also yielded Dictyotosporites filosus Dettmann. The presence of these species illustrates that the younger (Aptian) category of the Speciosus Assemblage (see Dettmann 1963) is represented in this interval, and indicates correlation with at least part of the section between 10,492 feet and 11,528 feet in Flaxmans No. 1 well (Dettmann 1964b).

Core 25 in Port Campbell No. 4 well yielded only sparse numbers of spores and pollen grains in which no diagnostic species are present, whilst in core 24 a single corroded specimen of Dictyotosporites speciosus was observed. The latter occurrence may suggest conformity with the Speciosus Assemblage although the possibility that the single representative of D. speciosus was derived from stratigraphically lower horizons must not be overlooked. Cores 20, 22, and 23 are either barren or yielded extremely sparse numbers of spores and pollen grains that are elements of the Speciosus, Paradoxa, and younger assemblages.

Paradoxa Assemblage: Good concentrations of identifiable spores and pollen grains were obtained from cores 19 and 20. Constituent species include Coptospora paradoxa (Cookson & Dettmann), Balmeisporites holodictyus Cookson & Dettmann, and Pilosisporites grandis Dettmann which indicate that the microfloras are referable to the Aptian-Albian Paradoxa Assemblage. Thus, on microfloral evidence these horizons are considered correlatives of sediments between 7473 feet and 9135 feet in Flaxmans No. 1 well and equivalents of the latter sequence (see Dettmann 1964b).

Assemblage II: The first appearance of angiospermous grains, Tricolpites sp., denotes the presence of Assemblage II in core 17. Associated spore species include Kraeuselisporites majus (Cookson & Dettmann), Crybelosporites striatus, and Cicatricosisporites sp. A. Microplankton are apparently absent from this level. Core 16 did not yield any plant microfossils whilst

cores 14 and 15 contain fair concentrations of spores (Appendicisporites sp. A., Crybelosporites striatus etc.), pollen grains (Tricolpites sp., Amosopollis cruciformis Cookson & Balme), and microplankton (Hystrichosphaeridium spp., Cyclonophelium sp.) that form associations referable to Assemblage II. The samples containing Assemblage II are considered to be Upper Albian-Cenomanian/Turonian in age and are correlated with sediments between 6882 feet and 7220 feet in Flaxmans No. 1 well and their equivalents (see Dettmann 1964b and later).

Assemblage III: This assemblage, diagnosed by cf. Gleicheniidites sp., first occurs in core 13 and was observed in succeeding core samples (8-12 incl.). Other spore species include Cicatricosisporites sp. A., Appendicisporites sp. A., and Laevigatosporites ovatus Wilson & Webster. Angiospermous pollen shows an increasing abundance in numbers and types present with decrease in depth. Microplankton are present in all samples, but their poor preservation precludes identification of several types. Stratigraphically significant microplankton species identified include: Gonyaulax edwardsi Cookson & Eisenack (core 12); Odontochitina operculata Deflandre (core 12); O. cribropoda Deflandre & Cookson (core 11); O. porifera Cookson (cores 10 and 11); Hexagonifera vermiculata (Cookson & Eisenack (core 8); and H. glabra Cookson & Eisenack (core 8). The stratigraphical occurrence of these species in Port Campbell No. 4 well is similar to that recorded in the neighbouring Port Campbell and Flaxmans wells (Evans 1961, 1962; Dettmann 1964a, 1964b). On this basis core 12 in Port Campbell No. 4 well is correlated with core 23 in Port Campbell No. 1 well and cores 5-7 in Port Campbell No. 2 well, whilst cores 8-11 are probably approximate equivalents of core 21 in Port Campbell No. 1 well, core 1 in Port Campbell No. 3 well, and core 16 in Flaxmans No. 1 well. As discussed previously (Dettmann 1964a), sediments containing Assemblage III are no older than Cenomanian/Turonian and probably range into the Senonian.

REMANIÉ FOSSILS

Microspores and pollen of Permian age were encountered in small numbers in the Upper Cretaceous horizons represented by cores 8 and 11.

Mary E. Dettmann,
Department of Geology,
University of Queensland,
St. Lucia, Queensland.

2nd October, 1964.

FORAMINIFERAL BIOSTRATIGRAPHY - PORT CAMPBELL NO. 4

Rotary cutting samples to 4800 feet and cores 1 to 14 have been examined from Frome-Broken Hill's Port Campbell No. 4 Well.

No comment can be made on the biostratigraphy above 3519 feet as no fauna was found in cores 1 to 5 and the cuttings were so heavily contaminated that no conclusion could be drawn.

3519 to 4400 feet.

The first appearance of Upper Cretaceous arenaceous foraminifera was noted in Core 6 (3519 to 3536 feet). This fauna consisted mainly of Haplophragmoides spp. which occurred sporadically throughout this interval, although no faunas were found in the richly glauconitic and limonitic cores 8 and 9. The fauna of this interval is similar to that of the Paaratte Formation in the other Port Campbell wells.

4400 to 4600 feet.

Arenaceous species occur at the top of the dark grey mudstone, but few calcareous and no planktonic forms were noted. This is in marked contrast to the top of the dark grey mudstone (Belfast Mudstone) in Port Campbell No. 1 and No. 2 wells. Core 10 (4580 to 4600 feet) contained an abundant arenaceous fauna indicative of Zonule A of Taylor (1964).

4600 to 4800 feet.

There is a marked change between the fauna of core 10 and that of core 11 (4600 to 4608 feet). In core 11 the fauna is still predominantly arenaceous, but includes 30% calcareous species. This gross faunal change is no doubt dictated by facies, but is by no means unusual within the Belfast Mudstone and has been fully discussed by Taylor (loc. cit.) However, the gross faunal change is accompanied by the presence of such forms as Colomia austrotrochus Taylor and Gavelinopsis cenomanica (Brotzen) which are characteristic species of Zonule B. The highest appearance of Textularia trilobita Taylor at 4700 feet confirms the determination of Zonule B. Well developed specimens of T. trilobita do not range as high as the other two species listed.

Cores 12 to 14 (4894 to 5005 feet).

No foraminifera were found in these cores although fish scales and bone accompanied a rich macroflora in Core 14. In the course of sample preparation, it was noted that the mudstone cores 12 and 14 did not have the same physical properties as Belfast Mudstone.

CORRELATION AND COMMENT

The nature of the Port Campbell No. 4 Upper Cretaceous sequence was predictable from previous work (Taylor, loc. cit.). Taylor proposed that the Upper Cretaceous sedimentation was transgressive onto a sloping surface, so that the lower part of the Belfast Mudstone is restricted to deeper sections. Also, he shows that the marginal-marine sediments of the Paaratte Formation developed from the north and west, gradually inundating Belfast Mudstone sedimentation.

Reiterating the Port Campbell No. 4 results, the lower part of the Belfast Mudstone (= Zonule B) is present, but is less than 300 feet thick, compared with well over 600 feet in Port Campbell No. 2. The upper part of the Belfast Mudstone does not appear to be fully developed in Port Campbell No. 4, as the characteristic calcareous and planktonic foraminifera are absent from it. Also, this upper part of the formation is only 200 feet thick compared with 1100 feet in Port Campbell No. 2. It would appear that the Belfast Mudstone sedimentation was terminated in Port Campbell No. 4 before it was in Port Campbell No. 2.

The nature and thickness of the Upper Cretaceous sections of Port Campbell No. 1 and No. 4 are closely comparable, except for the fact that the marginal-marine sediments of Port Campbell No. 4 do not contain tongues of Belfast Mudstone type sediment as in Port Campbell No. 1. These Belfast Mudstone tongues in Port Campbell No. 1 contain rich calcareous and planktonic foraminifera which indicate open ocean conditions. No such conditions are evident in any part of the Port Campbell No. 4 section. However, the rich glauconitic and limonitic cores 8 and 9 (4112 to 4132 feet and 4269 to 4289 feet) could represent close-shore lateral equivalents of the Belfast Mudstone tongues, and these cores could represent periods of slow deposition before the accelerated outwash of detrital material of the marginal-marine sediments. Therefore cores 8 and 9 are possibly the equivalents of the top of the Belfast Mudstone in Port Campbell No. 2.

It is noted that Zonule B has only been identified in Port Campbell No. 1, 2 and 4 and Flaxmans No. 1, although twenty-one Upper Cretaceous sections have been examined in western Victoria.

In conclusion, it would appear that Port Campbell No. 4 was closer to the Upper Cretaceous shoreline than Port Campbell No. 1 and certainly closer than Port Campbell No. 2. On the other hand, marine sedimentation commenced in this section before it did in Port Campbell No. 3, Timboon No. 5, Fergusons Hill No. 1, Sherbrook No. 1 and Latrobe No. 1.

July 1, 1964

DAVID J. TAYLOR

Reference:

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Evans, P. R. Palynological observations on F.B.H. Flaxmans Hill No. 1 well. Bur. Min. Resourc. Aust. Rec. 1962/57.

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APPENDIX 2

OIL &
GAS ANALYSES

STATE LABORATORIES

MELBOURNE

An. G & F./ 29/7 30th July, 1964.

Report on Sample No. 848/64

Sample : Bore-hole gas
Locality : Port Campbell
Sender : The Manager,
Frome-Broken Hill Co. Pty. Ltd.,
95 Collins Street,
MELBOURNE.

Port Campbell No. 4

A sample of bore-hole gas was received for analysis. The gas was obtained during the drilling of oil-well, Port Campbell No. 4.

Particulars of Sample.

Drilling Company	Frome-Broken Hill
Name of Well	Port Campbell No. 4
Drill Stem Test	No. 9
Depth (feet)	5,947 - 5,970
Date	28th July, 1964

Condition of Sample.

The sample was received in a low-pressure air cylinder and was under slight pressure.

Results:

The Mines Department's Gas Chromatograph was being serviced when this sample was received and the analysis was made by the Research and Testing Department of the Gas and Fuel Corporation.

	% V/V
Methane	82.2
Ethane	6.6
Propane	3.6
Isobutane	1.07
n-butane	1.22
Neopentane	0.018
Isopentane	0.49
n-pentane	0.40
C_6 and higher	1.47
Oxygen	0.7
Nitrogen	2.2

Comments.

The gas contains a very complete range of hydrocarbons including nearly $1\frac{1}{2}$% of hexanes and higher ones in the series.

This is certainly a petroliferous gas.

John C. Kennedy
Senior Chemist
Mines Department

STATE LABORATORIES

Melbourne

An. PS/JK/21/8

18th November, 1964

Report on Sample No. 907/64

Sample : Bore Hole Gas
Locality : Port Campbell
Sender : Frome-Broken Hill Co. Pty. Ltd.,
95 Collins Street,
MELBOURNE.

Port Campbell No. 4.

A sample of bore-hole gas was received for analysis. The gas was obtained during testing of oilwell Port Campbell No. 4.

Particulars of Sample:

Drilling Company	Frome-Broken Hill
Name of Well	Port Campbell No. 4
Drill Stem Test	No. 12
Depth (feet)	5,874 - 5,903
Date	13th August, 1964

Results:

Condition of Sample

The sample was contained in a cylinder under a pressure of 5-10 p.s.i.

Analysis	%
Carbon Dioxide	Nil
Nitrogen	2.5
Oxygen	0.5
Hydrogen	0.4
Methane	83.8
Ethane	4.8
Ethylene	Nil
Propane	3.4
Propylene	Nil
Butane	2.1

John C. Kennedy
Senior Chemist
Mines Department

STATE LABORATORIES, MELBOURNE

An. PG/17/9 17th November, 1964

Report on Sample No. 1208/64

Sample : Bore-hole gas
Locality : Port Campbell
Sender : Frome-Broken Hill Co. Pty. Ltd.,
95 Collins Street,
MELBOURNE.

Description of Sample :

Port Campbell No. 4

A sample of bore-hole gas was received for analysis. The gas was obtained during the testing of oil-well Port Campbell No. 4.

Particulars of Sample:

Drilling Company:	Frome-Broken Hill
Well:	Port Campbell No. 4
Drill Stem Test:	No. 21
Depth (feet):	5,870 - 5,878
Remarks:	Wellhead pressure 40 p.s.i.

Results:

Condition of Sample

The sample was received in a cylinder, and was under slight positive pressure.

Analysis	%
Carbon dioxide	Nil
Nitrogen	2.4
Oxygen	0.6
Methane	84.4
Ethane	5.7
Ethylene	Nil
Propane	3.4
Propylene	Nil
Butane	2.3

Analyses were carried out by the Janak Gas Chromatograph.

Hydrocarbons higher than butane may be present, but cannot be determined by this instrument.

John C. Kennedy
Senior Chemist
Mines Department

PETROLEUM REFINERIES (AUST.) PTY. LTD.

ANALYSIS OF GAS

PORT CAMPBELL NO. 4

	D.S.T. No. 9 5,947 to 5,970 feet.	D.S.T. No. 12 5,874 to 5,903 feet.
Air	11.5 %%	11.9 %
Methane	75.77 %	74.39 %
Ethane	5.66 %	7.3 %
Propane	3.58 %	3.8 %
Iso-Butane	1.87 %	0.9 %
n-Butane	1.10 %	0.86 %
Iso-Pentane	0.43 %	0.29 %
n-Pentane	0.36 %	0.19 %
Hexane and higher	0.53 %	0.29 %

PETROLEUM REFINERIES (AUSTRALIA) PTY. LTD.

Results of analysis of crude oil from Port Campbell No. 4, D.S.T. No. 12, 5,874 to 5,903 feet.

Specific Gravity 60/60°F	0.8246	
API Gravity	40.0	
Hempel Distillation		
initial boiling point.	150	°F
5% Recovered	180	
10%	212	
15%	257	
20%	300	
25%	329	
30%	365	
35%	404	
40%	441	
45%	480	
50%	513	
55%	543	
60%	579	
65%	609	
70%	643	(cracked)

Viscosity SSU @ 100°F	36.9	
SSU @ 122°F	34.6	
Water (Dean and Starke)	1.1%	
B.S. & W	3.0%	
Pour Point	80°F	
Sulphur	0.03%	
Salt Content	48	lb/1000 barrels

Determination of the Reid Vapour Pressure could not be made as the sample is solid at the test temperature.

Melbourne,
January 27, 1965.

APPENDIX 3

CORE DESCRIPTIONS AND ANALYSIS

CORE DESCRIPTIONS

Core No. 1

2,555 to 2,575 feet. Recovered 3 feet.
SAND; clear to white, mainly clear, medium to fairly well sorted, with rare fragments of green grey mica schist, rock fragments, mica, carbonaceous and pyritic plant remains. No hydrocarbons.

Core No. 2

2,892 to 2,912 feet. Recovered 10 feet.
SAND; medium grey, consisting of clear to milky, very fine to fine grained, subangular to subround, well sorted quartz grains, with occasional black carbonaceous specks, rare dark lithic fragments, minor clayey matrix and trace of white mica flakes and glauconite. Sand is interbedded with moderately hard black, micaceous, carbonaceous, sandy SILTSTONE up to 6" thick, with abundant white and brown mica flakes and some pyrite in places. Bedding flat or nearly so. No evidence of hydrocarbons.

Core No. 3

3,206 to 3,226 feet. Recovered 1 inch.
SAND; light grey, consisting of clear to milky, mainly clear, fine to medium grained, subround to round quartz grains, with some muscovite, amber coloured resin, streaks of carbonaceous and pyritic material and a lump of pyrite-cemented gritstone.

Core No. 4

3,226 to 3,245 feet. Recovered 12 feet.
9 feet SAND; slightly silty, clear, very fine to fine grained, angular to subround quartz with occasional coal and lithic fragments. Well sorted, interbedded with thin beds and lenticles of dark grey to black micaceous, carbonaceous SILTSTONE up to 1 inch thick.

1 foot SILTSTONE; very carbonaceous and micaceous, with pockets of brown to amber resin, interlaminated with very fine to fine grained SAND.

3 feet SAND; pebbly to silty, slightly pyritic, composed of clear, few stained, angular to subround, few round quartz grains, some with pyrite inclusions. Poorly sorted, unconsolidated, with carbonaceous material, resin and mica flakes. Bedding flat. No hydrocarbons.

Core No. 5

3,518 to 3,519 feet. Recovered 6 inches.
SANDSTONE; light grey, well consolidated, made up of very fine to fine angular to subround, mainly subangular, quartz with scattered coarse subround grains, all bound by calcite cement. Hard, and with appearance of quartzite.

Core No. 6 — 3,519 to 3,536 feet. Recovered 11 feet.
SANDSTONE; interbedded with SILTSTONE up to 6 inches thick. Sandstone is made up of clear to milky, fine to medium grained, subangular to subround, well sorted quartz grains, some glauconite, mica and carbonaceous matter bound in parts with calcite cement, but mainly unconsolidated and uncemented. Some quartz pebbles up to 10 mm. in size scattered through the core. The interbedded siltstone is medium to dark brown-grey, carbonaceous, micaceous, pyritic, glauconitic, argillaceous, with white layers and lenses of fine SAND. Bedding flat. No hydrocarbons.

Core No. 7 — 3,821 to 3,838 feet. Recovered 16 feet.
SAND; grey, silty, glauconitic and micaceous, made up of very fine to fine grained, angular to subround quartz with some coarse, round quartz grains scattered through the core. Silt fraction up to 50%, especially in bottom part of the core. Abundant glauconite and common brown, green and white mica. Streaks and lenses of white, very fine SAND are common. Concretions made up of sandy pyrite, sometimes very glauconitic and calcareous, are occasionally found. Bedding flat. No hydrocarbons.

Core No. 8 — 4,112 to 4,132 feet. Recovered 18 feet.
SANDSTONE; dark green, massive, glauconitic, consisting of clear, grey, green-stained, medium to very coarse grained, subround, poorly sorted quartz, dark green, coarse glauconite pellets set in a pale green silty glauconitic, kaolinitic matrix with irregular patches of finely disseminated pyrite. No apparent bedding. No hydrocarbons.

Core No. 9 — 4,269 to 4,289 feet. Recovered 15 feet.
SANDSTONE; brown, uniform, very poorly consolidated, made up of iron-stained, fine to coarse grained, subangular to subround quartz grains, with altered glauconite-limonite pellets and few pebbles set in a brown to green limonitic-glauconitic matrix. No bedding apparent. No hydrocarbons.

Core No. 10 — 4,580 to 4,600 feet. Recovered 6 inches.
SILTSTONE; grey to brown grey, micaceous, fossiliferous with small pyrite nodules. Slickensided and broken up. No bedding. No hydrocarbons.

Core No. 11 — 4,600 to 4,608 feet. Recovered 5 feet 2 inches.
2 feet SILTSTONE; dark grey to brown grey, micaceous, slightly pyritic, fossiliferous, very tight. Breaks up with conchoidal fracture.

3 feet SILTSTONE; dark brown-grey, micaceous, fossiliferous, abundantly glauconitic and slightly pyritic. Tight and less broken up than top part of core. No bedding. No hydrocarbons.

Core No. 12 — 4,894 to 4,914 feet. Recovered 2 feet.
SILTSTONE; dark grey to brown-grey, sandy in parts, micaceous, pyritic. Pyrite in small nodules or fine, hair-like lines, ?algae. Carbonaceous fragments scattered through core, some pyritised. Occasional fossil shell fragments and fish scales. Glauconite occurs as scattered pellets or in accumulation in sand streaks. Small gas bubbles from core observed, but no fluorescence. Dip: 0^{o} - 10^{o}.

Core No. 13 — 4,977 to 4,985 feet. Recovered 1 inch.
SANDSTONE; light grey, made up of clear, milky, grey, rarely dark grey, medium to coarse grained, angular to subround, well sorted quartz grains and some muscovite flakes set in a white to light grey kaolinitic, clayey matrix. No fluorescence. Acetone test negative, but with faint blue-white fluorescence on acetone solution.

Core No. 14 — 4,985 to 5,005 feet. Recovered 14 feet.
2 feet SAND to SANDSTONE; light grey to dirty white, fine to medium grained, subangular to round, mainly subround, well sorted quartz, few dark rock fragments and carbonaceous material set in a white, kaolinitic matrix. Very porous, noncalcareous.

12 feet SILTSTONE to MUDSTONE; dark grey to brown grey, moderately hard, containing black shining coal, amber to dark brown resins, feldspar, muscovite, fine crystalline aggregates or nodules of pyrite, shell fragments, plant remains and impressions. Noncalcareous, interlaminated with light grey, very fine SANDSTONE. Slickensided and well bedded. Small gas bubbles from the core but no fluorescence was observed. Acetone test negative.
Dip: 10^{o}.

Core No. 15 — 5,152 to 5,167 feet. Recovered 5 feet.
SANDSTONE; white, moderately consolidated, composed of fine to coarse grained, angular to subangular quartz, some feldspar, green chlorite grains, brown silvery-green (altered biotite) and white mica, few rock fragments, occasional magnetite set in a white, slightly calcareous, argillaceous (?kaolin) matrix. Many quartz grains exhibit secondary growth. Coaly matter interbedded in form of lenses and bands. Spotted, faint golden yellow fluorescence in the bottom part of the core. Acetone test negative. Light cut with light yellow fluorescence and resinous smell in trichloroethane.
Dip: 10^{o} - 15^{o}.

Core No. 16 — 5,456 to 5,476 feet. Recovered 6 feet.
SANDSTONE; green, massive, composed of medium to coarse grained, subangular to round, dark grey and red rock fragments, mainly cloudy feldspars, clear quartz, green to

Core No. 16 (Cont'd)

brown mica, chlorite set in a chloritic matrix which is generally slightly, but in patches strongly, calcareous. Bottom 4 inches is MUDSTONE conglomerate, made up of green mudstone pebbles from 0.1 to 4 inches in diameter, set in green pyritic sandstone matrix. Light brown fluorescence on calcareous cementing material only. No hydrocarbons.

Core No. 17

5,754 to 5,770 feet. Recovered 16 feet.
3 feet 9 inches SILTSTONE to very fine SANDSTONE; medium grey, micaceous, carbonaceous, consists of silt to very fine grained rock fragments, feldspars, quartz, chlorite, brown and white mica set in a light to medium grey clayey matrix with common very fine laminae of dark grey argillaceous and carbonaceous material towards base showing small scale cross-bedding.

1 foot SILTSTONE; medium brown, carbonaceous, micaceous, with small plant fragments generally lying semi-parallel to bedding.

11 feet 3 inches SANDSTONE; consists of medium to coarse grained, subangular to subrounded, clear, grey, milky, occasionally yellow and pink feldspar and quartz, dark grey, green grey, red-brown rock fragments, minor brown and white mica and chlorite set in a white clayey matrix. Carbonaceous material mainly in top part, together with irregular patches of highly calcareous matrix which fluoresced golden yellow, but which yielded negative acetone test. No hydrocarbons. Dip: 7°.

Core No. 18

6,070 to 6,084 feet. Recovered 13 feet 9 inches.
9 feet 9 inches SANDSTONE; light grey to green-grey, fine to medium grained, angular to subrounded, well sorted feldspar, dark rock fragments, quartz, brown and white mica, some in large flakes, all set in a white, slightly calcareous matrix. Fine to coarse carbonaceous fragments, and plant remains scattered through the core, especially in the top 3 feet. Tight, slightly cross-bedded and flat-bedded. Odd mud pellets.

4 feet MUDSTONE to SILTSTONE; green-grey to brown, due to disseminated carbonaceous matter. Slickensided, broken up, fractured, with calcite fillings showing golden yellow fluorescence. No hydrocarbons.

Core No. 19

6,355 to 6,367 feet. Recovered 7 feet.
SILTSTONE to very fine SANDSTONE; medium to brown-grey, carbonaceous, micaceous, medium grained, hard, tight, non-calcareous, with few laminae of carbonaceous accumulations. Slightly cross-bedded, dip fairly flat. No fluorescence except a faint one on carbonaceous matter. Few gas bubbles from core.

Core No. 20 — 6,663 to 6,683 feet. Recovered 7 feet.
SILTSTONE; green-grey, brown-grey to brown, micaceous, carbonaceous, hard, dense and very slightly cross-bedded. Noncalcareous. Coal fragments and plant remains, sometimes pyritised, disseminated in the core. Dip probably flat. No hydrocarbons. Density: 2.65.

Core No. 21 — 7,051 to 7,068 feet. No recovery.

Core No. 22 — 7,183 to 7,191 feet. Recovered 8 feet.
5 feet SILTSTONE to very fine SANDSTONE; light green-grey, fairly consolidated, carbonaceous and very micaceous, made up of feldspar, chlorite, minor dark rock fragments and quartz. Noncalcareous with occasional re-worked grey-brown indurated bentonitic clay pebbles. Mica, mainly brown biotite.

3 feet MUDSTONE to SILTSTONE; medium to dark grey, carbonaceous, sericitic, uniform, well consolidated, tight with occasional coalified plant remains. Slickensided, laminated, with small scale faulting. Fracturing sub-conchoidal. Dip: 10°. No hydrocarbons. Density: 2.5.

Core No. 23 — 7,690 to 7,710 feet. Recovered 20 feet.
SANDSTONE; green-grey, fine to medium, mainly fine grained. 70% feldspar, clear, white to pink, angular to subangular; 15% rock fragments, dark, medium grained, subangular to subrounded; 15% matrix, pale green, chloritic and slightly calcareous; minor quartz, some large flakes of biotite, pyrite and chlorite. Core is massive, uniform, with a calcite concretion at 7,700 feet, and no apparent bedding. Gas bubbles, common on freshly pulled core, were also observed under the microscope. No fluorescence. Acetone test negative, but solution fluoresced bright blue under ultra violet light. Fluorescence slightly green-grey in tri-chloroethane. Oily residue from soxhlet extraction shows bright yellow fluorescence. Density: 2.33.

Core No. 24 — 7,889 to 7,907 feet. Recovered nil on pulling core barrel, but recovered 18 feet when pulling Core 25.

Core No. 25 — 7,907 to 7,910 feet. Recovered 3 feet and 18 feet of Core 24, which are described hereunder.
21 feet SANDSTONE; light to medium grey, massive, compact, hard, tight and generally noncalcareous. Consists of very fine to fine grained, clear to grey feldspar, grey to black rock fragments, some quartz, common mica, minor carbonaceous particles set in a white to light grey, clayey matrix. Unidentified occasional pink and brown grains may be quartz and/or feldspar. Bedding poor. Dip: 0° - 10° as indicated by occasional micaceous and carbonaceous laminae. No hydrocarbons or fluorescence.

Core No. 26 — 8,279 to 8,299 feet. Recovered 20 feet.

7 feet SANDSTONE; light to medium grey, slightly calcareous, consists of very fine grained, subangular to subround, white, dull, cloudy, pink feldspar, dark rock fragments, some quartz, white and brown mica and green chlorite set in a white, clayey, slightly calcareous matrix. Black carbonaceous patches up to $\frac{1}{2}$" long frequent. Sandstone appears massive with a joint or fracture one foot from the top of the core dipping at 80° and having white calcite filling red-stained with iron oxide in places.

13 feet SILTSTONE; dark grey, tight, non-fissile, micaceous, carbonaceous and slightly sandy, fractured, subconchoidal. Bedding flat or nearly so. Laminated in places, showing small scale cross-bedding. No hydrocarbons.

Core No. 27 — 8,500 to 8,520 feet T.D. Recovered 17 feet.

4 feet SILTSTONE; medium grey, carbonaceous, micaceous, massive to laminated, lenticular and interlaminated with very fine SANDSTONE, which has abundant brown mica and brown carbonaceous matter, especially conspicuous on joint surfaces. Brown, carbonaceous matter has a greasy appearance but does not fluoresce or yield cut.

3 feet SANDSTONE; light grey-green, massive to laminated and cross-bedded in places. Composed of very fine to medium, mainly fine grained, dull, clear, milky, often partially kaolinised feldspar, dark grey to black rock fragments, and minor quartz, mica and chlorite. Grains have tendency to parallel orientation in laminated parts. Cement argillaceous, slightly calcareous.

1 foot SILTSTONE; as for the top of the core.

3 feet SANDSTONE; as for the top part of the core.

6 feet SILTSTONE; as for the top of the core, except more interlaminated with very fine sandstone.

Dip up to 10° in siltstone, and up to 30° in cross-bedded sandstone. No hydrocarbons.

SIDEWALL CORES

2,270	feet	2¼"	SILTSTONE; dark grey, brown, sandy, slightly glauconitic and pyritic.
4,025	"	1¾"	SAND; dark grey-green, very silty and glauconitic, quartz, clear, medium to coarse grained, angular to subround.
4,150	"	2¼"	SANDSTONE; dark green, very glauconitic, with medium to coarse, mainly medium grained, angular to subround, stained and clear quartz, and brown (altered) and green relatively fresh and polished glauconite pellets; matrix dark green, glauconitic.
4,839	"	1¾"	SILTSTONE; medium grey, fairly glauconitic and pyritic; slightly sandy.
4,875	"	1¾"	SILTSTONE; medium grey, pyritic and micaceous.
4,946	"	2"	COAL; very dark grey to black.
4,973	"	1"	SAND to SANDSTONE; white, silty, clear, very fine grained to granule size, unsorted quartz.
5,013	"	1¾"	SAND to SANDSTONE; very light grey, white, silty; with white and grey silt laid in laminated fashion. Sand: from very fine to coarse grained, angular and clear quartz, poorly sorted.
5,149	"	1¾"	SAND to SANDSTONE; white, clear, very fine to fine grained, angular, silty, interbedded with dark grey carbonaceous, very pyritic SILTSTONE. Along one side of the core it becomes silty, pyritic, dark grey, chloritic sand with few very coarse round quartz grains, and green chloritic matrix.
5,277	"	2¼"	SANDSTONE; light grey, mottled, fine grained feldspar, rock fragments and quartz; chlorite common; argillaceous matrix. Faint blue fluorescent streaks across core with a faint cut.
5,307	"	¾"	SANDSTONE; very light grey mottled, fine grained, argillaceous with rock fragments, feldspars and quartz, white clayey matrix.
5,700	"	1¾"	SANDSTONE; light grey greenish, medium to coarse grained, angular to round feldspar, rock fragments and quartz. Some mica and chlorite.
5,841	"	1½"	SILTSTONE-MUDSTONE; light grey, micaceous.
5,845	"	1½"	MUDSTONE; light grey, fairly clean with bentonitic characteristics.
5,876	"	1¼"	SILTSTONE; light grey, bluish, slightly sandy, micaceous.

5,878 feet		1½"	SANDSTONE; light grey, fine to medium, mainly fine grained, consists of feldspars and rock fragments, minor quartz.
5,892	"	2"	SANDSTONE; light grey, fine to medium grained, made up of feldspars, rock fragments and little quartz.
5,899	"	2"	SANDSTONE; light grey, greenish, fine to medium grained, some coarse, mainly medium grained, angular to subround with 60% feldspar, 30% rock fragments and 10% quartz, well sorted. Very good yellow greenish fluorescence throughout core, very good cut in trichloroethane and positive acetone test.
5,949	"	2"	SANDSTONE: light grey, greenish, fine to medium grained, angular to subround, well sorted feldspar, rock fragments and quartz. Fair yellow green fluorescence, fair cut with trichloroethane, and positive acetone test.
5,955	"	1¾"	SANDSTONE; light grey, fine to medium grained, made up of feldspars, rock fragments and quartz. Patchy fluorescence along one side only. Fair cut with trichloroethane and positive acetone test.
5,965	"	1¾"	SANDSTONE; as for 5,955 feet with patchy fluorescence throughout the core. Good cut with trichloroethane and positive acetone test.
6,167	"	1¾"	SANDSTONE; light grey greenish, fine to coarse grained, mainly medium, with feldspars, rock fragments and quartz; well sorted.
6,172	"	¾"	SANDSTONE; light grey, mottled, fine to medium grained, angular to subround, dull, pink feldspars, dark rock fragments, quartz, mica, occasional chlorite, clayey matrix.
6,205	"	1"	SILTSTONE-MUDSTONE; light grey, bluish, micaceous.
6,267	"	1¾"	SANDSTONE; light grey, greenish, fine to coarse, mainly medium; feldspar, rock fragments, quartz, mica, chlorite.
6,407	"	2"	SANDSTONE; light grey, fine grained, well sorted; feldspars, rock fragments, quartz, chlorite.
6,432	"	1½"	SANDSTONE; as for 6,407 feet.
6,479	"	1¼"	SANDSTONE; light grey, fine to medium, micaceous; feldspars, rock fragments, quartz, chlorite.
6,559	"	1"	SILTSTONE; light grey, interlaminated with very fine grained SANDSTONE.
6,562	"	1"	SILTSTONE; light grey, slightly micaceous.
6,569	"	1½"	SANDSTONE; light grey, fine to medium grained, well sorted; feldspars, rock fragments, mica. Argillaceous matrix.

6,575	feet	1½"	SANDSTONE; as for 6,569 feet.
6,595	"	1½"	SANDSTONE; light grey greenish, fine to medium grained; feldspars, rock fragments, chlorite.
6,599	"	1¾"	SANDSTONE; light grey greenish, micaceous, fine to medium grained, feldspar, rock fragments, quartz, chlorite, very coaly.
6,693	"	1¾"	SANDSTONE; light grey, fine to medium grained feldspars, rock fragments, well sorted, argillaceous matrix.
6,694	"	1½"	SANDSTONE; as for 6,693 feet.
6,728	"	1½"	SANDSTONE; light grey, greenish, fine grained, angular to subround, well sorted feldspars, rock fragments, quartz.
6,758	"	1"	SANDSTONE; light grey, very fine to fine; feldspar, rock fragments.
6,925	"	1¼"	SANDSTONE; light grey, fine to medium grained, angular to subround, well sorted, feldspars, rock fragments, quartz, mica, with re-worked mudstone pebbles. Fair patchy fluorescence; fair cut with trichloroethane. Positive acetone test.
7,121	"	¾"	MUDSTONE; light to medium grey, slightly micaceous.
7,203	"	2"	SILTSTONE; light grey, greenish, micaceous.
7,250	"	1"	SANDSTONE; light grey, greenish, medium to coarse grained, angular to subround feldspars, rock fragments, quartz, mica.
7,307	"	1"	SANDSTONE; light grey greenish, fine to coarse grained, mainly medium, feldspars, rock fragments, quartz, mica, chlorite.
7,320	"	1"	SANDSTONE; light grey greenish, fine to coarse grained, mainly medium, angular to subround, 30% to 40% rock fragments, 60% to 70% feldspars, less than 10% quartz.
7,419	"	¾"	SANDSTONE; light grey, very fine grained, micaceous.
7,500	"	¾"	SANDSTONE; green, mottled, fine to medium grained, mainly fine, angular to round; feldspars, rock fragments, quartz, chlorite.
7,553	"		Nil recovery.
7,555	"	1¼"	SANDSTONE; light grey, fine grained feldspars, rock fragments, argillaceous. Very few slightly fluorescent specks, no cut.
7,667	"	1"	SANDSTONE; light grey, fine to medium grained, angular to subround feldspars, rock fragments, quartz, mica, with odd well rounded quartz granules.

7,726	feet	¾"	SANDSTONE; light grey, fine to medium grained, angular to subround feldspar, rock fragments, mica, quartz, chlorite.
7,757	"	2"	SANDSTONE; light grey, greenish, fine to medium grained feldspars, rock fragments, quartz.
7,880	"		Nil recovery.
7,880	"	¾"	SANDSTONE; light grey, very fine to fine grained, feldspars, rock fragments.
7,881	"	1½"	SANDSTONE; light grey, very fine grained feldspars and rock fragments, argillaceous matrix.
7,900	"		Nil recovery.
7,900	"		Nil recovery.
8,222	"	1¾"	SANDSTONE; light grey, very fine grained feldspars, dark rock fragments, chlorite, argillaceous matrix.
8,440	"		Nil recovery.
8,474	"	1¼"	SILTSTONE to very fine SANDSTONE; light grey, micaceous, slightly carbonaceous.

CORE ANALYSIS REPORT

FOR

MINORA RESOURCES NL

PORT CAMPBELL 4

ADDED TO WCR
BY NRE
12/8/99
3 PAGES

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

1st August 1988

Minora Resources NL
7th Floor
Colonial Mutual Building
55 St. George's Terrace
Perth W.A. 6000

Attention: Mr T. Scholefield

Subject : Core Analysis
Well : Port Campbell #4
File : WA-CA-407

Dear Sir,

Core Laboratories received 4 samples from the subject well for analysis.

One-inch diameter plug samples were drilled from the core pieces using tap water as the bit lubricant. These plugs were dried at 115°C to constant weight. Permeability to air, helium injection porosity and grain density were then determined.

Core Laboratories thanks Minora Resources NL for the opportunity to have been of service.

Yours faithfully,
CORE LABORATORIES

Peter Lane
Petrophysical Laboratory Supervisor

PRL:jc:7

CORE LABORATORIES AUSTRALIA PTY., LTD.

Company : MINORA RESOURCES NL
Well : PORT CAMPBELL 4
Location :
Country : AUSTRALIA

Field :
Formation :
Coring Fluid :
Elevation :

File No.: WACA407
Date : 1-AUG-88
API No. :
Analysts: PL

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY (HORIZONTAL) Kair md	POROSITY (HELIUM) %	GRAIN DENSITY gm/cc	DESCRIPTION
1	7183.0- 92.0	0.03	11.5	2.70	SST: grn- gry,vf gr,hd,wl srt,ang
2	7690.0- 10.0	0.29	11.6	2.65	SST: grn- gry,f gr,hd,wl srt,ang
3	7889.0- 07.0	0.13	9.2	2.67	SST: grn- gry,f gr,hd,wl srt,ang
4	8279.0- 99.0	0.01	10.3	2.71	SST: grn- gry,f gr,hd,wl srt,ang

Received 15/3/95

BA/KH

BD

GFE Resources Ltd

9 March, 1995

Department of Agriculture, Energy and Minerals
Petroleum Operations Branch
3rd Floor, 115 Victoria Parade
FITZROY VIC 3065

ATTENTION: Kathy Hill
General Manager

Dear Kathy,

Please find enclosed por/perm measurements and petrology studies for the core chips from Port Campbell-4 sampled by GFE late last year.

Due to an inconsistency in labelling, one depth is given in metres while the others are given in feet. The samples were taken from cores 16, 24 and 25.

Yours sincerely,

ADDED TO WCR
BY NRE
12/8/99
3 PAGES

NOEL NEWELL
SENIOR EXPLORATIONIST

PETROLEUM DIVISION
15 MAR 1995

NN/aj:j3475

Level 6, 6 Riverside Quay, South Melbourne Victoria 3205 Telephone: (03) 684 4888 Facsimile: (03) 684 4897

Address all mail to Box 629, Market Street Post Office, Melbourne Victoria 3000 A.C.N. 005 469 581

TABLE: 1

CORE ANALYSIS

GFE RESOURCES LTD
PORT CAMP 4
CORE

21-Nov-94
FILE NO:CAP-94-15

Sample	Depth	Helium Porosity %	Summation of Fluids Porosity	Grain Density gm/cc	Air Perm md KH	Air Perm md KV	Residual SATS % pore vol Oil	Residual SATS % pore vol Water
	2349.70m	11.6		2.68	0.16			
	5456-5458	19.8		2.69	2.5			
	7895-7897	8.2		2.65	0.10			
	7900-7902	11.6		2.66	0.45			

* = no data

= irregular sample

GEOTECHNICAL SERVICES PTY LTD

TABLE: 1

CORE ANALYSIS

GFE RESOURCES LTD
PORT CAMP 4
CORE

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FILE NO:CAP-94-15

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* = no data

= irregular sample

GEOTECHNICAL SERVICES PTY LTD

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: 24th February 1965

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with ~~mercury~~ air at 750 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precipitate	Colour	Fluor.	
Port Campbell No. 4	1	2555' 2575'	INSUFFICIENT SAMPLE REMAINING FOR TESTING													
"	2	2894' 2896'	Sandstone, friable	35	35	702	803	1.72	2.65	2	Nil	Nil	Nil	Nil	Nil	
"	3	3206' 3226'	Sand grains only remaining. UNSUITABLE FOR TESTING													
"	4	3232' 3234'	Sandstone, friable	35	N.D.	3,100	N.D.	1.70	2.63	Nil	Nil	Nil	Nil	Nil	Nil	Horiz. plug disintegrated
"	5	3518' 3519'	Sandstone, siliceous	N.D.	3	N.D.	Nil	2.66	2.75	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	Insufficient sample for Vert. plug
"	6	3519' 3521'	Siltstone & sandstone	25	25	2	31	2.08	2.77	9	Nil	Nil	Nil	Nil	Trace	
"	7	3835' 3837'	Siltstone	27	25	Nil	1	2.13	2.86	23	Nil	Pale Yellow	Nil	Trace	Trace	
"	8	4112' 4114'	Sandstone (dark green)	35	33	22	17	1.96	2.95	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	

Additional Informations:

General File No. 62/399
Well File No. 64/4063

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: 24th February, 1965

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with ~~mercury~~ air at ~~750~~ 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precipitate	Colour	Fluor.	
Port Campbell No. 4	8	4122' 4124'	Sandstone (dark green)	19	20	Nil	Nil	2.47	3.07	99	Nil	Nil	Nil	Nil	Nil	
"	8	4126' 4128'	As above	18	18	Nil	Nil	2.63	3.19	N.D.	N.D.	N.D.	N.D.	N.D.	ND.	
"	9	4273' 4275'	Sandstone, friable	28		N.D.		1.99	2.78	"	"	"	"	"	"	Sample too friable to obtain plugs
"	9	4283' 4284'	As above	29		N.D.		2.03	2.86	Nil	Nil	Nil	Nil	Nil	Nil	As above
"	10	4580' 4600'	Shale	INSUFFICIENT SAMPLE REMAINING FOR TESTING												..
"	11	4600' 4602'	Shale	26		N.D.		2.20	2.96	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	Broken shale, pieces only.
"	12	4894' 4896'	Shale	22	27	Nil	Nil	2.32	3.08	"	"	"	"	"	"	
"	13	4977' 4985'		NIL CORE RECOVERY												

Additional Information:

General File No. 62/399
Well File No. 64/4063

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: 24th February, 1965

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with air at 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Sozhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precipitate	Colour	Fluor.	
Port Campbell No. 4	14	4985' 4987'	Sandstone, carbonaceous bands	22	21	34	426	2.06	2.62	5	Trace only	Yellow	Fair	Yellow	strong	
"	14	4993' 4995'	Shale	22		N.D.		2.28	2.92	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
"	15	5154' 5156'	Sandstone	25	23	264	302	2.00	2.64	1	Nil	Nil	Nil	Nil	Nil	
"	16	5460' 5462'	Sandstone	22	22	8	4	2.14	2.73	23	"	"	"	"	"	
"	17	5756' 5758'	Sandstone and siltstone	21	23	Nil	2	2.16	2.78	36	"	Pale Yellow	"	"	Fair	
"	18	6078' 6080'	Sandstone	20	20	2	5	2.17	2.71	8	"	Nil	"	"	Nil	
"	19	6357' 6359'	Siltstone	19	18	Nil	Nil	2.30	2.82	22	Trace only	Pale Yellow	Faint trace	Pale yellow	Strong	
"	20	6665' 6667'	Siltstone	16	17	Nil	Nil	2.36	2.82	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	

Additional Information:

General File No. 62/399
Well File No. 64/4063

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: 24th February

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with mercury at 750 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precip-itate	Colour	Fluor.	
Port Campbell No. 4	21	7051' 7067'		NIL			CORE			RECOVERY						
"	22	7187' 7189'	Siltstone and sandstone	18	25	N.D.	Nil	2.29	2.92	57	Trace only	Pale Yellow	Faint trace	Pale yellow	strong	
"	23	7692' 7694'	Sandstone	11	11	Nil	"	2.34	2.64	11	Nil	Nil	Nil	Nil	Nil	
"	23	7700' 7702'	Sandstone	12	12	"	"	2.36	2.69	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
"	23	7708' 7710'	Sandstone	12	14	"	"	2.35	2.70	"	"	"	"	"	"	
"	24	7895' 7897'	Sandstone	9	11	"	"	2.41	2.67	15	Nil	Nil	Nil	Nil	Nil	
"	25	7907' 7909'	Sandstone	9	9	"	"	2.43	2.67	16	"	"	"	"	Trace	
"	26	8279' 8281'	Sandstone	11	11	"	"	2.51	2.81	42	"	"	"	"	Nil	

Additional Information:

General File No. 62/399
Well File No. 64/4063

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: 24th February, 1965

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with ~~mercury~~ air at ~~750~~ 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precip-itate	Colour	Fluor.	
Port Campbell No. 4	26	8297' 8299'	Shale	11	10	Nil	Nil	2.52	2.82	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
"	27	8500' 8502'	Shale	8	9	"	"	2.53	2.76	"	"	"	"	"	"	
"	27	8504' 8506'	Sandstone	10	10	"	"	2.47	2.74	25	Nil	Nil	Nil	Nil	Nil	
"	27	8516' 8517'	Shale and Siltstone	5	9	N.D.	N.D.	2.57	2.76	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	

Additional Information:

General File No. 62/399
Well File No. 64/4063

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: JULY 15/64

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with ~~mercury~~ air at ~~750~~ 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Grain	Water	Oil	Colour	Precip-itate	Colour	Fluor.	
Port Campbell No. 4	23	7690 7710	Sandstone-Medium Grain, Arkosic, Firm, Silty Matrix	14.3	13.9	Nil	Nil	2.35	2.73	72	Nil	Nil	Nil	Nil	Trace	
"	24A	7889	Sandstone as Above	11.1	11.1	Nil	Nil	2.43	2.73	51	Nil	Nil	Nil	Nil	Trace	
	24B	7907	"	10.8	10.4	Nil	Nil	2.39	2.68	55	Nil	Nil	Nil	Nil	Trace	

Additional Informations: CORE 23 WAS A PRESERVED (TINNED) SAMPLE
CORE 24 (TWO PIECES) WAS NOT PRESERVED

General File No. 62/399
Well File No.

APPENDIX 4

SUMMARY OF TESTING OPERATIONS

PE907166

This is an enclosure indicator page.
The enclosure PE907166 is enclosed within the container PE903901 at this location in this document.

The enclosure PE907166 has the following characteristics:

ITEM_BARCODE	= PE907166
CONTAINER_BARCODE	= PE903901
NAME	= Core Analysis Results
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Core Analysis Results, (Enclosure from WCR),Bureau of Mineral Resources, Geology and Geophysics, 15 July 1964, for Port Campbell-4.
REMARKS	=
DATE_CREATED	= 15/07/64
DATE_RECEIVED	= 7/01/65
W_NO	= W484
WELL_NAME	= PORT CAMPBELL-4
CONTRACTOR	= BUREAU OF MINERAL RESOURCES
CLIENT_OP_CO	= FROME-BROKEN HILL COMPANY

(Inserted by DNRE - Vic Govt Mines Dept)

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

Date: JULY 15/64

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with air at 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From: To:	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc.		Fluid Saturation in % Pore Space		Acetone Test		Solvent after Extraction		Remarks
				V	H	V	H	Dry Bulk	Grain	Water	Oil	Colour	Precip-itate	Colour	Fluor.	
Port Campbell No. 4	23	7690 7710	Sandstone-Medium Grain, Arkosic, Firm, Silty Matrix	14.3	13.9	Nil	Nil	2.35	2.73	72	Nil	Nil	Nil	Nil	Trace	
"	24A))	7889	Sandstone as Above	11.1	11.1	Nil	Nil	2.43	2.73	51	Nil	Nil	Nil	Nil	Trace	
	) 24B)	7907	"	10.8	10.4	Nil	Nil	2.39	2.68	55	Nil	Nil	Nil	Nil	Trace	

Additional Information: CORE 23 WAS A PRESERVED (TINNED) SAMPLE.
CORE 24 (TWO PIECES) WAS NOT PRESERVED.

General File No. 62/399
Well File No.

SUMMARY OF OPERATIONS - PORT CAMPBELL NO. 4 WELL

(See Fig 5. Graphical representation of all operations)

Drilling

Drilling Contractors' rig No. 2 was moved from Fergusons Hill No. 1 to Port Campbell No. 4 and rigged up. Rat holes were dug and the well spudded at 0100 hours on 10 June, 1964. A 12¼" hole was drilled to 1,400 feet and electric and sonic-gamma ray logs run. The hole was then opened to 17½" and 13⅜" casing run to 1,343 feet and cemented with 1,100 sacks of Class A cement. Obtained approximately 200 sacks of cement returns. Hole bridged shortly before plug reached bottom causing the casing to be pumped out of the hole a distance of 5 feet. Plug down with 1,000 p.s.i. After 6 hours released casing and nippled up blow-out preventors and tested to 1,800 p.s.i. satisfactorily.

Went in hole with 12¼" bit and located top of cement at 1,274 feet (37 feet above float collar). Pressure tested blow-out preventors and casing to 1,800 p.s.i. satisfactorily. Drilled out float collar and guide shoe and cleaned out to 1,400 feet. Pulled out and ran 8¾" bit.

Drilled ahead to 3,518 feet, cutting 4 cores. Schlumberger ran electric, micro and sonic-gamma ray logs. Drilled to 3,821 feet and Schlumberger ran dipmeter log.

Drilled to 4,985 feet and ran D.S.T. No. 1 testing interval 4,943 to 4,985 feet. Packer seat failed after tester open for 2 minutes. Test was unsatisfactory. Made trip and conditioned hole. Ran D.S.T. No. 2, testing interval 4,963 to 4,985 feet, and recovered approximately 1,036 feet of salt water. Drilled to 5,062 feet and ran D.S.T. No. 3, testing interval 5,005 to 5,062 feet. Recovered approximately 4340 feet of salt water, 180 feet of muddy water and 90 feet of mud - total of 4,630 feet of fluid.

Continued drilling to 6,070 feet. Cut 13 cores from 3,518 to 6,070 feet. Schlumberger ran electric and sonic-gamma ray logs. The micro and dipmeter logs could not be run due to instrument trouble. Drilled to 6,663 feet and Schlumberger ran micro and dipmeter logs.

At 7,910 feet, Schlumberger ran electric log and velocity survey. A total of 8 cores were cut in the interval 6,070 to 7,910 feet.

Reached depth of 8,500 feet on 10 July, 1964. Schlumberger ran electric, micro, laterolog, sonic-gamma ray and dipmeter logs. Sixty side-wall samples were taken. Cut final core from 8,500 to 8,520 feet.

A total of 27 cores (432 feet) were cut from 2,555 to 8,520 feet, with a total recovery of 250 feet (58.9%).

Casing

Ran 253 joints of 5½" casing with float shoe at 8,182 feet and float collar at 8,147 feet. Cemented casing with 650 sacks of Class A cement with 110 gals of D-4 retarder added to mixing water. Reciprocated pipe until 1 minute before bumping plug with 2,100 p.s.i. Obtained 100% circulation. Centralizers were run over the intervals 8,165 to 7,190 feet, 6,030 to 5,910 feet and 4,080 to 3,960 feet. Estimated top of cement 7,000 feet.

Nippled up wellhead and blow-out preventors. Picked up 2½" tubing and cleaned out to float collar - checked float collar at 8,140 feet. Pressure tested casing and blow-out preventors to 1,800 p.s.i. satisfactorily.

Testing Through 5½" Casing

D.S.T. No. 4 (7,878 to 7,950 feet) 4 jets/ft.

Schlumberger perforated the interval 7,850 to 7,950 feet from wire line measurements. A collar log was run to 7,000 feet for future shooting reference.

Ran RTTS packer and set at 7,860 feet. No load water was used. A three position valve was run 450 feet above the tester. Opened tester for a 10 minute C.I.P. period. Opened C.I.P. valve and obtained slight blow at surface. Two hours after opening C.I.P. valve, ran swab to 7,400 feet without recovering any fluid. Re-ran swab with same results. Closed C.I.P. valve for 2 hour final pressures and pulled out of hole. Recovered 90 feet of rat hole mud. Test considered satisfactory.

Ran bar collar to 7,800 feet and laid a 40-sack cement plug to 7,611 feet. Pulled up and waited 4 hours on plug. Located top of plug at 7,628 feet. Pulled out of hole.

D.S.T. No. 5 (7,418 to 7,460 feet) 4 jets/ft.

Schlumberger located collars and perforated the interval 7,418 to 7,460 feet with 4 jets per foot.

Ran RTTS packer and set at 7,387 feet. No water cushion used and the C.I.P. valve was run 90 feet above the tester. Took 1½ hour initial C.I.P. Opened tester and obtained air cushion blow at surface - blow died. Closed in for 2 hour final C.I.P. Pulled out of hole and recovered 280 feet of rathole mud and salt water.

Ran bar collar and laid a 40 sack cement plug from 7,460 to 7,370 feet. After 4 hours, located top of plug at 7,370 feet.

D.S.T.'s Nos. 6 and 7 (7,302 to 7,325 feet) 4 jets/ft.

Schlumberger perforated the above interval from the collar log, along with the interval 7,235 to 7,254 feet.

Went in hole with RTTS and a tubing leak developed on reaching setting depth. Pulled out of hole. Re-ran RTTS and set at 7,275 feet to test 7,302 to 7,325 feet. No load water run and the C.I.P. valve run 60 feet above the tester. Took 1½ hour initial C.I.P. Opened tester and failed to receive air cushion blow. After two hours, pulled tester and found hydraulic choke plugged. Made trip to condition mud.

Ran RTTS and set at 7,275 feet to test the interval 7,302 to 7,325 feet. Took ½ hour initial C.I.P. Received no blow on opening C.I.P. valve. Ran swab and did not locate fluid. Pulled out of hole and recovered 60 feet of rat hole mud. Charts indicated a dry test.

D.S.T. No. 8 (7,235 to 7,254 feet and 7,302 to 7,325 feet) 4 jets/ft.

Ran RTTS and set at 7,184 feet to test the intervals 7,235 to 7,254 feet and 7,302 to 7,325 feet. Took ½ hour initial C.I.P. Opened tester and received a very slight blow. Ran swab and recovered approximately ½ barrel of rat hole mud. Continued swabbing without recovery. Pulled tester and recovered approximately 190 feet of rat hole mud.

Ran bar collar and laid a 40 sack cement plug from 6,210 to 6,120 feet. After 4 hours, located top of plug at 6,120 feet.

Isolation Squeeze (5,946 to 5,947 feet and 5,970 to 5,971 feet) 4 jets/ft.

Schlumberger perforated the intervals 5,946 to 5,947 feet and 5,970 to 5,971 feet for isolation squeeze.

Ran Howco DM squeeze packer and set at 5,915 feet to squeeze isolation perforations. Attempted to break formation down and circulation was established at surface between the 5½" and 13⅜" casing strings with 1,200 p.s.i.

Mixed 125 sacks of Class A cement and circulated 120 sacks behind casing. The 5½" - 13⅜" annulus was closed during cement displacement. Obtained 1,000 p.s.i. pressure build-up. Pulled out of hole with stinger. After 6 hours drilled out DM squeeze packer and cleaned out to plug at 6,120 feet. Attempted pressure test - formation took fluid at 1,500 p.s.i. Standing pressure 600 p.s.i.

Ran second DM packer and set at 5,915 feet to re-squeeze isolation perforations. F/B/D 2,100/1,500/600. Mixed 75 sacks and squeezed 70 sacks to 1,400 p.s.i. Pulled out of hole with stinger. Ran bit and after 8 hours drilled out DM packer and cement - cleaned out to top of plug at 6,120 feet. Pressure tested isolation perforations to 1,700 p.s.i. for 15 minutes satisfactorily.

D.S.T. No. 9 (5,947 to 5,970 feet) 4 jets/ft.

Schlumberger perforated interval 5,947 to 5,970 feet with 4 jets/ft.

Ran RTTS to setting depth but could not get packer to set. Pulled out of hole and found junk lodged in the packer "J" slot.

Re-ran RTTS and set at 5,903 feet. Took 1 hour initial C.I.P. Opened well for flow and obtained an immediate strong blow at surface. Gas to surface in approximately 5 minutes. After 3 hours ran swab and located fluid at 750 feet. Pulled four swabs and left well to flare pit for the night. Well started to head approximately 6 hours after opening tool.

Tester open from 1415 hours, 26 July, until 1015 hours, 28 July, 1964. On a 12 hour test the well produced gas at the rate of 160 to 219 MCF/day. Fluid ranged between 215 and 240 bbls./day which cut approximately 85% salt water (11,600 ppm Cl) and 15% emulsion. The emulsion could not be broken with ease in the field. However, it is estimated that about 25% of the emulsion was oil. Flowing pressures with no choke at the wellhead ranged from 45 to 65 p.s.i.g. Flow was unsteady.

Abandonment 5,947 to 5,970 feet.

Ran and set RTTS at 5,916 feet to squeeze cement perforations 5,947 to 5,970 feet. F/B/D 1700/1400/500. Mixed 60 sacks of Class A cement and squeezed 55 sacks to a final pressure of 2200 p.s.i. Pulled out of hole with RTTS.

Went in hole with bit and, after 8 hours, drilled out cement across perforations 5,947 to 5,970 feet and cleaned out to top of plug at 6,120 feet. Pressure tested perforations to 1500 p.s.i. for 15 mins. - satisfactory.

Drilled out cement plug 6,120 to 6,210 feet and cleaned out to 7,100 feet. Went in hole with bar collar to 7,123 feet and laid a 40 sack cement plug from 7,123 to 7,029 feet to isolate perforations 7,235 to 7,254 feet and 7,302 to 7,325 feet.

The top of the plug was located by Schlumberger at 7,025 feet.

Isolation Squeeze 6,403 to 6,404 feet and 6,444 to 6,445 feet.

Schlumberger perforated the intervals 6,403 to 6,404 feet and 6,444 to 6,445 feet for isolation squeeze with 4 jets/ft.

Ran RTTS squeeze packer to squeeze isolation perforations but could not get the circulating by-pass sub to close. Pulled out of hole and ran DM squeeze packer, and set at 6,365 feet. Attempted to test DM packer and obtained circulation in the annulus.

Pulled out of hole with DM stinger and went back with RTTS squeeze packer. Set RTTS above perforations 5,947 to 5,970 feet and satisfactorily pressure tested casing. Re-set below perforations and obtained circulation.

Went back in hole with DM stinger and set in DM packer at 6,365 feet. Circulated behind the $5\frac{1}{2}$" casing (in 6,403 to 6,404 feet and 6,444 to 6,445 feet, and out 5,947 to 5,970 feet) for approximately 1 hour. Performed in-out squeeze using 100 sacks of Class A cement. Maximum pressure 1,500 p.s.i. Pulled up 10 stands and reversed out. Pulled out of hole with stinger.

Ran bit and after 8 hours drilled out cement from 5,565 to 6,090 feet. Cement was found below the perforations 5,947 to 5,970 feet due to tubing and casing being out of balance at completion of job. The DM stinger was pulled above the perforations before reverse circulating. Pressure tested perforations 5,947 to 5,970 feet to 2,200 p.s.i. for 15 minutes satisfactorily.

Drilled out DM packer and cement to 6,450 feet and cleaned out to top of plug at 7,025 feet. Pressure tested perforations 6,403 to 6,404 feet and 6,444 to 6,445 feet to 1,500 p.s.i. for 15 minutes satisfactorily. Pulled out of hole.

Cement Bond Log

Schlumberger ran cement bond log from 7,000 to 4,900 feet. Results are summarised as follows:

(1)	7,000 to 6,620 feet	-	excellent bonding.
(2)	6,620 to 6,560 "	-	fair bonding.
(3)	6,560 to 6,500 "	-	no bonding.
(4)	6,500 to 6,250 "	-	poor bonding with isolated sections showing fair bonding.
(5)	6,250 to 6,000 "	-	fair bonding generally with sections showing good bonding.
(6)	6,000 to 5,400 "	-	good bonding generally with many sections showing excellent bonding.
(7)	5,400 to 4,980 "	-	fair to poor bonding decreasing to poor bonding at the top of the interval.

Re-squeeze (6,403 to 6,404 feet and 6,444 to 6,445 feet)

Ran and set RTTS squeeze packer at 6,370 feet to re-squeeze the intervals 6,403 to 6,404 feet and 6,444 to 6,445 feet. F/B/D 2400/2400/1600. Mixed 50 sacks of Class A cement and squeezed 45 sacks to a final pressure of 2500 p.s.i. Pulled out of hole with RTTS squeeze packer.

Ran bit and drilled out cement and cleaned out to top of plug at 7,025 feet. Pressure tested perforations to 1,500 p.s.i. satisfactorily.

D.S.T. Nos. 10 & 11 (6,404 to 6,444 feet) 4 jets/ft.

Schlumberger perforated the interval 6,404 to 6,444 feet with 4 jets/ft.

Ran RTTS and set at 6,379 feet to test the perforated interval. Took a 1 hour I.C.I.P. Opened C.I.P. valve and obtained weak blow that died. Ran swab to top of C.I.P. valve and failed to locate fluid. Closed C.I.P. valve for 1 hour F.C.I.P. and pulled out of hole. Recovered approximately 500 feet of mud in tubing. Choke assembly was found plugged. Made trip with open-ended tubing and conditioned mud.

Re-ran RTTS and set at 6,380 feet to re-test the interval 6,404 to 6,444 feet. Took 15 min. I.C.I.P. Opened C.I.P. valve for flow period and obtained a good blow to surface. After tool was open 2 hours, ran swab and located fluid at 2,500 feet. Swabbed a total of 20.5 bbls. of salt water that tested 12,700 ppm Cl. Closed C.I.P. valve for 1 hour F.C.I.P. while reversing out. Pulled out of hole with tester. Water sample from below C.I.P. valve tested 13,500 ppm Cl.

Abandonment of Interval 6,404 to 6,444 feet

Ran bar collar to 6,200 feet and laid a 40 sack cement plug from 6,200 to 6,107 feet. After 4 hours, located top of plug at 6,120 feet. This plug was intentionally placed below the previously tested interval 5,947 to 5,970 feet to facilitate a re-test since there was some doubt as to the interval being properly isolated on initial testing. Instructions were received to forego a re-test of the interval 5,947 to 5,970 feet at this time.

D.S.T. No. 12 (5,874 to 5,903 feet) 4 jets/ft.

Schlumberger perforated the interval 5,874 to 5,903 feet with 4 jets/ft.

Ran RTTS and set at 5,842 feet and took a 65 min. I.C.I.P. Opened C.I.P. valve and recovered a strong blow with gas to surface in 2 minutes. Small amount of fluid to surface in 2 hours. Flowed well to burn pit for 13 hours to clean up. Placed well on 6 hour test. Spot checks made of gas flow during clean up period indicated that flow was decreasing. Bottom hole pressure charts seemed to confirm this observation. Closed C.I.P. valve for 2 hour F.C.I.P. Pulled out of hole.

Abandonment of Interval 5,874 to 5,903 feet

Went in hole with bar collar to 5,903 feet and laid a 30 sack cement plug from 5,903 to 5,810 feet. After 4 hours located top of plug at 5,817 feet.

D.S.T. No. 13 (5,672 to 5,702 feet)

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 5,643 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve for flow and obtained fair blow at surface. Ran swab after tool open 2 hours and swabbed a total of 10.5 bbls. of fluid (salt water with some mud). Salt water tested 12,700 ppm Cl. Closed C.I.P. and took a 1 hour F.C.I.P. Pulled out of hole and recovered 180 feet of salt water that tested 13,200 ppm Cl.

Squeeze Cementation of the Interval 5,672 to 5,702 feet

Ran RTTS squeeze packer and set at 5,642 feet to squeeze perforations 5,672 to 5,702 feet. F/B/D 2300/2300/1500. Mixed 50 sacks of Class A cement and squeezed 45 sacks to a final pressure of 2,850 p.s.i. Pulled out of hole.

Ran bit and drilled out cement across perforations and cleaned out to top of plug at 5,817 feet. Pressure tested perforations 5,672 to 5,702 feet to 1,500 p.s.i. for 15 minutes satisfactorily.

Squeeze Cementation of the Intervals 5,874 to 5,903 feet and 5,947 to 5,970 feet

Drilled out cement plug 5,817 to 5,903 feet and cleaned out to top of plug at 6,120 feet.

Went in hole with RTTS squeeze packer and set at 5,850 feet to squeeze the intervals 5,874 to 5,903 feet and 5,947 to 5,970 feet. F/B/D 1700/1400/1000. Mixed 100 sacks of Class A cement and squeezed 95 sacks to a final pressure of 3,300 p.s.i.

Ran bit and drilled out cement from 5,848 to 5,975 feet and cleaned out to plug at 6,120 feet. Drilled out plug at 6,120 to 6,200 feet and cleaned out to top of plug at 7,025 feet. Circulated and conditioned mud.

Squeeze Cementation of the Interval 6,404 to 6,444 feet

Went in hole with RTTS squeeze packer and set at 6,375 feet to squeeze the interval 6,404 to 6,444 feet. F/B/D 2800/2000/1650. Mixed 50 sacks of Class A cement and squeezed 45 sacks to 2,500 p.s.i.

Ran bit and drilled out cement and cleaned out to top of plug at 7,025 feet.

Cement Bond Log

Schlumberger ran cement bond log from 7,000 to 5,000 feet. Very little improvement in bonding was noted in those sections of the hole that had shown only partial bonding on the first cement bond log run.

D.S.T. No. 14 (6,900 to 6,928 feet) 4 jets/ft.

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 6,847 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve for flow and obtained fair blow that diminished. Ran swab and recovered 2.1 bbls. of mud-cut salt water. Closed C.I.P. valve and took a 1 hour F.C.I.P. Pulled out of hole with tester without reversing out. Recovered 180 feet of fluid (mud-cut salt water) that tested 10,500 ppm Cl.

Abandonment of the Interval 6,900 to 6,928 feet

Ran bar collar to 6,010 feet and laid a 25 sack cement plug from 6,910 to 6,817 feet. After 4 hours located top of plug at 6,816 feet.

D.S.T. No. 15 (6,691 to 6,696 feet, 6,722 to 6,731 feet and 6,752 to 6,765 feet)

Schlumberger perforated the interval with 4 jets/ft.

Ran and set RTTS at 6,658 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve for flow and obtained a fair blow that died. Ran swab and recovered

6 bbls. of salt water. Closed C.I.P. valve for 1 hour F.C.I.P. and pulled out of hole without reversing out. Water sample from below C.I.P. valve tested 12,300 ppm Cl. Approximately 150 feet of water recovered above C.I.P. valve.

Abandonment of the Intervals 6,691 to 6,696 feet, 6,722 to 6,731 feet and 6,752 to 6,765 feet

Ran bar collar to 6,722 feet and laid a 25 sack cement plug from 6,722 to 6,632 feet. After 3 hours located top of plug at 6,630 feet.

Isolation of the Interval 6,554 to 6,555 feet

The interval proposed for testing (6,555 to 6,601 feet) was indicated on the bond log to be isolated from below but not from above.

Schlumberger perforated a 1 foot interval, 6,554 to 6,555 feet, with 4 jets for an isolation squeeze.

Ran RTTS squeeze packer and set at 6,521 feet. F/B/D 2400/2400/1800. Mixed 50 sacks and squeezed 45 sacks to a final pressure of 2,800 p.s.i.

Went in hole with bit and scraper and drilled out cement and cleaned out to plug at 6,630 feet. Pressure tested casing to 1,500 p.s.i. Conditioned mud and pulled out of hole.

D.S.T. No. 16 (6,555 to 6,601 feet) 4 jets/ft.

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 6,526 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve for flow and after 10 minutes started losing mud in annulus. Pulled packer off and re-set with same results. Pulled out of hole to check tester. Re-ran tester and set at 6,526 feet and took a $\frac{1}{2}$ hour I.C.I.P. Opened C.I.P. valve and again started losing fluid in annulus. Pulled packer off and re-set at 6,340 feet (above perforations 6,404 to 6,444 feet). Annulus remained level, indicating loss of isolation between perforations 6,404 to 6,444 feet and 6,555 to 6,601 feet.

Ran DM bridge plug on tubing and set at 6,475 feet to isolate perforations 6,555 to 6,601 feet.

Re-squeeze of the Interval 6,404 to 6,444 feet

Ran RTTS squeeze packer and set at 6,380 feet to squeeze perforations 6,404 to 6,444 feet. T/B/D 2700/2400/1800. Mixed 75 sacks of cement and squeezed 70 sacks to a final pressure of 3,100 p.s.i.

Went in hole with bit and drilled out cement across perforations 6,404 to 6,444 feet and cleaned out to DM bridge plug at 6,475 feet. Drilled out DM bridge plug and cleaned out to top of plug at 6,630 feet. No cement was found in the perforated interval 6,555 to 6,601 feet.

D.S.T. No. 17 (6,555 to 6,601 feet)

Ran RTTS and set at 6,525 feet and took a 55 minute I.C.I.P. Opened C.I.P. valve for flow and received a fair blow at the surface. Ran swab and located fluid at 4,000 feet. Swabbed 10 bbls. of salt water. Closed C.I.P. and took ½ hour F.C.I.P. Pulled out of hole and recovered 2,000 feet of salt water in tubing that tested 13,800 ppm Cl.

Abandonment of the Interval 6,555 to 6,601 feet

Ran bar collar and laid a 25 sack cement plug from 6,150 to 6,060 feet. After 4 hours located top of plug at 6,066 feet.

Isolation Test of the Intervals 5,947 to 5,970 feet and 5,874 to 5,903 feet

Schlumberger perforated two 1 foot intervals, 5,992 to 5,993 feet and 5,847 to 5,848 feet, to confirm isolation above and below the intervals 5,947 to 5,970 feet and 5,874 to 5,903 feet.

Ran RTTS and set at 5,980 feet to dry test perforations 5,992 to 5,993 feet - surface indications dry. Re-set RTTS at 5,803 feet to dry test over all interval - surface indications wet. Re-set RTTS at 5,865 feet (below isolation perforations) - surface indications wet. Re-set RTTS at 5,925 feet - surface indications dry. It was assumed that the perforations 5,874 to 5,903 feet were still open. The fact that no loss of fluid in the annulus occurred while setting below the top isolation perforations (5,847 to 5,848 feet) the interval 5,874 to 5,930 feet was isolated from above.

The interval 5,947 to 5,970 feet was completely isolated.

D.S.T. No. 18 (5,942 to 5,957 feet) 4 jets/ft.

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 5,925 feet and took a 55 minute I.C.I.P. Opened C.I.P. valve for flow and obtained a fair blow of gas at surface. Ran swab after tester open 1½ hours.to top of C.I.P. valve and recovered approximately 2oo feet of fluid (? mud-cut water). Allowed well to remain open throughout night. Re-ran swab at daylight and located fluid approximately 800 feet above C.I.P. valve. Recovered rathole mud and water with slight show of oil. Closed C.I.P. valve for 30 minute F.C.I.P. and pulled out of hole. Recovered 270 feet of mud-cut oil emulsion. Water tested 6,600 ppm Cl.

D.S.T. Nos. 19 and 20 (5,942 to 5,980 feet) 4 jets/ft.

Schlumberger extended perforations from 5,957 to 5,980 feet with 4 jets/ft.

Ran RTTS and set at 5,927 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve for flow and received a good blow at surface. A slight gas blow continued after bleeding off air cushion.

Ran swab and located fluid approximately 200 feet above C.I.P. valve. Recovered small amount of rat hole mud and trace of water (6,050 ppm Cl.). Closed tester and pulled out of hole and recovered 150 feet of oil- cut mud. Water cut tested 8,100 ppm Cl.

Went in hole with RTTS packer and set at 5,920 feet; displaced mud in tubing with fresh water. Closed circulating valve on RTTS and pumped into formation. Formation broke down at 1,700 p.s.i. Pumped 10 bbls. of water in formation at maximum pumping rate of 6 bbl./min. at 1,900 p.s.i. Swabbed well down to packer and allowed to stand. Well made small amount of gas during this period (13 hours).

Ran swab and recovered 5 bbls. of water. and emulsion. The water tested 9,100 ppm Cl. Pulled packer off and reversed out.

Abandonment of the Interval 5,942 to 5,980 feet

Set RTTS squeeze packer at 5,823 feet to squeeze plug perforations 5,942 to 5,980 feet. F/B/D 1900/1700/1000. Mixed 75 sacks of cement and squeezed 70 sacks to a final pressure of 2,300 p.s.i.

Ran bit and casing scraper and drilled off cement plug from 5,817 to 5,883 feet. Conditioned mud and pulled out of hole.

D.S.T. No. 21 (5,870 to 5,878 feet) 4 jets/ft.

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 5,840 feet and took a 65 minute I.C.I.P. Opened C.I.P. valve and received good blow with gas to surface in 2 minutes. Flowed well to burn pit for 4 hours. Placed flow through test separator for 6 hours, well making 84 MCF/day of gas. Total fluid produced during 6 hour test was $\frac{3}{4}$ bbl. of mud-cut water and emulsion. Water tested 11,200 ppm Cl. Wellhead pressures ranged from 5 to 25 p.s.i.g. without a choke. The percentage of emulsion appeared to decrease towards the end of the test period. Closed C.I.P. valve for 3 hour F.C.I.P. and pulled out of hole. Recovered 3 stands (180 feet) of oil and 4 stands and a single (390 feet) of water - (slightly emulsion cut). The water recovered tested 13,600 ppm Cl.

D.S.T. No. 22 (5,870 to 5,903 feet) 4 jets/ft.

Went in hole with bit and scraper and drilled off cement plug from 5,883 to 5,905 feet.

Schlumberger extended perforations from 5,878 to 5,903 feet with 4 jets/ft. Ran RTTS and set at 5,840 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve for flow and received strong blow with gas to surface in less than 1 minute. Flowed well to burn pit for 2 hours without choke. No pressure on wellhead. Placed well on 4 hour test - produced 14 MCF of gas (84 MCF/day) with negligible amount of liquid. Gas flow decreased during each hour of test.

Started stop-cocking well - 10 to 15 minute shut-in periods followed by 2 to 5 minute flow periods. Obtained small amount of fluid - mud-cut emulsion. After 4 hours of stop-cocking, fluid recovery was mainly emulsion and water.

Placed well on test to measure gas flow for 1 hour - produced 1.695 MCF of gas (40.68 MCF/day).

Returned well to burn pit and continued stop-cocking with 30 minute shut-in periods and 15 minute flow periods. During 8 hour period, well produced about 2 bbls. of oil with a water-cut of 60% to 70%. Water tested 14,600 ppm Cl. Closed C.I.P. valve and took a 4 hour F.C.I.P. Pulled out of hole without reversing out and recovered 11 stands (1,034 feet) of fluid above C.I.P. valve. Fluid consisted of equal parts of water and oil. Water tested 14,500 ppm Cl. Oil gravity was 46.4° API.

Abandonment of the Interval 5,870 to 5,903 feet

Ran bar collar to 5,870 feet and laid a 40 sack cement plug from 5,870 to 5,621 feet. After 4 hours located top of plug at 5,624 feet.

D.S.T. No. 23 (5,271 to 5,281 feet and 5,303 to 5,307 feet) 4 jets/ft.

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 5,242 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve and obtained good blow that diminished and died in 20 minutes. Ran swab and located fluid 400 feet from surface. Swabbed a total of 35 bbls. of salt water that tested 14,250 ppm Cl. Closed C.I.P. valve and reversed out while taking F.C.I.P.

Abandonment of the Intervals 5,271 to 5,281 feet and 5,303 to 5,307 feet

Ran bar collar to 5,270 feet and laid a 25 sack cement plug from 5,270 to 5,180 feet. After 3 hours located top of plug at 5,182 feet.

Isolation of the Interval 4,020 to 4,030 feet

Schlumberger perforated a 1 foot interval from 4,100 to 4,101 feet with 4 jets.

Closed blind rams on blow-out preventors and established circulation through perforations at 4,100 to 4,101 feet to surface through $5\frac{1}{2}$" - $13\frac{3}{8}$" annulus. Circulated behind $5\frac{1}{2}$" casing for 4 hours.

Ran and set DM squeeze packer at 4,070 feet and circulated 125 sacks of cement behind casing. Pulled out of DM packer. Waited 12 hours for cement to set before perforating.

D.S.T. No. 24 (4,020 to 4,040 feet) 4 jets/ft.

Schlumberger perforated the interval with 4 jets/ft.

Ran RTTS and set at 3,992 feet and took a 1 hour I.C.I.P. Opened C.I.P. valve and obtained a good blow that died in 30 minutes.

Ran swab and located fluid at 450 feet from surface. Swabbed a total of 48.5 bbls. of water that tested 1,700 ppm Cl. Reversed out and pulled out of hole.

Abandonment of Interval 4,020 to 4,040 feet.

Ran bar collar to 4,020 feet and laid 25 sack cement plug from 4,020 to 3,945 feet. After 4 hours located top of plug at 3,950 feet. Placed a 5 sack cement plug in top of $5\frac{1}{2}$" and $13\frac{3}{8}$" casing.

Well abandoned on 26 August, 1964.

Melbourne,

September, 1964.

W. D. WOOD

D.S.T. No. 2.	I.H.P.		2531 p.s.i.
	I.S.I.P.	30 minutes	2005 "
	I.F.P.	5 "	314 "
	F.F.P.	34 "	525 "
	F.S.I.P.	45 "	2005 "
	F.H.P.		2531 "
D.S.T. No. 3.	I.H.P.		2533 p.s.i.
	I.S.I.P.	30 minutes	2031 "
	I.F.P.	5 "	1572 "
	F.F.P.	30 "	2027 "
	F.S.I.P.	45 "	2029 "
	F.H.P.		2515 "
D.S.T. No. 4.	I.H.P.		4367 p.s.i.
	I.S.I.P.	10 minutes	191 "
	I.F.P.		184 "
	F.F.P.	120 "	200 "
	F.S.I.P.	120 "	222 "
	F.H.P.		4367 "
D.S.T. No. 5.	I.H.P.		4069 p.s.i.
	I.S.I.P.	30 minutes	359 "
	I.F.P.		105 "
	F.F.P.	11 hrs. 6 mins.	170 "
	F.S.I.P.	120 minutes	1592 "
	F.H.P.		4031 "
D.S.T. No. 7.	I.H.P.		3900 p.s.i.
	I.S.I.P.	30 minutes	81 "
	I.F.P.		94 "
	F.F.P.	80 "	99 "
	F.S.I.P.		-
	F.H.P.		3900 "
D.S.T. No. 8.	I.H.P.		3774 p.s.i.
	I.S.I.P.	30 minutes	-
	I.F.P.		61 "
	F.F.P.	13 hrs. 55 mins.	150 "
	F.S.I.P.	120 minutes	-
	F.H.P.		3774 "
D.S.T. No. 9.	I.H.P.		3040 p.s.i.
	I.S.I.P.		2456 "
	I.F.P.	43 hrs. 15 mins.	372 "
	F.F.P.		1261 "
	F.S.I.P.		-
	F.H.P.		-

D.S.T. No. 11.	I.H.P.	3144	p.s.i.
	I.S.I.P. 15 minutes	2615	"
	I.F.P.	184	"
	F.F.P. 5 hrs. 15 mins.	1177	"
	F.S.I.P. 60 minutes	2281	"
	F.H.P.	3111	"
D.S.T. No. 12.	I.H.P.	2912	p.s.i.
	I.S.I.P. 65 minutes	2301	"
	I.F.P.	267	" (questionable)
	F.F.P. 23 hrs. 55 mins.	312	"
	F.S.I.P. 120 minutes	-	
	F.H.P.	-	
D.S.T. No. 13.	I.H.P.	2823	p.s.i.
	I.S.I.P. 60 minutes	2208	"
	I.F.P.	164	"
	F.F.P. 4 hrs. 35 mins.	110	"
	F.S.I.P. 60 minutes	1659	"
	F.H.P.	2823	"
D.S.T. No. 14.	I.H.P.	3368	p.s.i.
	I.S.I.P. 60 minutes	2743	"
	I.F.P.	61	"
	F.F.P. 16 hrs. 29 mins.	49	"
	F.S.I.P. 60 minutes	2489	"
	F.H.P.	3368	"
D.S.T. No. 15.	I.H.P.	3244	p.s.i.
	I.S.I.P. 60 minutes	2657	"
	I.F.P.	92	"
	F.F.P. 7 hrs. 45 mins.	256	"
	F.S.I.P. 60 minutes	-	
	F.H.P.	3244	"
D.S.T. No. 17.	I.H.P.	3098	p.s.i.
	I.S.I.P. 55 minutes	2717	"
	I.F.P.	141	"
	F.F.P. 4 hrs. 15 mins.	883	"
	F.S.I.P. 30 minutes	2277	"
	F.H.P.	3098	"
D.S.T. No. 18.	I.F.P.	2777	p.s.i.
	I.S.I.P. 55 minutes	2155	"
	I.F.P.	56	"
	F.F.P. 19 hrs. 35 mins.	56	"
	F.S.I.P. 30 minutes	309	"
	F.H.P.	2777	"

D.S.T. No. 19.	I.F.P.	2907 p.s.i.
	I.S.I.P. 60 minutes	2051 "
	I.F.P.	137 "
	F.F.P. 13 hrs. 55 mins.	141 "
	F.S.I.P.	-
	F.H.P.	2863 "
D.S.T. No. 21.	I.H.P.	2708 p.s.i.
	I.S.I.P. 65 minutes	1925 "
	I.F.P.	119 "
	F.F.P. 11 hrs. 5 mins.	325 "
	F.S.I.P. 3 hours	1756 "
	F.H.P.	2708 "
D.S.T. No. 22.	I.H.P.	2688 p.s.i.
	I.S.I.P. 60 minutes	1871 "
	I.F.P.	184 "
	F.F.P. 27 hrs. 10 mins.	413 "
	F.S.I.P. 4 hours	1510 "
	F.H.P.	2677 "
D.S.T. No. 23	I.H.P.	2367 "
	I.S.I.P. 60 minutes	2133 "
	I.F.P.	Clock failed
	F.F.P. 198 minutes	-
	F.S.I.P. 60 minutes	-
	F.H.P.	-
D.S.T. No. 24	I.H.P.	1931 p.s.i.
	I.S.I.P. 60 minutes	1605 "
	I.F.P.	868 "
	F.F.P. 138 minutes	1251 "
	F.S.I.P. 60 minutes	1571 "
	F.H.P.	1931 "

[illegible]

(by [illegible] Chromatography)

Analysed by J. Puchol on 23.12 1964

Sample / Component	Flaxman's No. 1 D.S.T. 14 8518'-8528', 8462' - 8460' Packer Set at 8433, (Taken from wellhead)	Port Campbell - No. [illegible] D.S.T. [illegible] 5947' - 5970'
H	) Nil	N.D.
He	)	Trace
O + Ar	Trace	Trace
N	3.90 %	2.23 %
CO	N.Dc.	N.Dc.
CO2	0.17 %	0.15%
Methane	85.1 %	86.5 %
Ethane	6.63 %	5.25 %
Propane	2.69 %	3.04 %
Isobutane	0.49 %	0.81 %
Butane	0.51 %	0.98 %
Isopentane	0.152%	0.37 %
Pentane	0.109%	0.28 %
Neohexane	0.021%	0.033%
Dimethylbutanes	0.077%	0.110%
Methylpentanes	0.028%	0.039%
Hexane	0.042%	0.127%
Others	0.05 %	0.09 %
H_2S	Nil	Nil

Notes: N.Dc. - Not detected.

Copy attached to Flaxmans No. 1 well completion report.

ORK. 9/2/65

This section superseded by report by W.D. Wood, Sept. 1964

SUMMARY OF TESTING OPERATIONS

Open Hole Tests

D.S.T. No. 1 - 4,943 to 4,985 feet, Waarre Formation.

Packer seat failed one minute after opening tester.

D.S.T. No. 2 - 4,963 to 4,985 feet, Waarre Formation.

Packer set at 4,963 feet. Bottom choke - Hydraulic adjustable. Received good blow on both initial and final flow periods, which diminished to a weak blow at the end of the final flow period.

Recovered 90 feet of mud and muddy water, and 1,036 feet of brackish water of salinity 9,900 ppm Cl. Rw = 0.381 ohms/meter at 61°F. Blanked off gauge recorded closed-in pressures only.

The pressure charts indicated that partial plugging of the tail pipe perforations occurred almost immediately after opening the tester.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2520 psi	2540 psi
I.S.I.P. 30 minutes.	1980 "	2030 "
I.F.P. 5 "	300 "	?
F.F.P. 34 "	550 "	?
F.S.I.P. 45 "	1980 "	2030 "
F.H.P.	2520 "	2540 "

D.S.T. No. 3 - 5,005 to 5,062 feet, Waarre Formation.

Packer set at 5,005 feet. Bottom choke $\frac{3}{8}$". Good blow on both initial and final flow periods, decreased to a weak blow at the end of the final flow period.

Recovered 90 feet of rathole mud, 180 feet of mud-cut water and 4,340 feet of brackish water. Salinity 10,600 ppm Cl. Rw = 0.346 ohms/meter at 61°F.

The top pressure recorder gave a satisfactory chart. The build-up obtained on the initial closed-in period reached maximum value simultaneously with the closing of the C.I.P. valve. The bottom chart shows constant pressures throughout the test period.

D.S.T. No. 3 (Cont'd) Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2540 psi	2550 psi
I.S.I.P. 30 minutes	2050 "	2060 "
I.F.P. 5 "	?	?
F.F.P. 30 "	2050 "	2060 "
F.S.I.P. 45 "	2050 "	2060 "
F.H.P.	2540 "	2550 "

Despite plugging of tail pipe perforations to a certain extent as indicated by the pressure charts, both drill stem tests No. 2 and No. 3 are considered satisfactory, and indicate highly permeable salt-water bearing zones in the Waarre Formation.

Tests Through 5½" Casing

D.S.T. No. 4 - 7,878 to 7,950 feet, Otway Group.

Packer set at 7,860 feet. Choke size ⅜". After opening T.C. valve good blow of air cushion was received which died completely after a few minutes. Two hours after opening tool swab was run twice to 7,400 feet, but no fluid was brought to surface. Recovered 90 feet of rathole mud from tubing. The zone appears to be tight.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	4395 psi	4420 psi
I.S.I.P. 10 minutes	200 "	220 "
I.F.P.	180 "	190 "
F.F.P. 120 "	200 "	220 "
F.S.I.P. 120 "	225 "	250 "
F.H.P.	4395 "	4420 "

D.S.T. No. 5 - 7,418 to 7,460 feet, Otway Group.

Packer set at 7,387 feet. After opening T.C. valve received good blow from air cushion which died in approximately two hours. Ten hours after opening tool, two swabs were run to 7,280 feet, but no fluid was recovered. Recovered 280 feet of rathole mud and mud filtrate. Test is considered satisfactory. Zone appears to be tight.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	4095 psi	4105 psi
I.S.I.P. 30 minutes	368 "	357 "
I.F.P.	115 "	111 "
F.F.P. 11 hours, 6 mins.	185 "	167 "
F.S.I.P. 120 minutes	1585 "	1582 "
F.H.P.	3985 "	4000 "

D.S.T. No. 6 - 7,302 to 7,325 feet, Otway Group.

Packer set at 7,275 feet. Misrun. Bottom joint of hydrospring tester was plugged by sand.

D.S.T. No. 7 - 7,305 to 7,325 feet, Otway Group.

Packer set at 7,275 feet. No surface action on opening T.C. valve for flow period. Ran swab to T.C. valve, made three 500 foot pulls and then pulled to surface. No fluid was recovered. Pulled packer loose and, after 5 minutes, reset. No surface action was observed. Recovered 60 feet rathole mud.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	3940 psi	3990 psi
I.S.I.P. 30 minutes	90 "	85 "
I.F.P.	70 "	70 "
F.F.P. 80 "	90 "	90 "
F.S.I.P.		
F.H.P.	3940 "	3990 "

D.S.T. No. 8 - 7,235 to 7,254 feet and 7,302 to 7,325 feet, Otway Group.

Packer set at 7,184 feet. Bottom choke $\frac{5}{8}$" Hydraulic On opening T.C. valve a very good blow was received and maintained during flow period. Five swabs were run, after 11 hours, 15 minutes, to 7,184 feet. On first swab 0.5 bbl. of rathole mud was recovered. No recovery on subsequent swabs. Recovered from tubing 190 feet of mud. Bottom 90 feet contained honey coloured jelly-like fine globules of paraffin. Test satisfactory. Zone has low permeability.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	Stopped	3890 psi
I.S.I.P. 30 minutes	"	110 "
I.F.P.	"	60 "
F.F.P. 13 hours, 55 mins.	"	190 "
F.S.I.P. 120 minutes	"	1880 "
F.H.P.	"	3890 "

D.S.T. No. 9 5,947 to 5,970 feet, Otway Group.

Packer set at 5,903 feet. Bottom choke $\frac{5}{8}$" Hydraulic. Good blow to surface on opening T.C. valve with gas to surface in approximately 5 minutes. $3\frac{3}{4}$ hours after opening swab was run and recovered 4 bbls. of mud. Fluid level was found at 750 feet. Well started to head $7\frac{1}{4}$ hours after opening. Without using choke well was allowed to clean up to the pit and wellhead pressures were recorded from 20 to 40 psi. On $\frac{5}{8}$" bottom choke and upstream pressure production rates of 160 to 219 M.c.f.d. of gas were measured. Liquid produced consisted of 85% salt water with salinity of 12,000 ppm Cl. and Rw = 0.36 ohms/meter at 59°, and 15% emulsified crude oil of 38.2° API/60°F gravity. Production rate of liquid varied between 215 and 240 bbls. per day. Well was allowed to flow for 43 hours, 15 minutes before closing in. During that time flow was unsteady and pressures were recorded up to 65 psi. Tubing was emptied by reversed circulation prior to pulling out of hole. Pressure charts are not completed due to prolonged time of testing. Zone did not have proper isolation.

Pressures were as follows:

	Top Chart (24-hour clock)	Bottom Chart (12-hour clock)
I.H.P.	3083 psi	3082 psi
I.S.I.P. 60 minutes	2466 "	2497 "
Minimum F.P. 43 hours, 15 mins.	960 "	-

D.S.T. No. 10 - 6,404 to 6,444 feet, Otway Group.

Packer set at 6,379 feet. T.C. valve 60 feet above packer. Weak blow on opening T.C. valve, which died in $2\frac{1}{2}$ hours. After 13 hours 25 minutes, swab was run to 5,175 feet, but no fluid was recovered due to obstruction in tubing. Swab re-run with the same results. When pulling out of hole 500 feet of mud was recovered from tubing. Pressure charts indicate plugging of tools appeared to have occurred in the by-pass sub above the packer. The top pressure recorder did not read hydrostatic pressure after pulling packer loose.

Test is considered unsatisfactory.

D.S.T. No. 11 - 6,404 to 6,444 feet, Otway Group.

Packer set at 6,380 feet. Choke $\frac{5}{8}$" Hydraulic. T.C. valve was set 60 feet above packer. Good to fair blow on opening tester valve. Two hours later first swab was pulled from 1,700 feet without any fluid. Another six swabs were pulled from 3,500 feet resulting in production of 5 bbls.

D.S.T. No. 11 (Cont'd) of rathole mud and 15 bbls. of salt water. Approximately 4,000 feet of salt water was reversed out of tubing. Salinity measured on a sample from tubing below T.C. valve was 13,500 ppm Cl. Rw = 0.36 ohms/meter at 58°F. No hydrocarbons were noted during the test.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	3140 psi	3151 psi
I.S.I.P. 15 minutes	2650 "	2657 "
I.F.P.	135 "	186 "
F.F.P. 5 hours, 15 mins.	1170 "	1177 "
F.S.I.P. 60 minutes	2275 "	2286 "
F.H.P.	3140 "	3151 "

D.S.T. No. 12 - 5,874 to 5,903 feet, Otway Group.

Packer set at 5,842 feet. T.C. valve was run 90 feet above packer. On opening T.C. valve for flow, immediate blow of 20 psi was received at wellhead. Gas to surface in less than 2 minutes. First appearance of liquid on surface was recorded in 2 hours. Without using a choke well was allowed to clean up to flare pit for 13 hours. Recorded flow pressure, without choke, fluctuated between 8 and 22 psi. As a result of 6 hours meter run gas rate of 159.9 M.c.f.d. was estimated. Daily rate estimates of liquid which consisted of 45 bbls. per day of water and 12 bbls. per day of oil emulsion totalled 57 bbls. per day. While pulling out of hole 35 to 40 gallons of fluid was recovered from tubing with approximately 10% of crude oil. Gravity of crude oil: 46 API at 60°F; water salinity: 12,700 ppm Cl., and Rw = 0.362 ohms/meter at 60°F. Top pressure chart was not completed due to prolonged test period.

Pressures were as follows:

	Top Chart (24-hour clock)	Bottom Chart (48-hour clock)
I.H.P.	2920 psi	2949 psi
I.S.I.P. 65 minutes	2300 "	2339 "
I.F.P.	230 "	346 "
F.F.P. 23 hours, 55 min.	315 "	314 "
F.S.I.P. 120 minutes	-	1649 "
F.H.P.	-	2949 "

D.S.T. No. 13 - 5,672 to 5,702 feet, Otway Group.

Packer set at 5,643 feet. T.C. valve run 60 feet aboye packer. Fair blow on opening T.C. valve, decreased to a weak blow during the test. Swabbing started two hours after opening. Fluid level found at ± 4,000 feet. After 6 swabs were

D.S.T. No. 13 (Cont'd) pulled, total of 10.5 bbls. of rathole mud and water was recovered. While pulling out of hole 180 feet of salt water was recovered with salinity of 13,200 ppm Cl. and Rw = 0.31 ohms/meter at 60°F. No hydrocarbons were noted during the test.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2830 psi	2843 psi
I.S.I.P. 60 minutes	2210 "	2233 "
I.F.P.	145 "	186 "
F.F.P. 4 hours,35 min.	585 "	550 "
F.S.I.P. 60 minutes	1665 "	1700 "
F.H.P.	2810 "	2843 "

D.S.T. No. 14 - 6,900 to 6,929 feet, Otway Group.

Packer set at 6,847 feet. Bottom choke $\frac{5}{8}$" Hydraulic. T.C. valve run 60 feet above packer. Fair blow on opening T.C. valve, diminished to a weak blow. First swab run to 6,707 feet two hours after running tester valve, and recovered 1.5 bbls. mud-cut water. After waiting one hour second swab was run to 6,767 feet and recovered 2 bbls. of mud-cut water. Salinity: 10,500 ppm Cl.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	3365 psi	3375 psi
I.S.I.P. 60 minutes	2760 "	2822 "
I.F.P.	45 "	106 "
F.F.P. 16 hours, 29 min.	166 "	186 "
F.S.I.P. 60 minutes	2475 "	2551 "
F.H.P.	3365 "	3375 "

D.S.T. No. 15 - 6,691 to 6,765 feet, Otway Group.

Packer set at 6,658 feet. T.C. valve run 60 feet above packer. After 60 minutes period for I.S.I.P., T.C. valve was opened and received fair blow at surface that died in $1\frac{1}{2}$ hours. Three hours after opening T.C. valve three successive swabs were run to 3,500 feet, 4,500 feet and 5,600 feet without recovery of fluid. Another three swabs were pulled from ± 6,600 feet and recovered total of 6 bbls. of mud-cut water. While pulling out of hole 180 feet of water was recovered in tubing. Salinity: 12,500 ppm Cl. Rw = 0.414 ohms/meter at 54°F. Trace of brown, waxy globules of oil recovered from tubing.
Note: T.C. valve did not close for final shut-in pressure.

D.S.T. No. 15 (Cont'd) Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	3190 psi	3205 psi
I.S.I.P. 60 minutes	2650 "	2684 "
I.F.P.	70 "	107 "
F.F.P. 7 hours, 45 min.	460 "	506 " (max.)
F.S.I.P. 60 minutes	Valve did not close	
F.H.P.	3190 psi	3205 psi

D.S.T. No. 16 - 6,555 to 6,601 feet, Otway Group.

Packer set at 6,526 feet. Ten minutes after opening T.C. valve mud level started to drop in annulus. Packer was pulled loose and reset, but with the same result. Tester was pulled out of hole and, after it had been proved to be in order, was rerun into the hole. Loss of mud in annulus occurred again. When packer was pulled loose and set at 6,340 feet and mud in annulus stayed at the same level, it was evident that communications between zones 6,404 to 6,444 feet and 6,555 to 6,601 feet must have existed. After further isolation treatment the zone was re-tested.

D.S.T. No. 17 - 6,555 to 6,601 feet, Otway Group.

Packer set at 6,525 feet. Bottom choke $\frac{5}{8}$" Hydraulic. On opening T.C. valve a fair blow was noted and continued during test period. First swab run two hours after opening located fluid level at 4,000 feet. On four swabs total of 10 bbls. of water was recovered. At the end of the test 2,000 feet (11.5 bbls.) of water was recovered in tubing. Salinity: 13,800 ppm Cl. Rw = 0.351 ohms/meter at 60°F.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	3195 psi	3210 psi
I.S.I.P. 55 minutes	2695 "	2740 "
I.F.P.	110 "	135 "
F.F.P. 4 hours, 15 min.	1125 "	1150 "
F.S.I.P. 30 minutes	2275 "	2290 "
F.H.P.	3185 "	3210 "

D.S.T. No. 18 - 5,942 to 5,957 feet, Otway Group.

Packer set at 5,925 feet. T.C. valve run 60 feet above packer. Bottom choke $\frac{5}{8}$" Hydraulic. Good blow of 4 psi was received at the surface on opening T.C. valve. Small volume of gas appeared at surface after 20 minutes. Two swabs run to depths 2,800 and 4,200 feet 90 minutes after

D.S.T. No. 18 (cont'd) opening of tester valve resulted in no recovery. On third swab, run to ± 5,865 feet, 200 feet of oil emulsified rathole mud was recovered. Swabbing was discontinued, then resumed 15 hours after opening tester valve. Again three swabs were pulled resulting in additional recovery of 2 bbls. of emulsified mud. During the period between swab runs the well was open to the pit and a small gas flow was flared. At the end of the test 270 feet of oil emulsified mud was recovered from the tubing. Salinity of mud filtrate was 6,600 ppm Cl.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2760 psi	2800 psi
I.S.I.P. 55 minutes	2160 "	2206 "
I.F.P.	45 "	80 "
F.F.P. 19 hours, 35 min.	250 "	293 "
F.S.I.P. 30 minutes	290 "	320 "
F.H.P.	2760 "	2780 "

As a result of the hydrocarbon recovery, the test zone was extended and re-tested in D.S.T. No. 19.

D.S.T. No. 19 - 5,942 to 5,980 feet, Otway Group.

Packer set at 5,927 feet. Immediate good blow and gas to surface 20 seconds after opening T.C. valve and a small gas flow was flared. On first swab run 11 hours after opening tool fluid was located ± 200 feet above T.C. valve, and recovered 1 bbl. of oil-cut mud. Another three swabs were run and pulled dry. 150 feet of oil emulsified mud was recovered from tubing. Salinity of mud filtrate: 8,100 ppm Cl.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2880 psi	2923 psi
I.S.I.P. 60 minutes	2075 "	2100 "
I.F.P.	135 "	160 "
F.F.P. 13 hours, 55 min.	360 "	380 "
F.S.I.P.	Not	taken
F.H.P.	2880 psi	2923 psi

D.S.T. No. 20 5,942 to 5,980 feet, Otway Group.

On assumption that cement penetrated deeply into formation during isolation treatment, thus obstructing access of formation fluids into the hole, 10 bbls. of water were squeezed into formation in an attempt to improve access to

D.S.T. No. 20 (Cont'd) formation. The R.T.T.S. packer, without tester and pressure devices, was set at 5,920 feet. After mud in tubing was displaced with water, the circulating sub was closed and water pumped into formation. Formation broke down at 1,700 psi and 10 bbls. of fresh water was pumped in at a rate of 6 bbls. per minute at 1,900 psi. The well was then swabbed down to the packer. Swabbing was suspended and gas appeared at surface in 90 minutes. After 12 hours 5 bbls. of oil emulsion and muddy water was recovered by swabbing. The emulsion consisted of 18% mud solids, 27% mud filtrate, and water of salinity 9,100 ppm Cl.,and 54% oil of 44.8° API gravity. A small amount of oil emulsion was recovered from the tubing.

D.S.T. No. 21 - 5,870 to 5,878 feet, Otway Group

Packer set at 5,840 feet. Bottom choke $\frac{5}{8}$" Hydraulic adjustable. Good blow of 5 psi to surface immediately after opening T.C. valve, and gas appeared at surface in 2 minutes. Well was first opened to the pit and gas burned without using a choke on the wellhead. After 5 hours, well was allowed to flow through separator for production rate measurements. Using $\frac{1}{2}$" choke in flare line for back pressure and without a choke on wellhead, two estimates of gas production rate were made. The first was 85 M.c.f.d. on the basis of a 3 hour meter run, and the second 84 M.c.f.d. on the basis of a 6 hour meter run. During both meter runs, gas pressure on separator fluctuated between 5 and 25 psi. Total liquid recovered during the 6 hour period was $\frac{3}{4}$ barrel of mud-water-oil emulsion with 35% oil, 60% water, and 5% solids. Gravity of crude oil 34.7° API. Recovered 270 feet of oil and 450 feet of oil-water emulsion from tubing. Salinity of water: 13,600 ppm Cl., Rw = 0.325 ohms/meter at 62°F.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2890 psi	2930 psi
I.S.I.P. 65 minutes	1920 "	1941 "
I.F.P.	40 "	60 "
F.F.P. 11 hours, 5 min.	290 "	320 "
F.S.I.P. 3 hours	1740 "	1782 "
F.H.P.	2890 "	2930 "

As a result of the hydrocarbon recovery during the test, the test zone was extended and re-tested in D.S.T. No. 22.

D.S.T. No. 22 - 5,870 to 5,903 feet, Otway Group.

Packer set at 5,840 feet. Bottom choke $\frac{5}{8}$" Hydraulic. The T.C. valve was open after 60 minutes closed-in period and immediately a good blow of 15 psi was received with gas to surface in less than one minute. Without a choke on wellhead, well flowed to a pit for two hours before it was allowed to flow through the separator for production rate measurements. On 4 hour meter run, a flow of 14 M.c.f. of gas was measured. During that period only a negligible amount of liquid was produced. The amount of gas gradually decreased during the test. With the intention of accelerating cleaning up of the zone, stop-cocking of the well was commenced 6 hours after the tester valve was opened. This process first produced mud, then mud-oil emulsion, and then water-oil emulsion for the rest of the flow period. Fourteen hours after opening tool, flow was led again through separator and production rate was calculated at 1.69 M.c.f. of gas with no liquids during a one-hour meter run. The well was turned to the pit and stop-cocking was resumed for 8 hours, 18 hours after opening tool. During this 8 hour period, 0.5 bbl. of liquid was recovered which consisted of 60% to 70% water, and 40% to 30% oil. After a 4-hour closed-in period, 5.5 bbls. of liquid consisting of 50% oil of 46.4° API gravity and 50% salt water was circulated out from tubing. Water salinity was 14,500 ppm Cl. and Rw = 0.33 ohms/meter at 62°F.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2690 psi	2730 psi
I.S.I.P. 60 minutes	1850 "	1870 "
I.F.P.	135 "	160 "
F.F.P. 27 hours, 10 min.	450 "	480 "
F.S.I.P. 4 hours	1475 "	1490 "
F.H.P.	2690 "	2730 "

D.S.T. No. 23 - 5,263 to 5,307 feet, Waarre Formation.

Packer set at 5,242 feet. Bottom choke $\frac{5}{8}$" Hydraulic adjustable. Good blow on opening T.C. valve diminished and died in 20 minutes. A swab was run to 5,180 feet 108 minutes after opening tester valve and pulled 23 bbls. of mud and salt water. In another 4 successive swabs 12 bbls. of water with salinity of 14,300 ppm Cl. was recovered. The fluid level was constant during swabbing. Rw at 4,000 feet below surface = 0.324 ohms/meter at 62°F.

D.S.T. No. 23 (Cont'd) Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	2360 psi	2390 psi
I.S.I.P. 60 minutes	2120 "	2135 "
I.F.P.	Clock failed	1860 "
F.F.P. 198 minutes	" "	2135 "
F.S.I.P. 60 minutes	" "	2135 "
F.H.P.	" "	2390 "

D.S.T. No. 24 4,020 to 4,040 feet, ?Belfast Formation sandstone.

Packer set at 3,992 feet. Bottom choke $\frac{5}{8}$" Hydraulic adjustable. Good blow on opening tester valve died in 30 minutes. Swab, run 1 hour after opening tool, located liquid at 450 feet from surface. Total of 5 swabs were pulled and recovered 48.5 bbls. of water of salinity 1,750 ppm Cl. and Rw = 1.9 ohms/meter at 60°F.

Pressures were as follows:

	Top Chart	Bottom Chart
I.H.P.	1965 psi	2020 psi
I.S.I.P. 60 minutes	1590 "	1625 "
I.F.P.	675 "	1145 "
F.F.P. 138 minutes	1565 "	1600 "
F.S.I.P. 60 minutes	1565 "	1600 "
F.H.P.	1965 "	2020 "

CORE RECOVERIES

Core No.	Cored Interval	Recovery	% Recovery
1.	2,555 to 2,575 feet	3 feet	15
2.	2,892 to 2,912 "	10 "	50
3.	3,206 to 3,226 "	1 inch	1
4.	3,226 to 3,245 "	12 feet	63
5.	3,518 to 3,519 "	6 inches	50
6.	3,519 to 3,536 "	11 feet	65
7.	3,821 to 3,838 "	16 "	94
8.	4,112 to 4,132 "	18 "	90
9.	4,269 to 4,289 "	15 "	75
10.	4,580 to 4,600 "	6 inches	2.5
11.	4,600 to 4,608 "	5 feet	63
12.	4,894 to 4,914 "	2 "	10
13.	4,977 to 4,985 "	1 inch	1
14.	4,985 to 5,005 "	14 feet	70
15.	5,152 to 5,167 "	5 "	33
16.	5,456 to 5,476 "	6 "	30
17.	5,754 to 5,770 "	16 "	100
18.	6,070 to 6,084 "	13.75 "	98
19.	6,355 to 6,367 "	7 "	58
20.	6,663 to 6,683 "	7 "	35
21.	7,051 to 7,068 "	Nil	-
22.	7,183 to 7,191 "	8 feet	100
23.	7,690 to 7,710 "	20 "	100
24.	7,889 to 7,907 "	18 "	100
25.	7,907 to 7,910 "	3 "	100
26.	8,279 to 8,299 "	20 "	100
27.	8,500 to 8,520 "	17 "	85

PE903983

This is an enclosure indicator page.
The enclosure PE903983 is enclosed within the container PE903901 at this location in this document.

The enclosure PE903983 has the following characteristics:

ITEM_BARCODE	= PE903983
CONTAINER_BARCODE	= PE903901
NAME	= Locality & Geological Map
BASIN	= OTWAY
PERMIT	=
TYPE	= GENERAL
SUBTYPE	= PROSPECT_MAP
DESCRIPTION	= Locality & Geological Map of Port Campbell Embayment, (Plate 1 from WCR), Frome-Broken Hill Co. Pty. Ltd., for Port Campbell-4
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W484
WELL_NAME	= Port Campbell-4
CONTRACTOR	=
CLIENT_OP_CO	= Frome Broken Hill Co P/L

(Inserted by DNRE - Vic Govt Mines Dept)

PE602055

This is an enclosure indicator page.
The enclosure PE602055 is enclosed within the container PE903901 at this location in this document.

The enclosure PE602055 has the following characteristics:

ITEM_BARCODE	= PE602055
CONTAINER_BARCODE	= PE903901
NAME	= Composite Well Log
BASIN	= OTWAY
PERMIT	= PEP 6
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log, 1" = 100', (Plate 4 from WCR), Frome-Broken Co. Pty. Ltd, 26 August 1964, for Port Campbell-4
SUBTYPE	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W484
WELL_NAME	= Port Campbell-4
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Co. Pty Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE903904

This is an enclosure indicator page.
The enclosure PE903904 is enclosed within the container PE903901 at this location in this document.

The enclosure PE903904 has the following characteristics:

ITEM_BARCODE	= PE903904
CONTAINER_BARCODE	= PE903901
NAME	= Drilling & Testing Time Chart
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Port Campbell-4 Graphical Representation of Drilling Time and Testing Time, 1" = 500', (enclosure from WCR), Frome-Broken Hill Co. Pty. Ltd.
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	= 7/01/65
W_NO	= W484
WELL_NAME	= Port Campbell-4
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE903903

This is an enclosure indicator page.
The enclosure PE903903 is enclosed within the container PE903901 at this location in this document.

The enclosure PE903903 has the following characteristics:

ITEM_BARCODE	= PE903903
CONTAINER_BARCODE	= PE903901
NAME	= Geological X-sections before/after drill
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Port Campbell-4 Geological Cross Sections before and after drilling, 1" = 2000', (Plate 3 from WCR), Frome-Broken Hill Co. Pty. Ltd, October 1964.
REMARKS	=
DATE_CREATED	= 31/10/64
DATE_RECEIVED	= 7/01/65
W_NO	= W484
WELL_NAME	= Port Campbell-4
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE903902

This is an enclosure indicator page.
The enclosure PE903902 is enclosed within the container PE903901 at this location in this document.

The enclosure PE903902 has the following characteristics:

ITEM_BARCODE	= PE903902
CONTAINER_BARCODE	= PE903901
NAME	= Stratigraphic column prior to drilling
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= STRAT_COLUMN
DESCRIPTION	= Port Campbell-4 Stratigraphic column prior to drilling, 1" = 1000'(Plate 2 from WCR), Frome-Broken Hill Co. Pty. Ltd.
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	= 7/01/65
W_NO	= W484
WELL_NAME	= Port Campbell-4
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

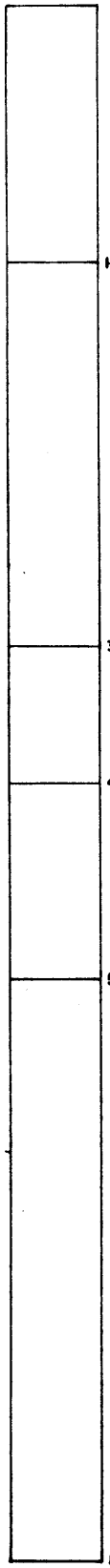
FROME-BROKEN HILL CO. PTY. LTD.

PORT CAMPBELL NO. 4

STRATIGRAPHIC COLUMN PRIOR TO DRILLING

SCALE : 1 INCH = 1000 FEET

PLATE 2



MOCENE — EOCENE	Limestone and soft fossiliferous marl.	HEYTESBURY GROUP
EOCENE — UPPER CRETACEOUS	Quartz sand, clayey, with carbonaceous siltstone bands.	WANGERRIP GROUP
	Siltstones and sandstones, carbonaceous, glauconitic.	
	Conglomerates, sandstones, siltstones, with some coal.	
UPPER CRETACEOUS	Sandstones, siltstones, and mudstones, glauconitic, carbonaceous.	PAARATTE FMN. BELFAST FMN. FLAXMANS BEDS
UPPER — LOWER CRETACEOUS	Clean quartz sandstone, interbedded with siltstones and slightly feldspathic sandstones.	WAARRE FORMATION
LOWER CRETACEOUS	Light grey to green grey sub grey-wacke sandstones, interbedded with light to dark grey carbonaceous siltstones and mudstones.	OTWAY GROUP