WCR

Port Campbell - 1

W460

1 Folio No	2 Referred to	3 Date	4 Clearing Officer's Initials	1 Folio No.	2 Referred to	3 Date
	Frome-Broken Hill Pty Ltd					

WELL. PORT CAMPBELL No 1. TYPE. NFW W460 BASIN W.D.

TENEMENT HOLDER Frome - Broken Hill

OPERATOR Frome - B.H. Co. Pty. Ltd. LOCATION Lat. 38° 34' 57"S Long. 142° 57' 50"E W.C.R. Ph: Paaratte

TENEMENT PEP 6 Military Map. Port Campbell 1m/l. 872417

ELEV. 337 Gl. 346.6 RT. (Datum) T.D. 5965. STATUS. Suspended Gas Producer Susp. Feb 9th 1960.

SPUD. Sept. 9th 1959 COMPL. Dec. 9th 1959. ABD.

CASING 13 3/8 @ 291' Cem. to Surface. 9 5/8" @ 3322 Cem to Surf. 5 1/2" @ 5962 Cem to 3000'

Stratigraphy Age	Formation	Top - Depth	Top - Elevation	Thickness
MESOZOIC. TERTIARY Miocene - Oligocene	Heytesbury Group	0	+346.6	1410
Eocene — U. Cret.	Wangerrip Group	1410	-1063.4	2835
~~Eocene~~ - Upper Cretaceous.	Paaratte Fm	4245	-3898	685
U. Cretaceous	Belfast Mdst.	4930	-4583	726
L. Cretaceous	Waarre Fm.	5656	-5309	309+

[Note: 1 On E-Log Top of Wangerrip would be better picked at 1375 (-1028)] -This depth now accepted by F-B.H.

2 On E-Log Apparent transition zone 1040' to 1375' between definite, Heytesbury & Wangerrip

Formation Test:

Open Hole D.S.T. 1. 5663 - 5718. V.O. 80 min. Strong blow increasing Recov. 900' G.C.M.

Thro. Perf. Casing. D.S.T. 2. 5908 - 5920 V.O. 100 min Rec. 5460 Gas cut Salt water 5924 - 5928

D.S.T. 3 5756 - 5766 V.O. 60 min S.I. 70 min. Slight flow and gas died after 10 min. Recov. 5314' G.C.M and salt water.

D.S.T. 4 5695 - 5701 V.O. 75 min Slight flow died after 30 min. Rec. 270' G.C.M. and 5050 Gas cut Salt water.

Production Test 1(3) 5656 - 5666 Recov. petrolif gas. with some condensate & salt water.

Production Test 1b 5657 - 5663 Max flow 4150 MCF/D. Recov. over 8,000 MCF of gas and 34 bbls of condensate.

D.S.T. 5. 4815 - 4820 Recov. gas cut salt water V.O. 195 min Weak 4830 - 4840 blow died after 190 min.

D.S.T. 6. 4696 - 4702 Slight blow Rec. 270 G.C. water & Sli G.C.M.

D.S.T. 7 4498 - 4515. V.O. 105 min. Weak blow became nil. S.I 30 min open bleed valve - Sli blow Rec. 270 G.C.M. & 3690' G.C.W.

D.S.T. 8 4463 - 4475. V.O. 60 min Weak blow to nil S.I. 30 min Recov. 210 Sli G.C.M. and 3600 Sli G.C.W.

Log Summary and Interpretation

Type	Run.	Interval	Date	Type	Run	Interval	Date
E-Log	1	30/9/59 291-3325					
"	2	3300 - 5549	21/11/59				
"	3	4450 - 5718	26/11/59				
"	4	5550 - 5934	7/12/59.				
Temp. Log	1	0 - 5942	17/12/59.				

Interval	φ	Sw
5660 - 5662	24% 167 md. H. 660 md. V.	
5663 - 5665	26.5% 2985 md. H 1695 md. V.	
5700 - 5718	14.8% 5 md. H 2.5 md. V	

CORES (S.W = Sidewall Core)

No.	Interval	Rec.	No	Interval	Rec	No	Interval	Rec.	No	Interval	Rec
1	421-439	15'	9	3148-3340	5'	17	4754-4764	8'	S.W 1.	5400'	3½"
2	900-918	9'	10	3333-3340	5"	18	4862-4869	6'	S.W 2	4700	1"
3	1067-1077	10'	11	3600-3618	9'	19	5018-5026	5'	S.W 3	4450	4½".
4	1457-1475	2'	12	3995-3997	—	20	5026-5031	5'			
5	1475-1493	6'	13	3997-4009	12'	21	5223-5233	8'			
6	1969-1987	9'	14	4280-4283	1'	22	5660-5670	3'6"			
7	2452-2466	16'	15	4284-4293	7'	23	5700-5718	8'			
8	2915-2933	7'	16	4516-4536	4'	24	5928-5934	6'			

Chemical Analyses (water, oil, gas)

Water

Test No.	Depth	Recovery	Salinity
1	5653-5718	Gas	
2	5708-5722, 5724-5728	G.C.S.W	13,700 ppm
3	5756-5766	G.C.S.W	12700 ppm
4	5695-5701	G.C.S.W.	12800 ppm
5	4815-4820, 4830-4840	G.C.W.	4934 ppm
6	4696-4702	G.C.W	1065 ppm
7	4498-4515	G.C.W	1136 ppm
8	4463-4475	G.C.W	994 ppm

Gas from D.S.T.1. — 63% Methane 10% Ethane + Higher Hydrocarbs. 23% CO_2 3% N_2.

Gas Cores 23+24. (5701' & 5932') Methane 7%. Ethane + higher hydrocarbs. 88%

Gas Production Test 5. 70% Methane 10% Ethane. 16% CO_2 3% N_2. (average analysis)

GENERAL (Summary conclusions, lithology, petrology, palaeontology, structure, tectonics):

Drilled on fold structure indicated by seismic reflection

0 - 1410 Calcareous facies of Jurassic age.

Albian 1410 dominant sand-silt facies of Anglesean age. Base of Tertiary indeterminant lithologically & it appears there is a transition to Cretaceous. First definite Cretaceous is at 4754 (Core 17)

~~There is a palaeo. controversy about Cretaceous~~ On evidence of mollusca (Kenley) & microplankton (Evans), & foraminifera (Taylor) the topmost Cretaceous considered ~~possibly~~ Upper Cret. ~~whilst on foraminifera (Taylor) an age no higher than albian~~ (lower Cret.) is suggested.

Sediments below 5656' are fresh water lower Cretaceous

During production tests on gas sand 5656-5668' pressure & rate of flow of gas dropped rapidly & showed no significant recovery on shutting in the well. Furthermore the well started to make salt water in increasing volume as the tests continued. It is thus concluded that the gas reservoir penetrated is of small dimensions. Not known if gas sand is small lens, or truncated from larger reservoir by faults.

All Communications should be addressed
SECRETARY FOR MINES

Telephone: 63 0321

DEPARTMENT OF MINES
TREASURY GARDENS
MELBOURNE, C.2
20-9-61

Our original copy of this report has been mislaid. The enclosed copy was forwarded to us yesterday by Mr. McQueen of Frome-Broken Hill at my request.

Plates of the illustrations are not included as spare copies were not available.

D.J. Taylor.
Geologist.

COPY.

FROME-BROKEN HILL COMPANY PTY. LTD.

PORT CAMPBELL NO. 1 EXPLORATION WELL.

The following porosity and permeability determinations on cores from the above well, have been made by the Commonwealth Bureau of Mineral Resources, Geology and Geophysics.

CORE NO.	DEPTH (feet)	POROSITY	PERMEABILITY (Millidarcies)
22	5660-5662	24%	H 169 V660
22	5663-5665	26.5%	H 2985 V 1695
23	5700-5702	14.8%	H 5 V 2.75
23	5702-5704	12.5%	H Nil V Nil
23	5706-5708	8.6%	H Nil V Nil

H = Horizontal permeability

V = Vertical permeability

PALYNOLOGY

A6/1

PORT CAMPBELL No.1

K.K. No.	Depth (m)	$\bar{R}_v$max	Range	N	Exinite Fluorescence (Remarks)
					WANGERRIP GROUP 369m
15335	748 Core	0.37	0.33-0.40	3	Rare sporinite, liptodetrinite and cutinite, greenish yellow to orange. (Clay-rich sandstone, d.o.m. rare I>V=E. Vitrinite rare and occurring as very small phytoclasts. Pyrite present. Poor source-potential, immature.)
15336	1100 Core	0.43	0.35-0.51	20	Sparse cutinite and sporinite, greenish yellow to orange. (Siltstone with abundant d.o.m. I>V>E. Inertinite abundant, vitrinite sparse, exinite sparse. Source-potential fair to moderate, immature.)
					PARATTE FORMATION 1294m
15337	1398 Core	0.59	0.57-0.64	3	Rare sporinite, orange, rare ?dinoflagellates, yellow. (Clay-rich siltstone with sparse d.o.m., I>E>V. Vitrinite population poorly defined and vitrinite very rare.)
					BELFAST FORMATION 1503m
15338	1532 Core	0.58	0.54-0.61	3	Sparse orange sporinite and rare greenish yellow to orange. (Claystone with sparse sand-size quartz grains. D.o.m. sparse to common, I>E>>V. Vitrinite population poorly defined.)
15339	1593	0.37	0.31-0.43	22	Dominant alginite A, yellow, derived from Reinschia sp. (Torbanite, similar to Permian torbanites. Alginite approx. 95%, vitrinite 5%, trace of inertinite.)
15340	1594 Core	?0.60	0.58-0.62	?2	Rare sporinite, orange and dinoflagellates yellow to orange. (Mudstone with sparse d.o.m., I>E>?V. Inertinite sparse. Pyrite common.)
15341	1808 Core	0.53	0.46-0.65	21	Sparse exinite; fluorinite bright green; sporinite and cutinite yellow to orange. (Claystone with d.o.m. abundant. V>>E, ?no I. Approx. 25% V. Possible oil-stain on some of the vitrinite but stain visible only in reflected light and no fluorescence from the stain.)

T.D. 1818+m

FROME-BROKEN HILL COMPANY PROPRIETARY LIMITED

Peter

Herewith Port Campbell No 1. Completion report plate — requested.

Allan.

17/5/63.

Frome-Broken Hill Company Pty. Ltd.

Report No. 7200-G-65

WELL COMPLETION REPORT

PORT CAMPBELL NO. 1, VICTORIA

by

J. S. Bain and A. F. McQueen

Melbourne

CONTENTS

		Page
I	SUMMARY	1
II	INTRODUCTION	2
III	WELL HISTORY	2
	(1) General Data	2
	(2) Drilling Data	4
	(3) Logging and Testing	9
IV	GEOLOGY	11
	(1) Summary of Previous Work	11
	(2) Stratigraphy	12
	(3) Structure	13
	(4) Relevance to Occurrence of Petroleum	14
	(5) Porosity and Permeability of Sediments Penetrated	14
	(6) Contribution to Geological Concepts Resulting from Drilling	15
V	REFERENCES	

APPENDICES

1. Palaeontological Reports
2. Formation Data and Fluid Analyses
3. Core Analyses
4. Formation Testing
5. Detailed Lithological Description

ILLUSTRATIONS

Plate 1. Locality Map.

Plate 2. Stratigraphic Column before Drilling (after Baker, 1953).

Plate 3. Port Campbell Structure: Geological section through site of Port Campbell No. 1 well based on information available prior to drilling.

Plate 4. Geological Section through Port Campbell No. 1 Well.

Plate 5. Port Campbell No. 1 Lithological Log.

Plate 6. Composite Electric Log (3300-5934 feet). Port Campbell No. 1 showing Perforations, Test Intervals and Results, Squeeze Cementations, Cement Retainers etc.

Plate 7. Stratigraphic Column after Drilling.

Plate 8. Reduced Composite Log Tracing.

Plate 9. Temperature Survey.

Plate 10. Microfossil Distribution chart. (added 01/08/00)

Plate 11. Microfaunal Zonation chart (added 01/08/00)

I. SUMMARY

The Port Campbell No. 1 exploration well was drilled to a depth of 5965 feet for Frome-Broken Hill Company Pty. Ltd., in the southwestern part of the Gambier-Otway section of the South Coast Cretaceous-Tertiary basin.

The well penetrated the Tertiary section and bottomed in paralic sediments of Lower Cretaceous age. The Miocene and Oligocene marl and calcareous clay were found to be 1410 feet thick while the lower Tertiary, Eocene and ?Palaeocene were found to be in excess of 3000 feet. Cretaceous sediments are about 1000 feet thick.

No apparent lithologic break was noted between lower Tertiary and Cretaceous sediments and a transition zone is assumed between the former and the first recorded Cretaceous fossiliferous sediments at 4754 feet.

A break in sedimentation shown by a very porous pebble conglomerate and sandstone is evident at 5656 feet, but it is thought to be a depositional feature rather than a major unconformity.

As the Cretaceous sediments cut in the well are indicative of shallow water marine to brackish and possibly deltaic conditions of sedimentation, this interpretation is somewhat strengthened.

A strong but non-commercial flow of petroleum gas with a small amount of condensate was produced from a coarse quartz sandstone between 5656 and 5668 feet. On test, flow rate and pressure decreased rather rapidly and recovery, on standing, was practically imperceptible, indicating that the reservoir is locally of small dimensions and lacking effective communication with any larger reservoir.

II. INTRODUCTION

The Port Campbell No. 1 exploration well was drilled by Frome-Broken Hill Co. Pty. Ltd. to evaluate the stratigraphy and to test for possible petroleum accumulation in the southeastern part of the Otway Basin, Victoria. Although the area was previously untested, information derived from water wells drilled by the Department of Mines of Victoria at Port Fairy and Timboon, together with knowledge of the geological section cropping out along the coast east of Princetown, indicated that facies favourable as a source of oil may exist in the area in Tertiary or Cretaceous rocks. The well was drilled on a fold structure indicated by seismic reflection methods.

This structure had reasonably good east-west relief and southerly closure, and appeared from seismic results to be closed to the north against a fault.

The Commonwealth Government agreed to share the cost of drilling, under terms of the Petroleum Search Subsidy Act, 1957-58.

III. WELL HISTORY

(1) GENERAL DATA

(a) Well name and number:

Port Campbell No. 1

(b) Location:

872417 Port Campbell 1 mile series No. 932, Zone 6, Victoria.
1500 feet N5°W of S.E. corner of Allotment 11 of 8.
Parish: Paaratte. County: Heytesbury.
State: Victoria

(c) Name and address of tenement holder:

Frome-Broken Hill Company Pty. Ltd.
53 Flemington Road,
North Melbourne, Victoria.

(d) Details of petroleum tenement:

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

(e) District:

Southwest Victoria.

(f) Total Depth:

5965 feet

(g) Date drilling commenced:

September 9, 1959.

(h) Date drilling completed:

December 9, 1959.

(i) Date well suspended:

February 9, 1960.

(j) Date rig released:

February 16, 1960.

(k) Drilling time in days to total depth:

92 days

(l) Elevation:

Ground: ... ... 337 feet
Rotary Table: ... ... 346.6 feet

(m) Status:

Shut-in. Casing left full of mud and a plate welded on blind flange of the top spool, within which the 5½" casing is landed, was inscribed with the following inscription:-

FROME-BROKEN HILL PTY. LTD.

PORT CAMPBELL NO. 1

(n) Cost of well:

The total cost of the Port Campbell bore, based on accounts received up to May 12, 1960, was £155,822. Additional expenditure in respect of the operation is expected to be of a minor nature.

Costs may be summarised as follows:

Construction of access roads, preparation of site, and installation of water supply.		£2,613
Delivery and installation of plant, delivery of materials, rigging up, rigging down, and removal of equipment from site.		17,682
Supervision and operation of laboratory.		2,436
Drilling and Coring		
Contract time and footage charge, drilling	£35,198	
" " " " " , coring	4,356	
Drilling bits	4,307	
Core heads	2,349	
Fuel, mud chemicals	7,734	
		53,944
Running and cementing casing, including cost of casing, cement and contract time		
13⅜" casing	2,874	
9⅝" casing	12,643	
5½" casing	10,262	
		25,779
Electric logging and other borehole surveys, including contract time and rental of unit		4,311
Formation testing and production tests, including contract time, hire of equipment, gun perforating, cost of tubing and chemicals used		24,115
Fishing, drilling out cement, repairs, waiting on chemicals and equipment and other down time		24,942
		£155,822

(2) DRILLING DATA

(a) Name and address of drilling contractors:

Oil Drilling and Exploration Limited,
82 Elizabeth Street,
SYDNEY, N.S.W.

(b) Drilling plant:

Make	Brewster
Type	N4
Rated Capacity with $4\frac{1}{2}$" drill pipe	5500 feet
Rated Capacity with $3\frac{1}{2}$" drill pipe	6700 feet
Motors (1)	
Make:	G.M.
Type:	Model 12107 Series 71
BHP:	302

(c) Mast/Derrick:

Make	Lee C. Moore
Type	126' Cantilever
Rated Capacity	325,000 lbs.

(d) Pumps:

Make	Oilwell
Type	214P
Size	$7\frac{1}{4}$" x 14"
Motors	G.M. Model 12107 Series 71. 302 BHP

(e) Blow out preventor equipment:

Make	Cameron (2)	Cameron
Size	12"	6"
Series (A.P.I.)	900	900

(f) Hole sizes and depths:

(1) $17\frac{1}{2}$" hole to 293 feet
- i. Drilled $12\frac{1}{4}$" hole to 293 feet
- ii. Reamed with hole opener to $17\frac{1}{2}$" to 293 feet
- iii. Set $13\frac{3}{8}$" surface casing at 291 feet

(2) $12\frac{1}{4}$" hole to 3340 feet
- i. Drilled $8\frac{3}{4}$" hole to 3340 feet
- ii. Reamed with hole opener to $12\frac{1}{4}$" to 3340 feet
- iii. Set $9\frac{5}{8}$" intermediate casing at 3322 feet

(3) $8\frac{3}{4}$" hole to 5965 feet

(g) Casing and liner details:

Size:	$13\frac{3}{8}$"
Weight:	48 lbs./ft.
Grade:	H.40
Range:	2
Setting Depth:	291 feet

Size:	$9\frac{5}{8}$"
Weight:	36 lbs./ft.
Grade:	J.55
Range:	2
Setting Depth:	3322 feet

Size:	$5\frac{1}{2}$"
Weight:	613 feet of 20 lbs/ft; 488 feet of 15.5 lbs/ft; 4861 feet of 14 lbs/ft.
Grade:	N80; J55; J.55 and H40 respectively.
Range:	2
Setting Depth:	5962 feet

(h) Casing and liner cementing details:

Size:	$13\frac{3}{8}$"
Setting Depth:	291 feet
Quantity cement used:	210 sacks
Cemented to:	Surface
Method used:	Circulated to surface using rig pumps.

Size:	$9\frac{5}{8}$"
Setting Depth:	3322 feet
Quantity cement used:	1022 sacks
Cemented to:	Surface
Method used:	Circulated to surface using rig pumps. 3 Centralizers run.

Size:	$5\frac{1}{2}$"
Setting Depth:	5962 feet
Quantity Cement used:	-
Cemented to:	5575 feet. Later squeezed at 5400; 4950; 4750; 4600; 4150 and circulated 3550 to 3000 approximately.
Method used:	Abortive circulation attempt by rig pumps. Later squeezed and circulated by HOWCO T.10 pump. 3 Centralizers run.

(i) Drilling fluid:

The drilling fluid used was of a bentonite-water base, with myrtan and caustic soda added to reduce viscosity, and barytes to increase the weight of the mud. Mud characteristics varied greatly during the drilling of Port Campbell No. 1. In the earlier stages while in the marl facies, viscosity reached as high as 150 secs., while later on, when drilling in the water sands, sand content reached 18% due to ineffectiveness of settling.

To 1500 feet depth, weight varied from 68 to 76 lbs/cu.ft., viscosity 33 to 150 secs., water loss 16 to 22 ccs. and wall cake 4/32".

To 3000 feet, viscosity was controlled with myrtan and caustic soda although, as mentioned above, the sand content increased. In general, mud was heavier at 72 to 88 lbs/cu.ft., viscosity ranged from 36 to 63 secs., water loss was lower at 6 to 16 ccs. and the filter cake was thinner at 2 to 3/32".

To 5000 feet, mud was usually about 75 to 81 lbs/cu.ft. weight, 40 to 80 secs. viscosity, 8 to 11 ccs. water loss and 3/32" wall cake thickness.

From 5000 feet to T.D., characteristics were better - a fairly steady weight of 76 to 80 lbs/cu.ft., viscosity less than 70 secs., water loss less than 10 ccs. and wall cake being maintained at 2/32". Sand content was less than 3%.

Sodium bicarbonate was used to treat cement contaminated mud, while rice husks were used in lost circulation zones. C.M.C. was used in the later stages of the hole to decrease water loss.

(j) Water supply:

During the initial stages of the well, water was pumped to the rig from a small water hole about $\frac{3}{4}$ of a mile away. However, this supply was exhausted about midway through the drilling, necessitating the carting of water by truck from Port Campbell and one other creek source.

Chloride content of this water was approximately 280 ppm.

(k) Perforation and shooting record:

Casing perforation (See Plate No. 6)

(a) For cementing purposes:
5674 to 5676 feet; 5632 to 5634 feet; 5400 feet; 4950 feet; 4750 feet; 4600 feet; 4440 to 4442 feet; 4150 and 3550 feet.

(b) For testing:
(1) 5908 to 5920 feet
5924 to 5928 feet
(2) 5756 to 5766 feet
(3) 5695 to 5701 feet
(4) 5656 to 5666 feet
and later 5657 to 5663 feet
(5) 4815 to 4820 feet
4830 to 4840 feet
(6) 4695 to 4702 feet
(7) 4498 to 4515 feet
(8) 4463 to 4475 feet

Perforations were made with Lane Wells 4" gun with 24 shot capacity. Length of gun was 10' 6" and size of bullet 15/32". Perforation density was four shots per foot, and as the spacing of shots on the gun was not at this interval, moving of the gun between shots was necessary.

No open hole shooting was undertaken.

(l) Plugging back and squeeze cementation jobs: (See Plate No. 6)

At T.D. 5965 feet

(i) Squeeze cementing of $5\frac{1}{2}$" casing

Attempts were made to break circulation behind the $5\frac{1}{2}$" casing at various depths so as to circulate cement.

When circulation was not achieved the perforations were squeezed off. Perforations were made and cemented as follows:

(a) 5400 feet, 15 sack squeeze, final squeeze pressure 4000 psi, held 3000 psi

(b) 4950 feet, 15 sack squeeze, final squeeze pressure 3000 psi, held 2000 psi

(c) 4750 feet, 15 sack squeeze, final squeeze pressure 3200 psi, held 2000 psi

(d) 4600 feet, 15 sack squeeze, final squeeze pressure 4000 psi, held 2400 psi

(e) 4150 feet, 15 sack squeeze, final squeeze pressure 3000 psi, held 1800 psi

(f) 3550 feet, circulated 140 sacks and 500 psi pressure left on cement.

In all cases except (f) pressure was left on the squeeze job for periods of 2 to 12 hours before reverse circulating and coming out of the hole. There was never more than about one barrel of cement circulated out of the hole.

These squeeze jobs were tested on drilling out with 1200 to 1500 psi pump pressure and found satisfactory at the time.

(ii) <u>After and during testing</u>

(a) Set 15 sack plug up from 5930 feet. Top of plug was not felt for.

(b) Squeezed 15 sacks over 5756 to 5766 feet at 2000 psi. Tested squeeze with 1500 psi and was found to be unsatisfactory. Squeezed further 10 sacks at 2600 to 1200 psi and pressure held for half an hour. Reverse circulated slight cement returns.

(c) Squeezed 20 sacks over 5695 to 5701 feet at final squeeze pressure of 2600 psi. Held 2100 psi for half an hour. Reverse circulated slight cement returns.

(d) Squeezed 25 sacks over 5656 to 5666 feet with final squeeze pressure of 2200 psi. Held 1200 psi, dropping to 700 psi for one hour. Reverse circulated approximately $1\frac{1}{2}$ bbls cement. Drilled out to 5690 feet, applied pressure to 900 psi and cement job held satisfactorily.

(e) Squeezed 17 sacks over 5674 to 5676 feet with final squeeze pressure 2000 psi. Held 1400 psi for one hour. Reverse circulated slight cement returns.

(f) Squeezed 15 sacks over 5632 to 5634 feet, but tubing found to be cemented up after pull out.

(g) Found leak at 3550 feet at this time, and squeezed 7 sacks with final pressure 2000 psi. Held 1000 psi pressure for 15 minutes. Reverse circulated, no cement returns. Tested squeeze at 1300 psi and it held satisfactorily.

(h) Squeezed further 15 sacks over 5632 to 5634 feet with 1820 psi final squeeze pressure and held 1500 psi pressure. This was then drilled out and retested and found satisfactory.

(i) Set cement retainer at 5670 feet prior to squeezing below again. However, it was not necessary to run cement to squeeze, as no mud loss or pressure drop was noted in casing below this depth.

(j) Set cement retainer at 5644 feet.

(k) Set cement retainer at 4810 feet. Squeezed 15 sacks through retainer over 4815 to 4820 feet and 4830 to 4840 feet. Held 2200 psi pressure and circulated slight cement returns.

(l) Set cement retainer at 4690 feet. Squeezed 15 sacks through retainer over 4696 to 4702 feet. Held 2000 psi pressure.

(m) Squeezed (bradenhead) 15 sacks over 4440 to 4442 feet. Final squeeze pressure 2600 psi. Circulated slight cement returns.

(n) Set cement retainer at 4485 feet. Squeezed 20 sacks. About 1 bbl cement circulated up after cement job.

(o) Squeezed (bradenhead) 20 sacks over 4463 to 4475 feet with 2000 psi pressure. No cement returns on circulation.

(m) Fishing operations:

(i) At total depth 3738 feet.

On tour change string was pulled off bottom but not rotated and it was found to be stuck when an attempt was made to drill ahead. Backed off above the casing shoe (with aid of string shot) and ran jars without success. Attempted to blow off the bit with $3\frac{1}{2}$ lb. charge detonated above the bit and jarred again without success. Up to this point normal circulation had been maintained at all times, but it ceased after this shot. Backed off above safety joint (overshot not able to go over safety joint) and washed over to top of drill collars. Could not go any further due to length of washover shoe. A smaller washover shoe was fitted and fish was washed over to full length of washover pipe (283 feet) - approximately 67 feet below the top of the drill collars. Made up and jarred again unsuccessfully, although circulation was restored. Backed off again at drill pipe-drill collar tool joint on third attempt, with the aid of a string shot, and washed over to bit. Ran in with Bowen overshot to pick up fish but grapples slipped on drill collars. Pulled out and found grapples left on fish. Made up again with jars and after short time jarred the fish free. Recovered bit and most of the grapples. Ran Bowen junk basket twice recovering nothing first time and 2 feet of core and few more bits of grapple the second time. Fish completely recovered.

(ii) Total depth 5965 feet.

While applying pressure to perforations below cement retainer set at 5670 feet the string parted above a weld of a field-made sub from $2\frac{7}{8}$" drill pipe to 2" tubing. Top of fish was 26.75 feet below rotary table. Ran cut down tapered tap and recovered fish.

(n) Side-tracked hole:

None.

(3) LOGGING AND TESTING

(a) Ditch Cuttings:

Cuttings were taken over a normal shale shaker. Interval sampled was every 5 feet to 293 feet; every 10 feet to 5718 feet, and every 5 feet to 5965 feet.

(b) Coring:

Original program outlined cores to be taken at "lithological change, significant drilling break, distinctly porous bed, sudden increase in chloride content as well as all oil and gas shows". In addition, routine stratigraphic cores were to be taken at a maximum interval of 500 feet as required by the Commonwealth Subsidy Agreement. No deviation occurred from the original program laid down.

Twentyfour cores were cut for a total footage of 296 feet. 165 feet 6 inches were recovered for a total recovery of 56%.

Coring equipment used was a conventional Hughes type J core barrel with $8\frac{3}{4}$" Hughes soft and hard formation core heads. Diameter of core recovered was $3\frac{1}{2}$".

See Appendix No. 3 for detailed core descriptions.

(c) Side wall Sampling:

Side wall cores were taken at three depths for the following recoveries:-

No. 1. 5400 feet - Recovered $3\frac{1}{2}$" black glauconitic sandy mudstone.

No. 2. 4700 feet - Recovered 1" of very fine clear loose sand.

No. 3. 4450 feet - Recovered $4\frac{1}{2}$" of grey sandy siltstone.

Tool used was a Homco mechanical side wall corer with varying length core barrels. Diameter of core was 1 inch.

(d) Electrical and other logging:

Electric logging was carried out by Oil Drilling & Exploration Limited before the intermediate casing string was run and at three other times during the drilling of the hole. Hole was logged to 5934 feet. In the bottom part of the hole, from 4500 to 5934 feet, the logs were run on a scale of 1 inch = 20 feet as well as the normal 1 inch = 50 feet, which was the scale for the other logs. A composite electric log reduced to a scale of 1 inch = 100 feet for comparison with the lithologic log, is included as Plate No. 8.

(e) Drilling time log:

Time taken, up to one hour, for each ten foot interval drilled is recorded on the lithologic log. For drilling times more than one hour, the time is printed in. Coring times are not recorded.

(f) Formation testing:

For details see Plate No. 6 and Appendix No. 4.

Drill stem test No. 1 was carried out in the open hole covering interval 5653 to 5718 feet using a Johnston open hole packer and test tool assembly. This revealed the presence of petroliferous gas which was later fully tested in Production Test No. 1.

The remainder of the tests, except Production Test No. 1 (a), were carried out through perforations in the $5\frac{1}{2}$" casing using a $5\frac{1}{2}$" Johnston hook wall packer and test tool assembly with pressure bomb. Production Test No. 1 (a) was carried out by landing open ended tubing in the well head and swabbing the tubing until the well came in.

Intervals tested through casing and brief results are as follows:-

DST NO. 2. 5908 to 5920 and 5924 to 5928 feet - recovered gas cut salt water.

DST NO. 3. 5756 to 5766 feet - recovered gas cut salt water.

DST No. 4. 5695 to 5701 feet - recovered gas cut salt water.

Production Test No. 1.

(a) 5656 to 5666 feet - recovered petroliferous gas with some condensate and salt water.

(b) 5657 to 5663 feet - as for (a)

DST NO. 5. 4815 to 4820 feet and 4830 to 4840 feet - recovered gas cut salt water.

DST NO. 6. 4696 to 4702 feet - recovered gas cut water.

DST NO. 7. 4498 to 4515 feet - recovered gas cut water with considerable clear fine to medium grained sand.

DST NO. 8. 4463 to 4475 feet - recovered gas cut water with considerable very fine grained clear sand.

(g) Deviation surveys:

Deviation surveys were conducted using the Totco instrument dropped through the drill string. The hole was almost vertical, maximum deviation being 1° at 4170 and 4750 feet. Totco deviations are listed below:-

Depth (feet)	Deviation (degrees)	
269	1	
500	$\frac{1}{2}$	These readings made
1000	$\frac{1}{2}$	on Halliburton wire
1500	$\frac{1}{2}$	line.
1969	0	
2450	0	
3300	0	
3340	$\frac{1}{2}$	
4170	1	
4360	$\frac{3}{4}$	
4750	1	
4950	$\frac{3}{4}$	
5185	$\frac{3}{4}$	
5550	$\frac{1}{4}$	
5920	0	

(h) Temperature Survey:

A temperature survey was run on December 17, 1959, in an attempt to find the height of the cement behind the casing. This was determined as being at 5575 feet. Bottom hole temperature at 5942 feet was shown as 180°F.

(i) Other well surveys:

None.

IV. GEOLOGY

1. Summary of Previous Work

(a) Geological

Previous geological work in the eastern part of the Otway Basin has been carried out by Baker (2 and 3), Reeves and Evans (5) and Bain (1). D. J. Belcher and Associates made a photogeological interpretation of the area and Wulff (7 and 8) examined Mesozoic rocks in the Cape Otway area to check structures indicated by this study. Wulff also examined isolated exposures of Tertiary rocks extending westward from Colac, but no deductions about structure could be made as a result of this work.

Sea cliff sections provide the most useful exposures in the area, as the land surface is mostly covered by recent deposits and basalt. This widespread masking of the Tertiary sediments makes both regional and detailed geological studies difficult to accomplish.

Baker, on lithological and palaeontological evidence, has divided the Tertiary sequence exposed in cliff sections east of Port Campbell into groups and formations and has measured their thickness. Reeves and Evans also measured some of the sections but obtained thicknesses different from those obtained by Baker.

In the younger sediments exposed along the cliffs east and west of Port Campbell Bain noted gentle folding which was later confirmed by seismic work. Prior to drilling, it was estimated that the Port Campbell well would intersect about 1500 feet of marls and clays equivalent to the Tertiary Gambier Formation, and 3000+ feet of sands and sandstone equivalent to the lower Tertiary-Upper Cretaceous Knight Group, which were intersected by bores on the western part of the basin. Below the sands and sandstones it was expected that extensions of the Jurassic rocks of the Cape Otway area would be found. However, one interpretation of the seismic results indicated that an unidentified section could exist between the Tertiary as known in other parts of the basin and equivalents of the Jurassic rocks of the Otway area. In the latter area, the contact between these units is a small angular unconformity.

(b) Geophysical

A seismic reflection survey over part of the eastern margin of the basin was carried out for Frome-Broken Hill Co. Pty. Ltd. during the earlier part of 1959. This revealed several reflecting horizons which could be traced over much of the area and which indicated folding and faulting in the sediments. Although this seismic survey was not a

detailed one, it indicated the presence of the Port Campbell fold structure which appeared to be a faulted anticlinal fold with north-south trending axis along which were three minor closed structures.

The most southerly closed structure was selected for the test well and seismic results showed it to have good east-west relief and south closure, and closure to the north against a fault.

(c) Drilling

Prior to the drilling of the Port Campbell exploration well, no deep drilling had been done in the Port Campbell area. At Timboon, $6\frac{1}{2}$ miles to the north, the Department of Mines of Victoria had drilled a water well to a depth of 2695 feet, and started another well while drilling was in progress at Port Campbell. Rocks to a depth of 850 feet in the Timboon bore could be correlated with rock units cropping out along the coast, but below this depth, correlations could not be made with certainty. The coarse sand and ligneous clays below 850 feet were believed to be equivalents of the Eocene Knight Group which was intersected in the Portland and Nelson bores in the western part of the basin.

At Port Fairy, about 40 miles west northwest of Port Campbell, a water well drilled by the Department of Mines intersected 435 feet of black carbonaceous and micaceous siltstone which was identified as Cretaceous and probably Upper Cretaceous. The distance of this well from the Port Campbell site made it difficult to assess the likelihood of the extension of the Cretaceous rock to that area, but the occurrence of this unit below the previously known arenaceous section of Lower Tertiary age at Port Fairy enhanced the prospects of the Port Campbell area.

2. Stratigraphy

The section penetrated by the Port Campbell No. 1 well can be divided into 5 fairly distinct lithological units. The two uppermost units can be correlated satisfactorily with the Tertiary succession observed at outcrop along the Cape Otway-Port Campbell coast and are therefore referred to in this report under the existing stratigraphic names. The three lowermost, however, have not been seen at outcrop and, for convenience, have been given local names which are considered to be appropriate. These formation names have been agreed to by the State Nomenclature Committee.

The section is thus generalised as follows:

Surface to 1410 feet	Heytesbury Group	(Miocene-Oligocene)
	Dominantly clayey marl with hard limestone bands becoming more sandy towards the base.	
1410 to 4245 "	Wangerrip Group	(Eocene)
	Dominantly sandstone and siltstone with conglomerate, limestone, dolomite and lignite in places.	
4245 to 4930 "	Paaratte Formation	(Eocene-Upper Cretaceous)
	Transition zone consisting of sandstone, siltstone mudstone and dolomite.	
4930 to 5656 "	Belfast Mudstone	(Upper Cretaceous)
	Black glauconitic mudstone.	
5656 to 5965+ "	Waarre Formation	(Lower Cretaceous)
	Sandstone, siltstone and mudstone with pyrite and coal.	

The section cut to 1410 feet is a dominantly calcareous facies of Miocene-Oligocene age (Janjukian) and is correlated with Baker's Heytesbury Group. Very little limestone was cut at the top of the hole and it appears that Baker's Port Campbell Limestone is missing from the section cut in the hole.

Below 1410 feet the section is a dominantly sandy-silty facies of Eocene age (Anglesean). The sediments are equivalent, in part at least, to Baker's Wangerrip Group. The bottom of the Tertiary cannot be determined lithologically and it appears that there may be a transition to the Cretaceous, definite evidence of which was first noted in a core at 4754 feet.

Palaeontologically, there is some controversy about the Cretaceous cut in the hole. Kenley on mollusca and Evans on microplankton (see Appendix 1) state that the topmost Cretaceous is possibly Upper Cretaceous while Taylor, on the foraminfera, allots an age no higher than Lower Cretaceous (Albian). Furthermore, Taylor suggests that there is a non-depositional break between Cretaceous and lowermost Tertiary. There is no lithologic evidence for a depositional break in Port Campbell No. 1, nor is there any indication of one on the electric logs.

During the course of drilling of the well it was considered that the sediments below 5656 feet, although not typical of Jurassic outcrops in the Otway area, could be of Jurassic age and that the base of the Cretaceous sediments was at 5656 feet.

It now appears from recent palaeontological work that some of the sediments classed as Jurassic in the Otway area are fresh water Lower Cretaceous.

In cores below 5656 feet Evans (Appendix 1) has found microplankton which suggests marine conditions and a Lower Cretaceous (Albian) age. Lithologically the sediments below 5656 feet appear to be predominantly of fresh water origin but marine faunas indicate they were laid down at least partly in marine conditions with small lenses of marine rocks, as distinct from the marine Upper Cretaceous mudstones above this depth. The geological significance of this lithological change at 5656 feet is unknown at present. In the first core cut below this depth at 5700 feet a dip of 10° was recorded, whereas no dips, other than those due to cross-bedding, were recorded above 5656 feet. In the next core below 5700 feet, no dips were recorded. In view of the lack of information about dips in the section cut, it is not possible to assess the structural significance of the 10° dip recorded at 5700 feet. Regional dip indicated by seismic surveys is of the order of less than two degrees.

3. Structure

The Port Campbell structure was outlined in a general way by a seismic survey. An anticlinal type fold having a north-south trending arcuate axis exists between Timboon and Port Campbell. Warping and faulting have distorted the fold producing three subsidiary structures separated by east-west trending faults with vertical displacement of the order of 200 to 500 feet. The most southerly of these three structures is the Port Campbell structure. Seismic contouring indicates closure of about 150 feet at the top of the Cretaceous section, increasing to about 200 feet one thousand feet deeper. This deeper horizon is probably the gas sand intersected at 5656 feet.

The Port Campbell well has not contributed much additional information about the structure of the area. Sediments down to about 3500 feet can be correlated in part with sediments intersected in the Timboon bore, and such correlations indicate a regional southerly dip of less than one degree between Timboon and Port Campbell. There is no significant faulting in these upper sediments.

With one exception, cores cut at Port Campbell were either cross bedded or gave no evidence of dip. A core at 5705 feet showed a dip of 10°, and jointing and slickensiding at an angle of 51° to 57° to the core axis was noted in some cores cut between 5018 and 5934 feet. These features indicate the possibility that the Port Campbell well approached a fault plane below 5000 feet. Seismic records indicate faulting in equivalents of the beds cut at this depth in the Port Campbell bore. Regional dips of the order of one or two degrees to the east are also indicated.

4. Relevance to Occurrence of Petroleum

The Port Campbell No. 1 well was the first hole in the south coast basin in southwest Victoria to produce a strong flow of petroliferous gas with condensate. All the sands tested produced some gas but, apart from the sandstone at 5656 to 5670 feet, in only minor quantities and apparently dissolved in formation water.

Gas from the sand tested over the interval 5656 to 5666 feet and later 5657 to 5663 feet was accompanied by a small volume of volatile liquid petroleum with specific gravity up to 0.772 at 60°F. Soxhlet extraction tests were carried out on all cores on site (see Appendix 3) and quite a number, even in the marl section, gave a positive cut, but no other indications of oil were noted during drilling of the well.

During the production tests on the gas sand at 5656 to 5668 feet, pressure and rate of flow of gas dropped rapidly and neither showed any significant recovery on shutting the well in. Furthermore, the well started to make salt water in increasing volume as the tests continued. It must be concluded, therefore, that the gas reservoir penetrated by the bore is of small dimensions. It is not known, however, whether the sandstone is a relatively small lens or whether it has been truncated by faults which have closed it from communication with some larger reservoir.

5. Porosity and Permeability of Sediments Penetrated (See Appendix No. 3)

Porosity and permeability of the sediments cut in the Port Campbell No. 1 well were estimated in a qualitative way only by the well site geologist and were described as tight, dense, fairly porous etc.

Porosity and permeability of the top clayey marl section was very low, as evidenced by the electric log, while the sands and sandstones below this has widely varying porosities.

Below 4250 feet the sands tested in drill stem tests 5, 6, 7 and 8 show good porosity and permeability and some porosity is evident in the cores.

From 4800 to 5656 feet the sediments are all tight mudstones with very little porosity and permeability. At 5656 feet the top of a very porous and permeable sandstone was cut. Porosity over the interval 5660 to 5662 feet is 24% and permeability 167 millidarcies horizontal and 660 md vertical. The interval 5663 to 5665 feet had a porosity of 26.5% and a permeability of 2985 md horizontal and 1695 md vertical.

Only one other core, from 5700 to 5718 feet, was measured for porosity and permeability, and this showed the porosity of the interval 5700 to 5702 feet to be 14.8% and permeability 5 md horizontal and 2.75 md vertical. Tests on other parts of this core showed no permeability.

The electric log indicates a distinct change of formation at 5656 feet, with rapid changes of formation characteristics below that depth.

6. Contribution to Geological Concepts Resulting from Drilling.

Prior to the drilling of Port Campbell No. 1 there was no subsurface information, other than that from a bore at Timboon, about the eastern end of the Otway Basin. The Mines Department Port Fairy bore, located 44 miles to the northwest, had shown that marine Cretaceous dark colored glauconitic mudstones, now known as the Belfast Mudstones, were present in the area, but it was not known whether they would extend to the Port Campbell area. There is no outcrop evidence of these marine Cretaceous rocks anywhere in the basin.

The marls and calcareous clays penetrated down to 1410 feet and the thick underlying sandstones confirmed the already suspected wide distribution of the Tertiary Heytesbury and Wangerrip Groups in this region. The discovery of the black glauconitic mudstones of Cretaceous age in considerable thickness suggests that these sediments also occur over a wide area, although they have been overlapped around the margin of the basin.

The evidence of transition between the Belfast Mudstones and the Wangerrip Group supports the idea of continuous sedimentation in this basin through Cretaceous to Middle Tertiary time. The age of the Otway Group and its relation to the Waarre Formation were not disclosed by the Port Campbell well, but the nature of the Waarre Formation, alternating sandstones and dark mudstones with coal and both marine and non-marine fossils, suggests that deposition might have been continuous also from Jurassic to Cretaceous in the deeper parts of the basin.

The Port Campbell well has thus contributed very considerably to our knowledge of stratigraphy and geological history of southwest Victoria and the neighboring part of the Southern Ocean. In the latter respect, especially, a lot remains to be learned but it would seem that a sedimentary basin of considerable magnitude formed in this region during the upper Mesozoic and Tertiary. Only the landward margin of this basin is present in Victoria and South Australia where much of the section is non-marine. Marine Cretaceous sediments extend inland quite an appreciable distance in the Port Campbell area but apparently are not present in the Otway region. It is not known yet whether there is any lateral gradation from marine conditions in the Port Campbell area to non-marine in the Otways, but the presence of Lower Tertiary Wangerrip gravels unconformably overlying the Jurassic or Lower Cretaceous sediments on Cape Otway suggest that the earth movements responsible for the Otway uplift took place in late Cretaceous time along with considerable elevation of the northern margin of the basin to expose and subject to erosion a land mass made up largely of quartz sandstone - probably the Carbo-Devonian.

Melbourne, April, 1960.

J. S. BAIN

A. F. McQUEEN

V. REFERENCES

1. Bain, J. S. — Tertiary Stratigraphy and Structure from Nelson to Cape Otway, Victoria. Frome Report 7200-G-50.

2. Baker, G. — The Geology and Physiography of Moonlight Head District, Victoria. Proc. Roy. Soc. Vic. Vol. 60, 1950.

3. Baker, G. — The relationship of Cyclaminna-bearing Sediments to the Older Tertiary Deposits, Southeast of Princetown, Victoria. Mem. nat. Mus. Melb. No. 18, 1953.

4. Kenley, P. — The Occurrence of Marine Cretaceous Sediments in the Belfast No. 4 Bore, Port Fairy. Min. Geol. J. Vol. 6, No. 3, 1958-59.

5. Reeves, F. and Evans, H. J. — Geology and Oil Possibilities of the South Coast of Australia. Frome Report No. 7200-G-7.

6. Taylor, D. J. — A Review of Palaeontological Knowledge of Mesozoic and Tertiary Sediments of Southwest Victoria. Frome Report No. 7200-G-62, 1960.

7. Wulff, G. E. — Some Field Observations about the Structure of Jurassic Sediments in the Otway Ranges. Frome Report No. 7200-G-52, 1958.

8. Wulff, G. E. — Examination of Tertiary Rocks between Colac and Heywood, Western Victoria. Frome Report No. 7000-G-45, 1958.

APPENDIX 1

COPIES OF PALAEONTOLOGICAL REPORTS AND MEMORANDA

AS SUBMITTED TO THE COMPANY

by

Bureau of Mineral Resources, Geology and Geophysics.

Department of Mines of Victoria.

Company Palaeontologist.

(COPY)

DEPARTMENT OF MINES VICTORIA

Palynological Examination of Port Campbell Bore Sample

Locality	:	Port Campbell
Bore	:	No. 1
Depth	:	3450' - 3460'
Supplier	:	Frome-Broken Hill Pty. Ltd.
Date	:	27.10.59
Rock Type	:	Coal and sand grains

The coal was separated from the sand and treated by the Hydrofluoric acid - Schulze's maceration method. A microscopic examination of this preparation revealed the presence of plant microfossil material principally in the form of cellular debris. Some few microspores present were of little diagnostic value for age determination as they possess a geological time range from Upper Cretaceous - Lower Tertiary. One pollen examined appeared to have an academic and possible subsequent practical value in that it has not been previously reported from Australian sediments and may be of use as an Index Fossil. Grain 24 u in diameter, small, triangular in polar view with convex sides, strongly aspidate in domes up to 5 u in diameter. Exine to 2 u thick, very strongly echinate.

No relationship with overseas forms has as yet been established.

(Signed) J. Douglas
Geologist.

29th October, 1959

Addendum to Report on Frome Broken Hill Sample

An examination of further preparation has resulted in the isolation of a few more pollens with the same Upper Cretaceous - Lower Tertiary time range, but it is my opinion (based on the absence of spores confined to the Mesozoic, and lithology) that the sample is of Lower Tertiary (Eocene - Oligocene) in age.

Microspores identified as Upper Cretaceous to Lower Tertiary age are Cyathidites sp. (fern spore) and Triorites sp. (a dicotyledenous pollen).

(COPY)

PRK/SK

Department of Mines
Treasury Gardens,
MELBOURNE, C.2.

23rd November, 1959.

CRETACEOUS SEDIMENTS IN THE PORT CAMPBELL NO. 1 BORE
PARISH OF PAARATTE

Introduction

Samples of bore core from the deep bore being drilled by Frome-Broken Hill Co. Pty. Ltd., in the southeast part of allotment 11, Sec. VIII, Parish of Paaratte, about 3 miles northwest of Port Campbell were examined for macrofossils. The core was taken at intervals in the depth range 3740-4762 feet. An additional sample which had previously been examined for gaseous hydrocarbons came from a depth of 5021 feet.

Lithology of Samples

The black siltstones represented in the core from 4754-4762 feet in this bore are lithologically similar to those encountered from 4550 - 4985 feet in the Belfast No. 4 bore, Port Fairy. The sample from 5021 feet contains disseminated quartz sand, but is otherwise indistinguishable from the other siltstones.

Macrofauna

4754 - 4756 feet.

Pisces:- Small fish scales and bones

Incertae sedis:- Organic fragment undet.

4756 - 4758 feet.

Pelecypoda:- One small sp. undet.

Gastropoda:- Merelina sp. (identical with the Port Fairy species) 2 other spp. undet.

Annelida:- Tubulostium sp. (identical with the Port Fairy species)

4758 - 4760 feet.

Pelecypoda:- One small sp. undet.

Ammonoidea:- Fragment of a somewhat crushed small, compressed ammonite with weakly keeled venter. Test thin and apparently lacking strong ornament.

Pisces:- Fish scales and bones.

4760 - 4762 feet.

Pelecypoda:- 2 small sp. undet.

Annelida:- Tubulostium sp. (as above)

Incertae sedis:- Tubular organisms undet.(2 pieces). Fragments undet.

5021 feet

Foraminifera:- One Miliolid foraminifer

Ammonoidea:- Small Ammonite fragment undet. showing septal sutures.

Remarks

The most common fossils in the Belfast No. 4 bore Cretaceous sediments, in order of relative abundance, are:-

(1) Fish scales and bones

(2) Plani-spirally coiled Annelid tubes - Tubulostium sp.

(3) Small Rissoid gastropod - Merelina sp.

(4) Small Ringiculid gastropod - Eriptycha sp.

(5) Ammonites, crushed and fragmentary tests of several genera.

Of these organisms, forms identical to the first three occur in the Port Campbell No. 1 bore. In addition, the ammonite fragments although not identifiable, appear to be referable to genera occurring at Port Fairy.

Conclusions

The siltstones and sandy siltstones represented by the core from 4754 - 4762 and 5021 feet in the Port Campbell No. 1 bore are directly correlable, both on lithological and faunistic grounds with the Cretaceous (?Upper Cretaceous) sediments from 4550 - 4985 feet in the Belfast No. 4 Bore at Port Fairy.

Reference

Kenley, P.R., 1959 The Occurrence of Marine Cretaceous Sediments in the Belfast No. 4 bore, Port Fairy:
Min. & Geol. Jour. Vic. Vol. 6, No. 3 (in press).

P.R. Kenley
Senior Geologist

FROME-BROKEN HILL COMPANY PTY. LTD.

PALAEONTOLOGICAL DETERMINATIONS PORT CAMPBELL NO. 1 WELL

By: D. J. Taylor
1.12.59. Melbourne

Depth: 4430 - 40 feet

Fauna List:

Foraminifera: Haplophragmoides
Globigerinids
Miliolids
Indeterminate arenaceous forms

Age: Indeterminate. Appears to be facies fauna - muddy conditions?

Depth: 4600 feet

Fauna List:

Foraminifera: Haplophragmoides
Globigerinids
Indeterminate arenaceous forms

Age: Indeterminate. as above.

Depth: 4695 feet

Fauna List:

Foraminifera: Haplophragmoides, Bathysiphon
Ammobacculites, Cibicides
Tritaxia, Nodosaria
Gaudryina, Miliolids

Ostracodes
Gastropods

Age: Cretaceous (Lower?)

Depth: 4757 feet

Fauna List:

Foraminifera: Haplophragmoides, Ammodiscus
Ammobacculites, Textularia
Nodosaria, Miliolids

Ostracodes

Age: Cretaceous(Lower?)

Depth: 4975 - 4980 feet

Fauna List:

Foraminifera: Textularia, Nonion,
Cibicides, Globigerinids

Ostracodes
Gastropods
Bryozoans

Age: Cretaceous

Depth: 5025 feet

Fauna List:

Foraminifera: Haplophragmoides, Ammobacculites,
Ammodiscus, Textularia, Lenticulina,
Gumbelina, Eggutulina, Nodosaria
Gyroidina, Globigerinids, Miliolids

Ostracodes

Age: Cretaceous (Lower?)

Depth: 5231 feet

Fauna List:

Foraminifera: Haplophragmoides, Ammobacculites, Gaudryina

Fish teeth

Age: Cretaceous (Lower?)

Depth: 5460 - 5470 feet

Fauna List:

Foraminifera: Haplophragmoides, Ammobacculites, Textularia, Gaudryina, Lenticulina, Lagina, Miliolids

Ostracodes
Gastropods
Fish teeth

Age: Cretaceous (Lower?)

Depth: 5540 - 5549 feet

Fauna List:

Foraminifera: Haplophragmoides, Ammobacculites, Gaudryina, Textularia, Globigerinids

Ostracodes
Pelecypods: Inoceramus prisms

Depth: 5590 - 5595 feet

Fauna List:

Foraminifera: Haplophragmoides, Ammobacculites, Lagena, Nodosaria, Miliolids, Globigerinids

Gastropods
Schaphopods
Bryozoans
Echinoids

Age: Cretaceous (Lower?)

D. J. TAYLOR

(COPY)

FROME-BROKEN HILL COMPANY PROPRIETARY LIMITED

53 Flemington Road,
NORTH MELBOURNE, N.1.

December 2, 1959.

Memorandum to: Mr. N. Osborne

from: D. J. Taylor

EXAMINATION OF MICRO-FOSSILS FROM PORT CAMPBELL NO.1 WELL

INTERVAL BETWEEN 4430 FEET AND 5595 FEET

Foraminifera and other micro-fossils from cores and cuttings from the interval 4430 feet to 5595 feet from Port Campbell No. 1 well have been examined. Determination of the foraminifera has been conducted on a generic level, as the lack of literature, comparison material, and knowledge of Southern Australian faunas, did not permit specific identifications.

The foraminifera from and below 4695 feet constitute an assemblage characteristic of the Cretaceous. Arenaceous foraminifera are in abundance, and include Ammobaculites, Haplophragmoides, Textularia, and Gaudryina. Various lagenids, miliolids, and small globigerinids are also present. The foraminifera from 5025 feet include Eoguttulina and Gumbelina, which are essentially Cretaceous genera. The fauna from 5540 feet to 5549 feet contains numerous calcite prisms which are from the shells of Cretaceous pelecypod Inoceramus.

It is probable that the age of the faunas from the interval 4695 feet to 5595 feet is Lower Cretaceous as Eoguttulina may be restricted to the Lower Cretaceous, and no Upper Cretaceous foraminifera genera are present. All the faunas from between 4695 feet and 5595 feet are uniform in content, therefore no division of this interval is suggested.

Above 4695 feet only two samples were examined; namely at 4600 feet and 4430-40 feet. These two higher samples contain numerous indeterminate arenaceous forms, Haplophragmoides, Miliolids, and globigerinids, specifically different to those below 4695 feet. It is impossible to give an age for the interval between 4430 feet and 4695 feet.

DJT/jm

(Sgd.) D. J. TAYLOR

(COPY)

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

Canberra

PRE/JB 106G/13/20

F.B.H. PORT CAMPBELL NO.1 BORE, VIC.

CHIEF GEOLOGIST: 31st December, 1959.

A sample of carbonaceous siltstone from core 23, 5700-5708 feet, has yielded spores and microplankton which indicate a Cretaceous, tentatively Albian, age for strata at that depth.

The bulk of the residue consists of organic debris, spores are common and microplankton are rare.

The marine organisms include:-

Odontochitina operculata (O. Wetzel),
Deflandrea acuminata Cookson & Eisenack,
Hystrichosphaeridium cf. H. Heterocanthum Deflandre & Cookson
H. anthophorum Cookson and Eisenack,
H. complex (White)

Spores are rather poorly preserved but include common -

Microcachriidites antarcticus Cookson,
Gleichenia cf. G. circinidites Cookson
Cyathidites spp.
Inaperturopollenites sp.,

and a few specimens of -

Cicatricosisporites australis. (Cookson)
Sphagnumsporites australis. (Cookson)

Tricolpate angiospermous pollens are relatively common.

At this stage, nothing more precise than a Cretaceous(rather than a Jurassic) age can be interpreted for this depth on the basis of spores, particularly when the presence of the angiosperm pollens is considered. The microplankton Odontochitina operculata is known to occur in beds of Aptian to Cenomanian age and Deflandrea acuminata is known from the Albian - Turonian Gearle Siltstone of W.A.

Although none of these microplankton is similar to those found in core 17, 4754 - 4762 feet, which were Albian or Cenomanian in age, on the basis of these forms the strata at 5700 - 08 feet do not appear to be older than the Albian.

(P. R. EVANS)
Geologist

(COPY)

BUREAU OF MINERAL RESOURCES

106/13/20

PRE/JB

7th January, 1960.

CHIEF GEOLOGIST

A sample from core 24 (5928 - 5934 feet) of the Port Campbell Bore No. 1 has yielded rare microplankton and abundant spores which indicate a Lower Cretaceous age for that sample.

The species of microplankton observed were:-

Odontochitina operculata (O. Wetzel),
Hystrichosphaeridium complex (White) (one specimen)
Veryhachium sp.

The first two species are restricted to the Cretaceous and the third is known from the Devonian to the Cretaceous.

Few of the spores can be compared with published species and several are new to my experience They include:-

Microcachryidites antarcticus Cookson
Cicatricosisporites australiensis (Cookson)
C. cf. C. Cooksoni Balme,
Sphagnumsporites australis (Cookson)
Trilobosporites trioreticulatus Cookson and Dettman
"Gleichenia" sp.,
Cyathidites sp.
Inaperturopollenites sp.,
Polypodiidites spp.

T. Trioreticulatus is a significant form as it is considered to be restricted to the Albian by the authors of the species and, to my knowledge, appears to be restricted to strata of Lower Cretaceous age.

(P. R. Evans)
Geologist

PRE/vg 106G/13/20

F.B.H. PORT CAMPBELL NO. 1 BORE

THE CHIEF GEOLOGIST

I wish to make the following comments on the last paragraph of the report by F.B.H. of 8th January, 1960 on progress on the Port Campbell Bore.

2. The conclusions reached by Mr. Osborne from my palaeontological report of 31st December, 1959, are essentially correct. The discovery of microplankton in core 23 (and later in core 24, Report of 7th January, 1960) may be considered as an indication of marine conditions existing at the time of deposition at a depth in the bore of 5700 feet. Likewise the determination of a Lower Cretaceous (?Albian) age for that level does not permit a great time gap in the sequence between core 17 (the only other core so far examined) and core 23. The "Albian" age might be altered after further work on the whole of the bore sequence and comparison of that sequence with the work in progress in the Artesian Basin, but the discovery of Deflandrea acuminata is interesting since that species has previously been found in the upper part of the Gearle Siltstone of Western Australia which is dated as Albian - Turonian by D.J. Belford. The discovery of Odontochitina porifera, O. cribropoda and Deflandrea cretacea in core 17 (4758-60 ft.) of the Port Campbell Bore indicated an Upper Cretaceous age for that level and the combined evidence from core 17 and core 23 makes me consider that probably there is no break between the cores detectable by a study of these micro-organisms. The exact ranges of these fossils, I admit, have yet to be worked out, but published and unpublished data force me to confine any age determinations approximately to those opined by Dr. Cookson.

3. The ranges published for Cretaceous spores will require revision, but so far there has been no sign in the Port Campbell Bore of any species which are restricted to the Jurassic in Western Australia, the only area of the continent where spores from proven U. Jurassic beds have been studied.

4. The problem is posed by J.G. Douglas in his palynological report of 3rd December, 1959, on core 23 as to whether the bore has passed through the marine Cretaceous into the non-marine sandstones which previously have been known as Jurassic in age. He concludes that core 23 is in the non-marine section.

5. I differ from Douglas in that the microplankton of cores 23 and 24 indicate conditions of marine sedimentation, but the age of determination depends on the route of approach to the problem. Douglas, presumably, is comparing the Port Campbell sandstones with those in outcrop such as Cape Otway which have been considered previously to be Jurassic in age. He points out that Dr. I. Cookson has recently regarded subsurface equivalents of these beds tentatively as Lower Cretaceous in age. At present, I know of nothing to counter this view. However, there has been no mention previously of marine beds of that age in this part of Victoria. It is possible, therefore, that the Port Campbell sandstones are at the top of equivalents to the Cape Otway beds

which were deposited in paralic conditions where marine interfingering has taken place. Palaeontologically the beds sampled remain marine Lower Cretaceous, but lithologically they could readily be an equivalent of the beds at Cape Otway. Only an examination of material at depths greater than core 24 will confirm or alter this view.

(P.R. EVANS)

CANBERRA. ACT.

19th January, 1960.

cc: The Director, BMR.
Mr. N. Osborne,
General Manager,
Frome-Broken Hill Co. Pty. Ltd.,
P.O. Box 384D,
Melbourne. C.1. VIC.

For your information.

(N.H. FISHER)
Chief Geologist.

Department of Mines
Treasury Gardens,
MELBOURNE, C.2.

PALYNOLOGICAL AGE DETERMINATION OF A SAMPLE FROM THE PORT CAMPBELL NO. 1 BORE, FROME-BROKEN HILL CO. PTY. LTD.

Bore.....Port Campbell No. 1

Depth.....5706'

Rock Type.....Core No. 23, Black carbonaceous shale with pyritic nodules.

Supplier.....Frome-Broken Hill Co. Pty. Ltd.

Date.....3/12/59

The rock was pulverized and treated by the Hydrofluoric acid-Schulzes maceration method to free contained microfossils from the matrix. The normal treatment schedule was considerably shortened to speed operations, and this resulted in the isolation of many imperfectly cleaned microfossils. All but a very few however were readily recognizable. Much cellular plant debris was isolated, as well as spores and Gymnosperm pollens.

Forms present included:-

(1) Cicatricosiporites australiensis (Cookson)

(2) Osmundacidites comaumensis (Cookson)

(3) Cyathidites sp.

(4) Di - and Tri-saccate Gymnosperm pollen grains.

Apart from (1) all the above have a long time range (Tertiary-Jurassic) and are of no use as Index fossils. Cicatricosisporites australiensis is regarded by Dr. I. C. Cookson, of the Melbourne University Botany School, as a Cretaceous Index Fossil, but is found in large numbers in South Gippsland, (Wonthaggi) Mesozoic coal measures. She has placed all the Victorian Mesozoic sequence in the Cretaceous, but has not however examined samples from the 1-2000' directly above the Mesozoic-Palaeozoic contact. Some controversy exists around her determination of the Wonthaggi coal measures as Lower Cretaceous.

However, the purpose of this examination was to determine the relationships of the sample to the contact of the marine Cretaceous and non marine heavy sandstones. On this basis the sample would be in the latter group known as "Jurassic".

This "Jurassic" determination is made on correlation with Mines Department Timboon No. 5A and Belfast (Port Fairy) No. 4 Bores. In the Belfast bore a narrow zone with a very similar floral assemblage to that described above has been examined some 600' below the Cretaceous-"Jurassic" contact, the contact being determined on lithological and palaeontological evidence. At Timboon this same floral assemblage has been found only 100' below the boundary.

The essential point for this enquiry is that the flora in question is found below the Cretaceous-"Jurassic" boundary and hence is determined as "Jurassic". The absence of angiosperm pollen grains is negative evidence that also points to the inclusion of the sample in the "Jurassic" sequence.

John G. Douglas
Geologist

DEPARTMENT OF MINES OF VICTORIA

Extract of report "Microplankton and Microfloral Correlation of Victorian Western District Deep Bores at the Stage of Sampling reached 24.2.60."

by

John Douglas

PORT CAMPBELL NO. 1 WELL

This bore excited much public interest when natural gas began to flow under pressure in late December 1959.

Core samples forwarded to this Department were examined (see Unpublished Reports, Vic. Mines Department 1959/70, 78 and 94) but a thorough sampling schedule is only now under way, as work on the Belfast No. 4 Bore held up the study of the Port Campbell material.

However, work has proceeded to the point where only Belfast No. 4 has been more thoroughly sampled.

Samplings have not yet been extensive enough to define the Tertiary-Cretaceous boundary, but this occurs above 4754' and below 3450'. See Table below.

Port Campbell

Depth	Depth Diff.	Slide Nos.	Micro - Fossils		Age
			Plantae	Plankton	
3450' 660'	1294'	723-8			Tertiary
4754' - 6'		754-6	Proteacidites sp.	Deflandrea cretacea Cookson cf. Fromea sp. etc.	Marine
4756' - 8'	2'	751-3			
4758' - 60'	2'	746-50			Upper
4760' - 2'		744-5			
	100'		Dinoflagellates, & Micro		Upper
4862' - 4'	2'		Plankton with Genus Hystrichosphaeridium		
4864' - 6'		790-8	characteristic		
	152'	828-31			Cretaceous
5018' - 20'		799-804			
	2'				
5020' - 2'	-	805-10			
5021'		881-5			
	5'				
5026' - 8'	2'	In			
5028' - 30'	193'	Preparation			
5223' - 5'		819-27			
	2'				
5225' - 7'		828-31			
	2'		Dinoflagellates, & Micro plankton with Genus Hystrichosphaeridium Characteristic		Marine Upper Cretaceous
5227' - 9'		832-41			
	2'				
5229' - 31'		842-49			
	431'				
5662' - 5663' 6"					
	37' 6"		Barren		
5701'					Predominately
	5'				
5706'		740-3	Cicatricosisporites australiensis, Cookson, Podocarpaceae etc.		
	224'				
5930'		811-8		Deflandrea cretacea	Non Marine
	2'				
5932' - 4'		773-8	Cingulatisporites, Podocarpaceae		

At 4754' a zone of marine Upper Cretaceous sediments characterized by microplankton of the genus Hystrichosphaeridium and other forms extends to at least 5231'.

No corings were available from here to 5662' where preparations were barren.

This depauperate zone extends to 5706' where the sporomorph Cicatricosisporites australiensis appears. (Cf. Nelson and Belfast bores). Although this latter is confined to a narrow horizon here the appearance of the Dinoflagellate Deflandre cretacea at 5930' shows that the marine incursions had not finished, although a large number of plant macrofossils (Teeniopteris spatulata Oldham and Morris, Ginkgoites sp. and Articulated stems) indicates that these were more in the nature of estuarine or brackish lake deposits.

File 106/13/20

F.B.H. PORT CAMPBELL NO.1 BORE, VICTORIA

1. a) Cuttings from the base of the bore (5960-5965 ft.) contained a microflora which indicates that the bore bottomed in marine Cretaceous sediments.

b) A preliminary general examination of all cores from core 17 (4758-4760 ft.) to the base of the Cretaceous section suggests that a two-fold division of the Cretaceous section may be made. On present evidence, the divisions probably correspond to the major lithological units divided by the unconformity at 5657 ft. and they seem to have "zonal" equivalents elsewhere in eastern Australia.

2. Cuttings 5960-65 ft.

A sample of sandstone with subordinate mudstone from the above depth has yielded abundant microplankton and spores of a Cretaceous age. The species extracted include:-

Microplankton

Gonyaulax spp. nov.
Hystrichosphaeridium cf. H. heterocanthum
Odontochitina cribropoda
O. operculata

Spores

Cyathidites minor
Gleicheniidites sp.
Sphagnumsporites australis
Cicatricosisporites australiensis
Microcachryidites antarcticus
Pilosisporites notensis
Polypodiidites sp.
Bisaccate pollens

O. cribropoda was observed in core 17 (4758-60 ft.) and is probably a contaminant at the present level. However, the similarities between the spore assemblage and that from core 24 (5928-34 ft.) indicate that only minor contamination of the cuttings has occurred. The main difference in the total assemblages lies in the greater abundance of microplankton at the lower level. P. notensis has not been observed previously in the bore but it has a wide distribution in the Lower Cretaceous of eastern Australia (Cookson & Eisenack, 1958).

3. a) A preliminary and general examination of all cores from core 17 (4758-60 ft.) to total depth has displayed a two-fold division of this section of the bore. Microplankton occur persistently and, apart from the contaminant mentioned above, two assemblages can now be recognized, typified by O. porifera and Deflandrea spp. in core 17 to 21 (i.e. 4758 - 5231 ft.) and O. operculata in cores 23 and 24 (i.e. 5700 - 5934 ft., and seemingly to the base of the hole, 5965 ft.). Core 21 (5660-62 ft.) was barren of micro-organisms. The spores reflect a corresponding division with typical Lower Cretaceous species in the section below core 23 (5700 ft.) and a nondescript assemblage of few species, including Triorites sp., some angiospermous pollens and long-ranging gymnosperm species that occur throughout the Cretaceous.

b) The fossil assemblage of the upper division is similar to that occurring below 5304 ft. in the Nelson bore while the assemblage of the lower division is of similar aspect to the one found in the Cretaceous of the Artesian Basin. The nature of the boundary between the two divisions has yet to be examined, but it will be determined from available cuttings as soon as practicable.

c) It will be seen that the above observations, in the light of the new information, are a revision of my previous opinion that it is unlikely that the unconformity at 5657 ft. will be detectable by means of these micro-organisms. However, nowhere else in eastern Australia have these two fossil assemblages been observed in superposition at the one locality so that the Port Campbell Bore assumes a great significance in the interpretation of the stratigraphic ranges of the eastern Australian Cretaceous microplankton and micro-spores.

P.R. EVANS
Geologist.

Bureau of Mineral Resources,
Geology & Geophysics,
CANBERRA. ACT
15th March, 1960.

APPENDIX 2

FORMATION FLUID DATA AND ANALYSES

APPENDIX 2

FORMATION FLUID DATA & ANALYSES

1. Drill Stem Tests

(a) Water

Test No.	Depth	Recovery	Salinity
1	5653 to 5718 feet	Gas (See below)	
2	5908 to 5920 and 5924 to 5928 feet	Gas cut salt water	13,700 mg/litre as NaCl.
3	5756 to 5766 feet	"	12,700 "
4	5695 to 5701 feet	"	12,800 "
5	4815 to 4820 and 4830 to 4840 feet	Gas cut water	4,934 mg/litre chloride
6	4696 to 4702 feet	"	1,065 "
7	4498 to 4515 feet	"	1,136 "
8	4463 to 4475 feet	"	994 "

(b) Gas

Drill Stem Test No. 1 Open hole 5653 to 5718 feet
Recovered gas.

	Standard Vacuum Refining Co. (Aust) Pty. Ltd. %	Gas & Fuel Corporation Melbourne %
Hydrogen		0.022
Oxygen		1.14
Nitrogen	3.3	8.13
Carbon Dioxide	23.0	10.0
Methane	63.2	68.7
Ethane	5.4	6.1
Propane	2.7	3.0
Isobutane	0.7	0.67
n - Butane	0.7	0.76
Isopentane	0.1	0.26
n - Pentane	0.1	0.21
C6 Series		Traces
Water Vapour	0.8	

2. Cores

(a) Gas

Core number	19	23	24
Depth	5021 feet	5701 feet	5932 feet
Hydrogen	7.6	0.11	Reported to be similar to the gas recovered from Core 23.
Methane	52.1	6.5	
Ethane	32.5	31.5	
Propane	4.9	41.3	
Isobutane	1.7	4.9	
n - Butane	0.7	7.0	
Isopentane	0.36	1.56	
n - Pentane	0.17	1.61	
Neopentane?		0.063	
C6 & C7 Series		5.3	

Analyses by Gas and Fuel Corporation Melbourne.

(b) Water

Core No. 6.	1970 feet	less than 10 ppm NaCl.
Core No. 7.	2450 feet	" " " " "
Core No. 9.	2915 feet	" " " " "

Analysis by Bureau of Mineral Resources,

Geology and Geophysics. Canberra.

3. Production Tests 1a and 1 b 5656 to 5668 feet

Recovered gas condensate oil and salt water

a Gas Analysis

Analysis by	Standard Vacuum Refinery	Gas & Fuel Corporation	Standard Vacuum Refinery	Standard Vacuum Refinery	Gas & Fuel Corporation	Standard Vacuum Refinery	Standard Vacuum Refinery	Gas & Fuel Corporation
Date Collected	Jan 2	Jan 2	Jan 3	Jan 4	Jan 4	Jan 5	Jan 6	Jan 21
	%	%	%	Vapour Phase %	%	%	Gas chromatograph Method %	%
Helium		0.02						0 02
Hydrogen					0.02			0.18
Oxygen		1.1			0.02			
Nitrogen	3.5	6.8	3.4	3.5	3.7	3.4	3.4	3.5
Carbon Dioxide	15.6	12.5	14.9	15.6	16.1	16.2	16.2	14.2
Methane	71.6	51.8	70.5	71.6	71.2	70.1	70.1	72.5
Ethane	4.8	5.4	4.7	4.8	4.9	5.1	5.1	5.5
Propane	2.6	5.1	2.8	2.6	2.1	2.8	2.8	1.8
Isobutane	1.7	6.3	0 8	0.7	1.2	0.7	1.4	0.5
n - Butane			1.1	1.0		0.7		0.5
Isopentane	0.2		0.7	0.2		0.2	0.2	0.5
n - Pentane			0.3					
Hexane		11.0	0.3					Trace
Water Vapour						0.8	0.8	

(b) Condensate and oil analysis.

	Collected Jan. 2, 1960 Gas Sample Vessel	Collected Jan. 2	Collected Jan 3	Collected Jan. 6	Collected Jan 7. Oil	Collected Jan. 22
Analysis by:	Standard Vacuum Refinery	Vacuum Oil Coy.	Vacuum Oil Coy.	Vacuum Oil Coy	Vacuum Oil Coy.	Vacuum Oil Coy.
Specific Gravity		.704	.749	.752	.772	.726
Color		White	Yellow	Yellow	Brown-black	
Refractive Index		1.398	1.432	1.426	1.428	1 410
Odour		Sweet	Sweet	Sweet	Sweet	
Doctor Test		Negative	Negative	Negative	Negative	Negative
Copper Strip Test		-	-		1a	
Sulphur %		Below 0.01	-	Below 0 02	-	
Distillation	0^F	0^F	0^F	0^F	0^F	0^F
IBP °F	180	90	208	235	257	147
10% Recovered	246	134	235	253	306	183
20%	256	158	246	266	316	196
30%	264	176	257	279	331	205
40%	272	192	270	293	349	217
50%	280	208	286	307	369	228
60%	290	226	304	324	390	243
70%	300	246	329	345	421	257
80%	314	293	365	385	464	282
90%	333	342	428	444	536	320
FBP	388	381	545	460	592	444
Recovery %	99	94	98.0	92.0	96.0	
Residue %	1	5.6	2.0	8.0	4.0	
Loss		0.4	Nil	Nil	Nil	
Nature of Residue		Wax free at 20^oF	Waxy with MP 45-50°F	Waxy with MP 34-37°F	Waxy with MP 64°F	

Collected Jan. 22	Collected Jan. 23	Collected Jan. 29
Vacuum Oil Coy.	Vacuum Oil Coy.	Vacuum Oil Coy.
.731	.722	.728
		Water white
1.413	1.407	1.406
Negative	Negative	Negative
0^F	0^F	0^F
172	129	145
196	173	190
205	189	205
214	199	217
223	212	228
237	223	234
248	235	253
262	252	270
291	273	291
325	315	333
455	426	439

STRATIGRAPHIC COLUMN AFTER DRILLING

SCALE: 1" = 1000'

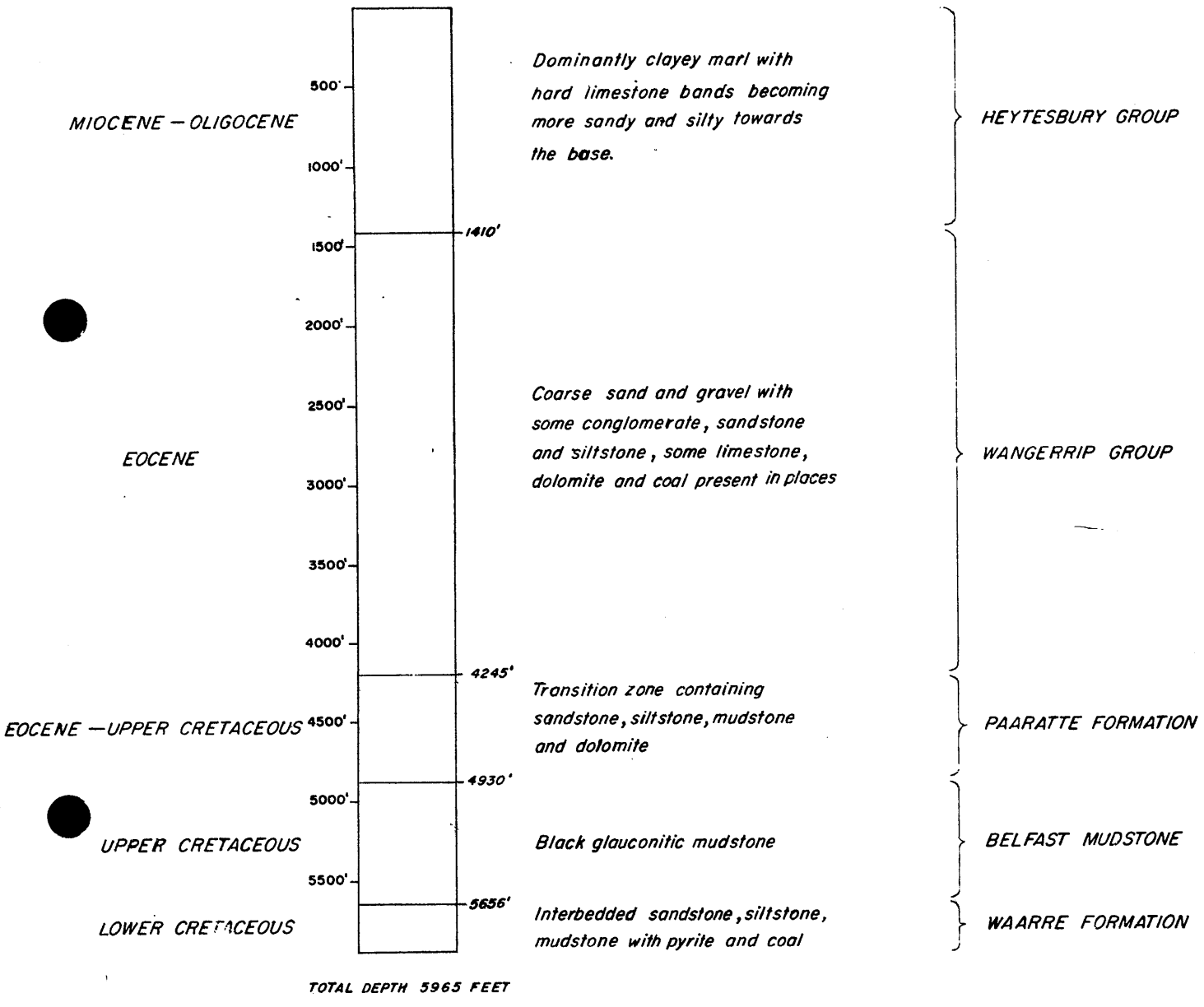


PLATE 7

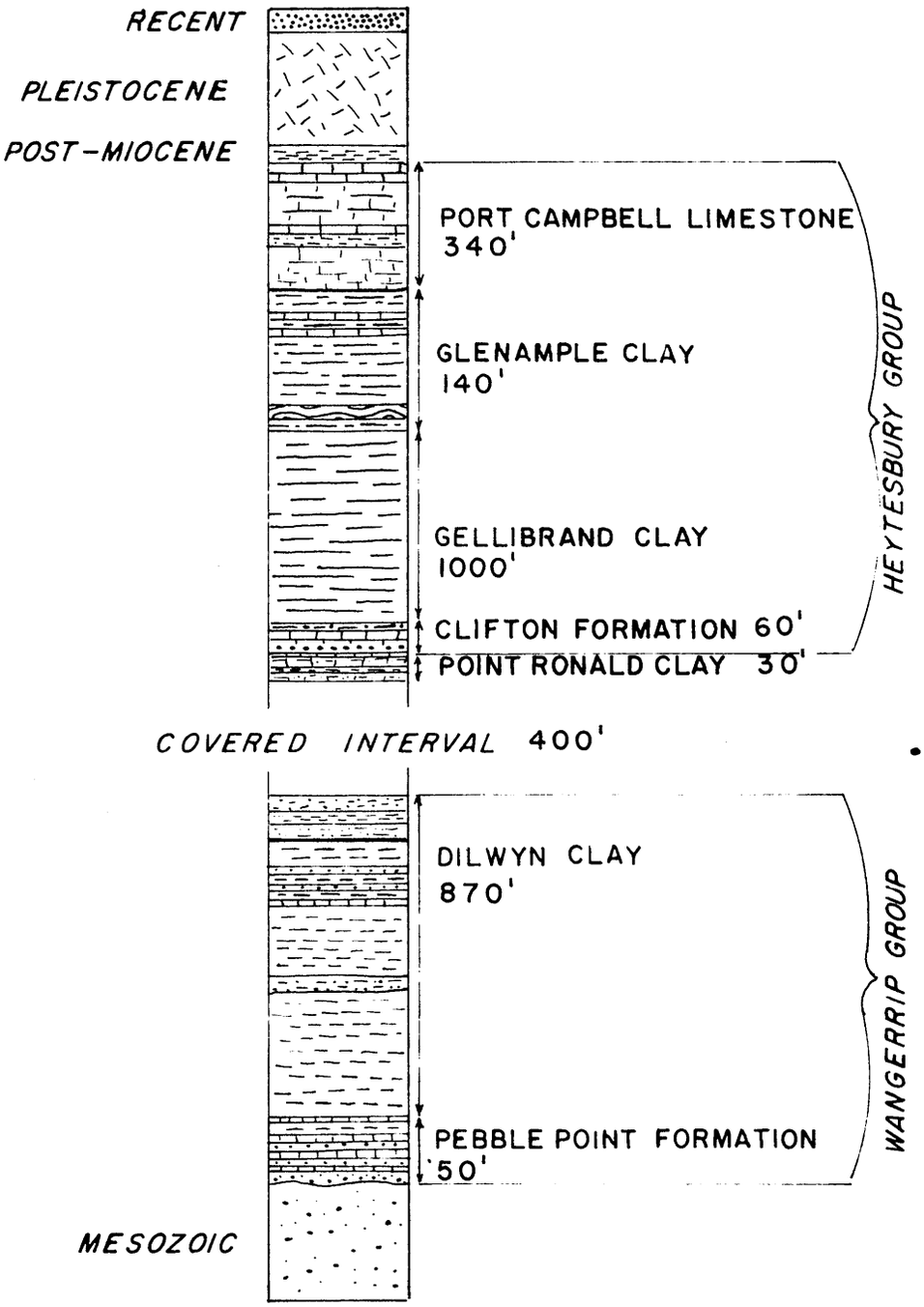
WELL COMPLETION REPORT
PORT CAMPBELL NO. 1.

J. S. BAIN.

MAR. 1960

STRATIGRAPHIC COLUMN BEFORE DRILLING

(After Baker, 1953)



Note: Thicknesses are approximate only

PLATE 2

WELL COMPLETION REPORT
PORT CAMPBELL NO.1

J.S.BAIN.
MAR 1960

LOCALITY MAP

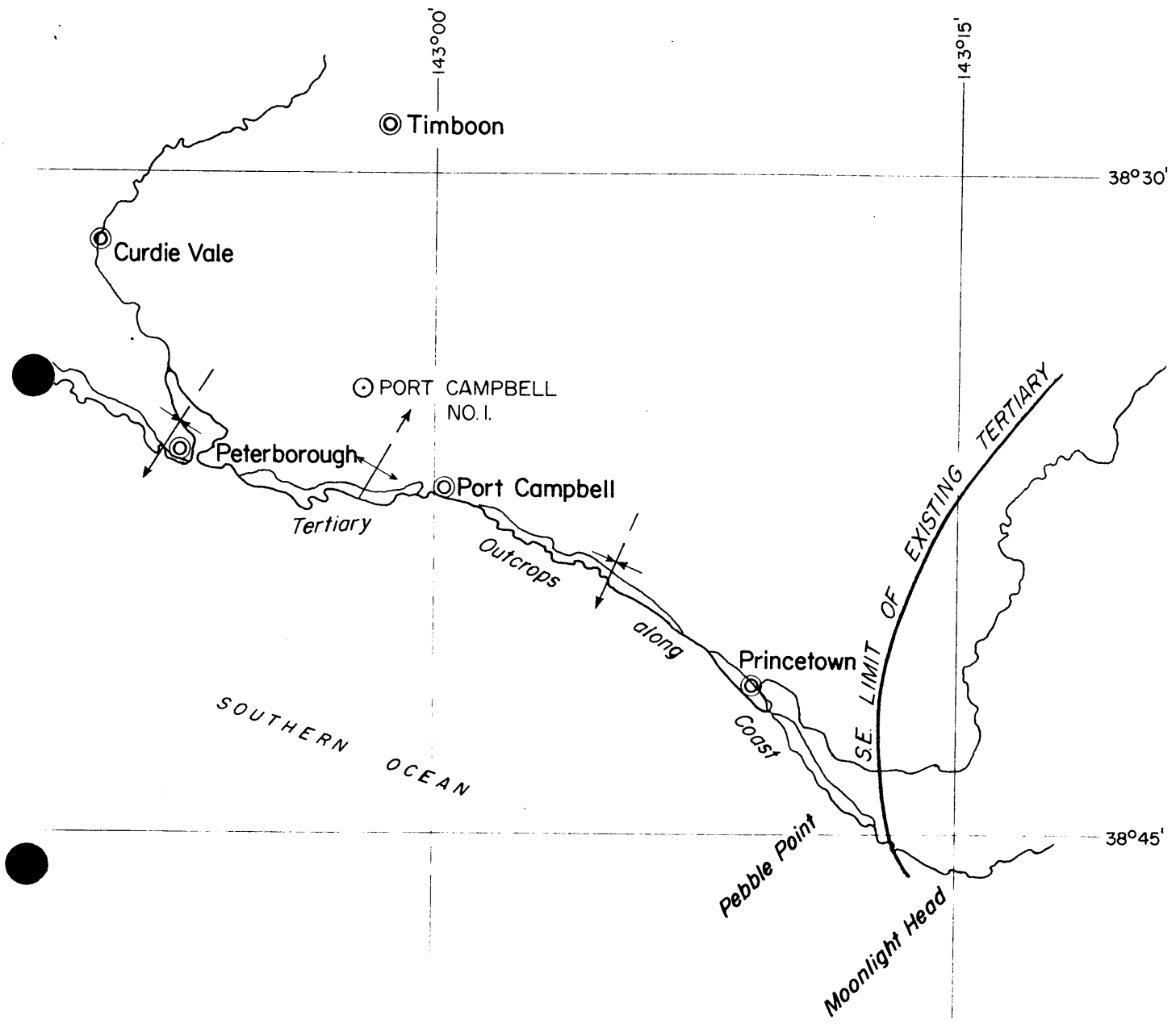


PLATE I

WELL COMPLETION REPORT
PORT CAMPBELL NO.1

J. S. BAIN.

MAR. 1960

4. Water Analysis

		Drill Stem Test 4 5695 to 5701 feet	Drill Stem Test 8 4463 to 4475 feet
Total Solids in Solution		P.P.M. 19,710	P.P.M. 4,592
Chloride	(cl)	8,020	1,160
Carbonate	(CO_3)	127	184
Bicarbonate	(HCO_3)	4,657	1,694
Sulphate	(SO_4)	102	19
Calcium	(Ca)	66	22
Magnesium	(mg)	71	3
Iron(Soluble)	(fe)	2	-
Sodium (by difference)		6,665	1,510
Total Hardness (as $CaCO_3$)		458	66
pH		8.8	8.8
Hypothetical Combinations are as follows			
Calcium bicarbonate		268	89
Magnesium bicarbonate		427	118
Ferrous bicarbonate		7	
Sodium bicarbonate		5,637	2,220
Sodium carbonate			325
Sodium sulphate		151	28
Sodium chloride		13,220	1,912

Analyses by State Laboratories, Melbourne

WATER ANALYSIS - Continued

	INTERVAL TESTED	PACKER SET AT	POINT OF SAMPLING	ANALYSIS in ppm									
				Na+	K+	Ca++	Mg++	Cl-	$SO_4^=$	HCO_3^-	CONDUCTIVITY AT 24°C	pH at 24°C	TOTAL SOLIDS at 180°C in ppm
DRILL STEM TEST NO. 4	5695 to 5701 feet	5681 feet	From just above packer	6,370	130	70	65	7,864	85	4,130	24,000 micromho	7.85	17,151
			1010' above packer	6,000	134	13	53	7,814	95	4,130	26,000 micromho	7.83	17,216
			2421' above packer	6,100	126	63	55	7,442	95	4,100	24,000 micromho	8.00	16,320
			4780' above packer	4,300	106	35	55	4,919	241	4,350	17,300 micromho	7.7	12,950
			5320' above packer	Mud	Not analysed								
PRODUCTION TEST NO. 1	5656 to 5666 feet	No packer. Flowing through tubing. Adjustable choke on surface.	From separator at 1.30 pm on Jan. 2, 1960.	380	25	95	17	469	86	840	3,200 micromho	7.1	1,664
			From separator at 2.45 pm on Jan. 3, 1960.	860	41	35	12	610	83	1,710	4,340 micromho	7.65	3,330
			From separator at 7.30 pm on Jan. 3, 1960.	8,000	130	70	60	8,678	122	6,700	27,000 micromho	7.85	18,000
			From "last tank filled" before well shut in at 12.30 am on Jan. 6, 1960.	4,200	73	45	70	5,486	46	2,820	17,900 micromho	7.8	11,828

ANALYSIS BY BUREAU OF MINERAL RESOURCES

APPENDIX 3

CORE ANALYSIS

APPENDIX 3

CORE ANALYSIS

CORE NO.1:

Interval 421 to 439 feet Recovery 15 feet.

15 feet of light to dark grey clayey marl. Extremely fossiliferous, very soft, puggy and compact. Uniform lithology and no dip.

Density at bottom of core = 1.94.

Soxhlet: No cut.

CORE NO. 2:

Interval 900 to 918 feet Recovery 9 feet.

9 feet of light and dark grey marl, soft, compact, extremely fossiliferous, puggy. Uniform lithology and no dip. A few pieces of clear white siltstone and white opaque slightly crystalline limestone through core.

Density at 902 feet = 1.29.

Soxhlet: Very faint cut and faint fluorescence.

CORE NO. 3:

Interval 1067 to 1077 feet Recovery 10 feet.

Top 6 inches - very dense, hard, heavy, compact, limonitic limestone. Calcareous matrix, fossiliferous. Sandgrains clear and brown (Fe stained), fine to very coarse grained and few granules, sub rounded, slightly frosted.

Density 2.66.

8 feet of marl, light brown to green, very glauconitic soft, micaceous, very fossiliferous, ovoid limonite pellets.

Density 1.94.

Bottom 1½ feet - dark brown to black, dense soft marl with many fossils and much glauconite. Density 2.08.

No dip.

Soxhlet: Slight cut with blue fluorescence.

CORE NO. 4:

Interval 1457 to 1475 feet Recovery 2 feet.

2 feet of brown hard, compact, calcareous, gritty, tight sandstone. Sand is clear and brown (Fe stained), medium to grit size, sub-rounded and some grains polished in a calcareous matrix. A few glauconite pellets and some limonite. Also has some stringers of black clay (?carbonaceous) through it.

Density at 1458 feet - 2.55. No dip.

Soxhlet: Slight cut with greenish fluorescence.

CORE NO. 5:

Interval 1475 to 1493 feet. Recovery 6 feet.

Top 2 feet 6 inches of hard compact calcareous sandstone. Quartz is clear and brown (Fe stained), fine to very coarse grained frosted, subrounded in calcareous matrix, limonite and glauconite pellets. Few sparse fossils.

Density at 1476 feet = 2.59.

Remainder of core (3 feet 6 inches) very friable quartz sand, clear brown, very fine to very coarse, polished grains, subangular to sub rounded, poorly sorted, very porous ?ligneous.

Probably fresh water sand.

Soxhlet: No cut.

CORE NO. 6:

Interval 1969 to 1987 feet. Recovery 9 feet.

9 feet of soft brown to black slightly loose dirty sandy siltstone, ?ligneous. Sand is fine to coarse grained and few grit and gravel fragments. Pyrite present.

Bottom two inches as above except it is hard and tight sandy siltstone. No dip in core.

Soxhlet: No cut.

Salinity of interstitial water less than 10 ppm NaCl.

CORE NO. 7:

Interval 2450 to 2466 feet. Recovery 16 feet.

16 feet of dark brown to black dirty sandy siltstone, soft, compact and fairly tight with some white and clear very fine to fine sub-angular to sub-rounded well sorted sand stringers through it. Ligneous. Much pyrite and a few glauconite pellets. In a few places the sand increased up to coarse grain in size.

Density 2.19 No dip.

When core is broken and washed up and the matrix washed out only the sand remains.

Soxhlet: No cut.

Salinity of interstitial water less than 10 ppm NaCl.

Extract with distilled water showed pH = 4.2
eH = -550 MV.

CORE NO. 8:

Interval 2915 to 2933 feet. Recovery 7 feet.

Top 1 foot. Pebble Conglomerate. White and light brown rounded to well rounded quartz pebbles in black ?carbonaceous matrix. Pyrite.

Rest of core is very loose sand clear white and grey, coarse to very coarse sub angular to sub rounded with few scattered quartz pebbles, very porous and permeable and without fine matrix. Some pyrite Fresh water sand.

Bottom one inch grades into a pebble conglomerate as for the top foot. No dip in core.

Soxhlet: No cut.

CORE NO. 9:

Interval 3148 to 3167 feet. Recovery 4 feet.

Main part of core except for 4 inches is loose, coarse to very coarse and in some places up to pebble size very porous quartz sand. Quartz is white and clear. Some grains dark grey and black (?Metamorphic origin) sub angular to sub rounded and poorly sorted. Fresh water sand. 3 inches of dark brown to black (?carbonaceous) silty mudstone, soft, tight, puggy at 3150', and 1 inch of this silty mudstone at bottom of core. Density 2.25 on this bottom inch.

Soxhlet: No cut and no fluorescence.

Salinity of intersitial water less than 10 ppm NaCl.

CORE NO. 10:

Interval 3333 to 3340 feet. Recovery 5 feet.

Top 3 feet 6 inches green, dark brown to black sandy siltstone (?glauconitic) soft, compact, sand grains are clear sub angular to sub rounded medium to very coarse and some granules. 6 inches of hard fine brown sandstone with siliceous matrix.

Bottom foot. Thin bedded laminated bands of black (carbonaceous) and white siltstone. Cross bedded and micaceous.

Soxhlet: Very slight cut and brownish green fluorescence.

CORE NO. 11:

Interval 3600 to 3618 feet. Recovery 9 feet.

Top foot very finely laminated bands of white and black sandy siltstone-mudstone. Sand is white and dirty, fine to medium grained sub angular and loose without matrix and in parts grades into black shale. Micaceous and evidence of crossbedding.

Rest of core (8 feet) of very slightly greenish light grey fine sandstone. Sand is white, few green grains, fairly clean, fine to medium, subangular to sub-rounded, slightly more compact than top foot with some black carbonaceous and micaceous stringers through it.

Density at 3609 feet = 2.21.

Dip of 10° - probably cross bedded dip.

Soxhlet: No cut.

Salinity of interstitial water less than 10 ppm NaCl.

JUNK BASKET CORE:

Interval 3738 to 3740 feet. Recovery nil

Interval 3740 to 3742 feet. Recovery 2 feet.

2 feet of light to dark grey and in places black siltstone. Compact, tight, moderately hard, laminated in places, very pyritic and micaceous. Cross bedded.

CORE NO. 12:

Interval 3995 to 3997 feet. Recovery nil.

CORE NO. 13:

Interval 3997 to 4009 feet. Recovery 12 feet.

Top 2 feet, dark grey to black and white to grey laminated interbedded sandy siltstone, tight, compact, and cross bedded. Sand fragments up to very coarse and sub-angular to sub rounded. Mica and pyrite present and black material is carbonaceous. 4 inches of hard slightly crystalline grey to black laminated, compact siltstone with a dolomitic matrix. Little slicken-sided in parts.

8 inches of light grey fine to very fine grained compact sandstone (as for bottom of this core).

2 feet of crossbedded black and light grey laminated micaceous sandy siltstone as for top 2 feet.

Bottom 7 feet - light grey white very fine to fine massive compact sandstone tight and with a few black thin cross bedded siltstone bands at base. Mica and pyrite (like bottom of Core No. 11).

Density 2.12.

Soxhlet: 4005 feet - No cut.

CORE NO. 14:

Interval 4280 to 4283 feet. Recovery 1 foot.

3 inches of finely laminated, grey and black crossbedded fine sandstone - siltstone. Pyrite and mica present.

2 inches of fine hard compact sandstone (like bottom of Core No. 13) tight, slightly calcareous, little carbonaceous matter and few green specks (?glauconite). Nodular weathering. Pyrite and mica. 2 inches of massive pyrite with a few fragments of fine grain sandstone through it. Rest of core dark brown to black silty mudstone, compact puggy and micaceous.

Soxhlet: 4282 feet - no cut.

CORE NO. 15:

Interval 4284 to 4293 feet. Recovery 7 feet.

7 feet of black and white to grey intermixed sandy siltstone grading into mudstone in places. Compact, tight, puggy, with pyrite and mica (biotite - muscovite). Few glauconite fragments. Crossbedding and general jumbled appearance of core. Few black carbonaceous specks. The white to grey siltstone is usually interbedded with very fine to fine grained subangular to sub rounded sandstone. Piece of brown conchoidal fractured mineral piece which fluoresces. (?amber).

Density 2.28.

Forams from cuttings at 4284 feet (?contamination).

Soxhlet: 4291 feet - no cut.

CORE NO. 16:

Interval 4518 to 4536 feet. Recovery 4 feet.

1 foot of black (carbonaceous) and white to light grey interbedded very fine sandstones and siltstones. Compact, tough, tight micaceous and a little pyrite. General mixing of bedding. Few small brown hard dolomite nodules.

1 foot 6 inches of grey to white and some light brown very fine to fine sandstone compact with a few thin bands of carbonaceous material. Mica and some pyrite. Hard brown dolomite nodules at base. Dip of 6° (?cross bedded).

Density 2.20. ?Fossil fish scale. (same as bottom of Core No. 13). Remainder of core is black and white grey interbedded and crossbedded siltstone and very fine to fine sandstone with brown hard dolomite nodules and some mica. (as for Core No. 15).

Soxhlet: 4520 feet - no cut.

CORE NO. 17:

Interval 4754 to 4764 feet. Recovery 8 feet.

8 feet of black fossiliferous mudstone, massive, tight and compact with few thin streaks of crossbedded white to grey silty bands at top. Few thin streaks of pyrite and some glauconite fragments, also fluorescent mineral (?amber). No obvious bedding.

Density 2.40.

Cretaceous.

Soxhlet - 4757 - Slight but distinct cut yellow ?waxy oil - just prior to evaporation, solution in petroleum ether had distinct bluish bloom, green fluorescence.

CORE NO. 18:

Interval 4862 to 4869 feet. Recovery 6 feet.

Dark grey to black, with few white patches, very fine to fine calcareous sandstone. Fossiliferous, hard compact, massive and tight. Few medium quartz grains. No bedding Quartz is white and clear, subangular to sub rounded in calcareous matrix. Black colour due to carbonaceous material and black mudstone fragments with some glauconite and a little pyrite. Density 2.47.

Soxhlet: 4868 feet - Slight cut as for Core No. 17.

CORE NO. 19:

Interval 5018 to 5026 feet. Recovery 5 feet.

5 feet of dark grey to black, sandy in patches, very glauconitic mudstone. Fairly tight, compact and massive. Very fossiliferous and has pyrite stringers through it and a few black carbonaceous fragments. Sand is clear and white, fine to coarse, subrounded to rounded, poorly sorted and is in small patches. Last foot is more sandy than top four feet and is slightly gas cut.

A little brown, very hard glauconitic dolomite at base. Jointing at bottom of core (51^{o}) with some slickensiding. No dip. Density 2.40.

Soxhlet: 5021 feet - Slight cut greasy oil residue - greenish fluorescence.

CORE NO. 20:

Interval 5026 to 5031 feet. Recovery 5 feet.

Dark green to black, sandy in patches, very glauconitic mudstone, hard, compact, fossiliferous, massive, fairly

tight. (As for Core No. 19). Slight gas cutting in top 1'6" and second bottom foot. Pyrite stringers. No dip. Density 2.41.

One inch of very fine to fine hard calcareous sandstone, tight compact without porosity and ½" of black and white crossbedded sandstone and mudstone of Density 2.47 at base of core. Few brown, very hard dolomite fragments through core.

CORE NO. 21:

Interval 5223 to 5233 feet. Recovery 8 feet.

8 feet of black and dark green, very glauconitic sandy mudstone. Tight, dense and sandy in only a few patches. No apparent macrofossils. Some dolomite fragments. Few mica flakes and pyrite stringers. Sand is loose and coarse to granule grain size. Quartz grains scattered through the core. No bedding. Jointing and slickensiding along plane at 54° to 57° to axis of core. Density 2.40.

Soxhlet - 5227 feet - Slight greasy cut - pale greenish fluorescence.

CORE NO. 22:

Interval 5660 to 5670 feet. Recovery 3 feet 6 inches.

Top 6 inches - granite and pebble conglomerate, light grey to white and clear sub angular to rounded quartz pebbles and granules in loose matrix. Friable, very porous and permeable. Pyrite and some coal stringers. Few calcareous and ? feldspathic cemented fragments. 3 feet of light grey and white medium to very coarse grained sandstone. Subangular to sub rounded, fairly well sorted and friable. Very porous and permeable. A little pyrite and a few coal bands.

Density 2.20.

Note Pinkish colour observed on standing due to mud penetration (Myrtan).

Soxhlet - 5661 feet - Slight cut, greasy appearance, pale greenish fluorescence.

Depth	Porosity	Permeability (Millidarcies)	
5660 feet	24%	167	Horizontal
		660	Vertical
5663 to 5665 feet	26.5%	2985	Horizontal
		1695	Vertical

CORE NO. 23:

Interval 5700 to 5718 feet. Recovery 8 feet.

Top 1'6", light grey to white, medium to granule (few pebbles) sandstone. Subangular to sub rounded, very porous and permeable. Calcareous and feldspathic matrix in parts. Pyrite and coal present.

6 foot 3 inches, of hard, black, tight, dense, compact mudstone with lenses of white and light grey siltstone with medium grained sandstone in parts. Dip 10°.

Much pyrite and coal fragments. Gas cut.

Density 2.46.

Bottom 3 inches sandstone as for top 1 foot 6 inches.

Soxhlet - 5705 feet - Slight but better than average cut - very pale yellow waxy residue - pale blue fluorescence.

Depth	Porosity	Permeability (Millidarcies)	
5700 to 5702 feet	14.8%	5	H
		2.75	V
5702 to 5704 feet	12.5%	Nil	H
		Nil	V
5706 to 5708 feet	8.6%	Nil	H
		Nil	V

CORE NO. 24:

Interval 5928 to 5934 feet. Recovery 6 feet.

Top inch, black, glauconitic, dense, tight, compact mudstone (?Shell fossil fragment). Rest of core is black, dense, tight, compact hard mudstone with much coal and pyrite. Gas cut and evidence of jointing and slickensiding.

Density 2.43.

SIDEWALL CORES:

NO. 1 5400 feet Recovery $3\frac{1}{2}$ inches

Black glauconitic sandy mudstone, tight, dense, compact. Sand is light grey and white and fine grained.

Slightly gas cut.

No. 2 4700 feet. Recovery 1 inch.

Sand-sandstone, clear, white and dark grey, loose, very fine to fine (few medium fragments), well sorted, clean. Few glauconitic and brown dolomitic fragments. One shell fragment.

No. 3 4450 feet. Recovery $4\frac{1}{2}$ inches

Grey to dark grey sandy siltstone, micaceous, soft, slightly carbonaceous, small patches of white very fine to fine sandstone also in core.

PALTECH P/L
1982.

A6/1

PORT CAMPBELL No.1

K.K. No.	Depth (m)	$\bar{R}_v$max	Range	N	Exinite Fluorescence (Remarks)
					WANGERRIP GROUP 369m
15335	748 Core	0.37	0.33-0.40	3	Rare sporinite, liptodetrinite and cutinite, greenish yellow to orange. (Clay-rich sandstone, d.o.m. rare I>V=E. Vitrinite rare and occurring as very small phytoclasts. Pyrite present. Poor source-potential, immature.)
15336	1100 Core	0.43	0.35-0.51	20	Sparse cutinite and sporinite, greenish yellow to orange. (Siltstone with abundant d.o.m. I>V>E. Inertinite abundant, vitrinite sparse, exinite sparse. Source-potential fair to moderate, immature.)
					PARATTE FORMATION 1294m
15337	1398 Core	0.59	0.57-0.64	3	Rare sporinite, orange, rare ?dinoflagellates, yellow. (Clay-rich siltstone with sparse d.o.m., I>E>V. Vitrinite population poorly defined and vitrinite very rare.)
					BELFAST FORMATION 1503m
15338	1532 Core	0.58	0.54-0.61	3	Sparse orange sporinite and rare greenish yellow to orange. (Claystone with sparse sand-size quartz grains. D.o.m. sparse to common, I>E>>V. Vitrinite population poorly defined.)
15339	1593	0.37	0.31-0.43	22	Dominant alginite A, yellow, derived from Reinschia sp. (Torbanite, similar to Permian torbanites. Alginite approx. 95%, vitrinite 5%, trace of inertinite.)
15340	1594 Core	?0.60	0.58-0.62	?2	Rare sporinite, orange and dinoflagellates yellow to orange. (Mudstone with sparse d.o.m., I>E>?V. Inertinite sparse. Pyrite common.)
15341	1808 Core	0.53	0.46-0.65	21	Sparse exinite; fluorinite bright green; sporinite and cutinite yellow to orange. (Claystone with d.o.m. abundant. V>>E, ?no I. Approx. 25% V. Possible oil-stain on some of the vitrinite but stain visible only in reflected light and no fluorescence from the stain.)

T.D. 1818+m

APPENDIX 4

FORMATION TESTING

APPENDIX NO. 4

FORMATION TESTING (See also Plate 6)

1. OPEN HOLE TESTING

D.S.T. NO. 1 - 5653 to 5718 feet.

¼" choke in Johnston packer. No water cushion. 2" Cameron valve choked back used as well head choke. Immediate strong blow of gas increasing in pressure to 1600 p.s.i.g. and steady until tool closed after 1 hour 20 minutes. Recovered 900 feet gas cut mud.

I.M.P. - 3020 p.s.i.

F.M.P. - 2910 "

I.F.P. - 2320 "

F.F.P. - 2310 "

S.I.P. - Not taken

2. DRILL STEM TESTS THROUGH CASING PERFORATIONS:

D.S.T. NO. 2 Intervals 5908 to 5920 feet and 5924 to 5928 feet. Johnston packer set at 5890 feet; ¼" choke in tool. No water cushion. Adjustable choke on well head wide open. Light flow of air (?gas) - Maximum reading of 3" of Hg through 1/8" orifice plate. Test open for 1 hour 40 minutes. Recovered 5460 feet of gas cut salt water with gas cut mud in first stand.

I.M.P. = 3100 p.s.i.

F.M.P. = 2900 "

I.F.P. = 1500 "

F.F.P. = 2175 "

S.I.P. = Not taken

Salinity of water 8,600 Mgms Cl/litre (on site)

13,700 ppm NaCl (Lab.)

D.S.T. NO. 3 Interval 5756 to 5766 feet.

Packer set at 5744 feet. No bottom choke. No water cushion. Adjustable well head choke wide open. Very slight flow of air and gas ceased after 10 minutes. Test open for 1 hour and shut in for 1 hour 10 minutes.

Recovered 5314 feet of gas cut mud and salt water.

Salinity - 7000 Mgms Cl/litre (on site)

12,700 ppm NaCl (Lab.)

I.M.P. = 2990 p.s.i.

F.M.P. = 2880 "

I.F.P. = 2050 "

F.F.P. = 2125 "

S.I.P. = 2125 "

D.S.T. NO. 4: Interval 5695 to 5701 feet.

Packer set at 5681 feet with 5/16" bottom choke. No water cushion. Adjustable well head choke wide open. Slight flow of gas diminishing to nothing after 30 minutes.

Well open for 1 hour 15 minutes.

Recovered 270 feet gas cut mud and 5050 feet of gas cut dirty salt water with much colloidal material.

Salinity - 1st. salt water sample = 5360 Mgms Cl/litre (on site)

Sample just above packer = 8300 Mgms Cl/litre (on site)

I.M.P. = 3050 p.s.i.

F.M.P. = 2900 "

I.F.P. = 1175 "

F.F.P. = 2105 "

S.I.P. = -

PRODUCTION TEST NO. 1: (a)

(a) Interval 5656 to 5666 feet.

Tubing landed at 5649 feet. Mud displaced with water and rocking commenced. No result. Swabbed well and after 17 swabs (approx. 47.7 bbls of water) well came in.

Well head nippled up and started producing through 24/64ths" top choke (on adjustable choke) while well cleaning itself up. Small amount of condensate and salt water also noted. Pressures dropped slowly on the tubing head and casing head until well shut in. Pressures recorded are listed below:

Readings from midnight, Saturday (2.1.60) until 11 am Sunday when well was shut in. 24/64" choke.

TIME	TUBING HEAD PRESSURE	CASING HEAD PRESSURE
	P.S.I.	P.S.I.
12.00	1825	1825
12.30	1825	1825
1.00	1800	1800
1.30	1800	1800
2.00	1800	1800
2.30	1800	1800
3.00	1800	1800
3.30	1775	1775
4.00	1775	1775
4.30	1775	1775
5.00	1775	1775
5.30	1750	1750
6.00	1750	1750
6.30	1725	1725
7.00	1675	1725
7.30	1700	1725
8.00	1600	1725
8.30	1600	1725
9.00	1600	1725
9.30	1600	1725
10.00	1575	1750
10.30	1550	1750
11.00	1550	1750

Flow reading taken through 2" orifice plate at 9.30 am Sunday, assuming specific gravity of gas at 0.6, = 4,200,000 cu.ft/24 hours.

Well was kept shut in until 5.00 pm (6 hours). Readings during shut in period are below:

TIME	TUBING HEAD PRESSURE	CASING HEAD PRESSURE
	P.S.I.	P.S.I.
11.00 am	1550	1750
11.30	1700	1700
12.00	1750	1675
12.30 pm	1775	1650
1.00	1775	1625
1.30	1760	1600
2.00	1760	1590
2.30	1760	1555
3.00	1760	1530
3.30	1760	1500
4.00	1760	1500
4.30	1760	1490
5.00	1760	1450

Well was then opened at 5.00 pm on 16/64" choke and quite a lot of salt water was coming in, so after half anhour shut the choke down to 12/64". This choke size also produced quite a lot of water and approximately 500 gallons flowed in two hours. Choke opened to 16/64" at 7.40 and well flowed on this choke. Pressure at midnight Sunday 3rd. January, 1960 was 1525 p.s.i. on tubing and 1725 p.s.i. on casing. Gas burning well.

Readings of pressure after well opened were as follows:-

CHOKE SIZE	TIME	TUBING HEAD PRESSURE	CASING HEAD PRESSURE
16/64"	5.30	1375	1600
12/64"	6.00	1275	1600
"	6.30	1300	1625
"	7.00	1325	1650
"	7.30	1425	1675
16/64"	8.00	1475	1700
"	8.30	1500	1725
"	9.00	1550	1725
"	9.30	1500	1725
"	10.00	1525	1725

CHOKE SIZE	TIME	TUBING HEAD PRESSURE	CASING HEAD PRESSURE
16/64"	10.30	1550	1725
"	11.00	1550	1725
"	11.30	1550	1725
"	12.00	1525	1725

Well was kept flowing through 16/64" top choke until shut in at 12.40 a.m. on 7/1/60. Periodic flow readings were taken through the Orifice Tester using a $1\frac{1}{2}$" orifice plate. Readings were also noted of the time taken to flow 500 gals. (approx.) from the liquid knockout tank. When it appeared that the fluid might kill the gas the well was shut in.

Fluid in the storage tank consisted of salt water, (chloride content done on site = 7,920 to 10,480 mgm/litre) and a film of light brown condensate becoming darker and a little heavier before well was shut in. Intermixed with this brown? hydrocarbon was a brown frothy mud substance which separated out on top of the tank and which could be fine particles and colloids of the drilling mud which had penetrated into the formation during its original drilling.

Initially the tank was filling at a rate of approximately 100 gallons an hour until the evening tour on 5/1/1960, when rate had gone up to 1000 gallons in 40 minutes. This rate further increased until during the evening tour on 6/1/1960 fluid was being collected at the rate of 100 gallons per 20 minutes. At this point it was decided to shut the well in.

In general, pressures taken half hourly throughout the test on both the tubing head and casing head decreased slowly with minor variations, the former decreasing somewhat faster than the latter, such that from 12.30 a.m. on 4/1/60, when tubing showed a pressure of 1525 p.s.i. and casing 1700 p.s.i., they had decreased to 1075 p.s.i. and 1500 p.s.i. respectively just before the well was shut in. Tubing pressure had been as low as 950 p.s.i. at 7.30 p.m. on 6/1/60.

Flow readings taken at various times and with their respective pressures are shown below - all through 16/64" top choke.

TIME & DATE		FLOW READINGS	TUBING PRESSURE	CASING PRESSURE
11.30 a.m.	4/1/60	1,674 M.c.f. per day	1450 p.s.i.	1675 p.s.i.
8.00 p.m.	"	2,227 " " "	1425 "	1625 "
8.00 a.m.	5/1/60	2,077 " " "	1375 "	1575 "
3.15 p.m.	"	1,858 " " "	1320 "	1550 "
8.30 p.m.	"	2,479 " " "	1290 "	1550 "
6.45 a.m.	6/1/60	2,721 " " "	1250 "	1500 "
2.45 p.m.	"	2,060 " " "	1180 "	1500 "
8.25 p.m.	"	1,446 " " "	1050 "	1500 "

Before each of these readings was taken, the top choke was opened to 17/64" for 1 minute and then shut back again to clear it, as it had been noticed that brown muddy material had probably choked the flow a little on a previous reading. However, the flow was usually steady by the time the reading was taken (usually 20 minutes before temperature constant) and it may be that the increase of the flow noted at 8.30 p.m. of 5/1/60 and 6.45 a.m. on 6/1/60, if not natural, was due to the adjustable choke being a fraction out on resetting to 16/64".

After the well was shut in at 12.40 a.m. on 7/1/60, tubing pressure built up from 1075 p.s.i. to a maximum and steady pressure of 1525 p.s.i. by 7.30 a.m., while the casing pressure initially went up from 1475 p.s.i. to 1500 p.s.i. at 2 a.m., then decreased slowly until constant at 1325 p.s.i. until day tour on the 8/1/60, when it was at 1300 p.s.i. It did not fall any further until well was killed. This pattern of pressure variation is similar to that noted when the well was shut in previously.

The well was left shut in until killed with mud at 6.00 a.m. on 9/1/60. Pressure readings were as follows.

PRESSURE RECORDINGS FROM 12.30 am, 4/1/60 tc 6.00 am, 9/1/60.

TIME	TUBING PRESSURE p.s.i.	CASING PRESSURE p.s.i.
	4/1/60	
12.30 am	1525	1700
1 "	"	"
1.30 "	"	"
2 "	"	"
2.30 "	1500	"
3 "	"	"
3.30 "	"	"
4 "	"	"
4.30 "	"	"
5 "	"	"
5.30 "	"	"
6 "	1475	"
6.30 "	1450	"
7 "	"	"
7.30 "	"	"
8 "	"	1675
8.30 "	"	"
9 "	"	"
9.30 "	"	"
10. "	"	"
10.30 "	"	"
11. "	"	"
11.30 "	"	"
12 "	"	"
12.30 pm.	"	"
1 "	"	1670
1.30 "	"	1660
2 "	"	1650
2.30 "	"	"
3 "	1400	"
3.30 "	"	"
4 "	"	"
4.30 "	"	"
5 "	1450	1625
5.30 "	1425	1650
6 "	1400	"
6.30 "	"	"
7 pm	1350	1650
7.30 "	1425	"
8 "	"	1625
8.30 "	"	"
9 "	1450	"
9.30 "	1425	"
10 "	1375	"
10.30 "	1425	"
11 "	"	"
11.30 "	"	"
12 "	"	"
	5/1/60	
12.30 am	1425	1700
1 "	1400	"
1.30 "	"	"
2 "	"	"
2.30 "	1375	"
3 "	"	1675
3.30 "	"	"
4 "	"	"
4.30 "	1350	"
5 "	"	1600
5.30 "	"	"
6 "	"	"
6.30 "	"	"
7 "	1325	1575
7.30 "	1350	"
8 "	1325	"
8.30 "	"	"
9 "	"	"
9.30 "	"	"
10. "	1310	"
10.30 "	"	"
11 "	1325	"
11.30 "	1310	"
12 "	1300	"
12.30 pm	1315	"

TIME	TUBING PRESSURE p.s.i.	CASING PRESSURE p.s.i.
1 pm	1315	1575
1.30 "	"	"
2 "	1300	"
2.30 "	"	"
3 "	1320	1550
3.30 "	1275	"
4. "	1300	"
4.30 "	"	"
5 "	"	"
5.30 "	"	"
6 "	"	"
6.30 "	"	"
7 "	1290	"
7.30 "	"	"
8 "	"	"
8.30 "	"	"
9 "	1275	"
9.30 "	"	"
10 "	"	"
10.30 "	"	"
11 "	"	"
11.30 "	"	"
12 "	"	"
6/1/60		
12.30 am	1250	1525
1 "	"	"
1.30 "	"	1500
2 "	"	"
2.30 "	"	1525
3 "	1225	"
3.30 "	"	"
4 "	1230	"
4.30 "	"	1500
5 "	"	"
5.30 "	"	"
6 "	1225	"
6.30 "	1250	"
7 "	"	"
7.30 "	1225	"
8 "	"	"

TIME	TUBING PRESSURE p.s.i.	CASING PRESSURE p.s.i.
8.30 am	1235	1500
9 "	1230	"
9.30 "	1225	"
10 "	1230	"
10.30 "	1225	"
11 "	"	"
11.30 "	"	"
12 "	"	"
12.30 pm	1200	"
1 "	"	"
1.30 "	"	"
2 "	"	"
2.30 "	1180	"
3 "	"	"
3.30 "	1175	"
4 "	1190	"
4.30 "	1550	"
5 "	1125	"
5.30 "	1110	"
6 "	1125	
6.30 "	1125	"
7 "	1000	"
7.30 "	950	"
8 "	1050	"
8.30 "	"	"
9 "	1100	"
9.30 "	1075	"
10 "	990	"
10.30 "	1125	"
11 "	1100	"
11.30 "	1075	"
12 "	"	"
7/1/60		
12.30 am	1075	1475
WELL SHUT IN		
1 am	1250	1500
1.30 "	1300	"
2 "	1350	"
2.30 "	1400	1475
3 "	1450	1450
3.30 "	1475	1425

TIME	TUBING PRESSURE p.s.i.	CASING PRESSURE p.s.i.
	7/1/60 (cont'd)	
4 am	1500	1400
4.30 "	"	"
5 "	"	"
5.30 "	"	1375
6 "	"	"
6.30 "	"	1350
7 "	"	1325
7.30 "	1525	1300
8 "	"	"

From this time until the well was killed on 9/1/60, pressure hardly varied. Tubing pressure remained between 1500 - 1530 p.s.i. while casing pressure remained between 1300 - 1325 p.s.i.

PRODUCTION TEST NO. 1 (b)

By A.P. Hansen S.V.O.C.
Petroleum Engineer.

Interval 5657 to 5663 feet.

A hookwall packer with a slotted bail below was run on two-inch tubing to a depth of 5638 feet. The mud in the tubing was displaced with water, the packer set, and the well swabbed from 3000 feet. The well started to flow at 9.15 am on January 19, 1960. Placed well on 5/16 inch choke to clean up well. Wellhead pressure at 9.30 am was 1025 p.s.i.g. and increased to 1325 p.s.i.g. at 12.00 noon. Pressure decreased to 1175 p.s.i.g. at 4.00 pm. Well making small amount of drilling mud and clear condensate of 62° A.P.I. gravity. No water being produced. Placed well on $\frac{1}{2}$ inch choke for one hour during which time the pressure decreased to 825 p.s.i.g. and then increased to 860 p.s.i.g. Changed choke back to 5/16 inch and flowed until 1.00 am.

Flowing pressure on 5/16 inch choke was 1280 p.s.i.g. Shut well in for build-up previous to running a bottom-hole static pressure. After a shut-in time of 24 hours, ran Amerada gauge and maximum recording thermometer to 5630 feet. Made stops at 0, 1500, 3000, 4500, 5000, 5500, 5600 and 5630 feet. Gradient showed liquid at 5600 feet. Pressure at 5630 feet was 1710 p.s.i.g. Extrapolations to 5660 feet gave sand static pressure of 1722 p.s.i.g. Wellhead static pressure by Amerada gauge was 1421 p.s.i.g. Wellhead static pressure by test gauge 1420 p.s.i.g. Bottom-hole temperature 157°F. Connected up testing equipment as follows: Wellhead consisted of a tee on tubing with two two-inch valves and a positive choke body on the wing and two two-inch valves running above. A calibrated test gauge was placed upstream of the choke to take wellhead pressures. From the choke, the flow-line entered a liquid knock-out from which liquid could be drained into a 500 gallon tank and measured. Gas passed from the top of the liquid knock-out into a line and then through a four-inch meter run and was flared through a vertical riser. Back pressure was held in the meter run with an adjustable choke. Gas was metered with a dry-flow orifice meter with a 0-100 inch differential and 1000 p.s.i. static element. Pressures were taken on the meter run with a calibrated test gauge and temperatures read from an ordinary thermometer in a thermometer well on the meter run. The well was opened on a 5/16" choke at 8.00 pm on January 20, and flowed on this choke for 18 hours, during which time the wellhead pressure gradually declined to 1260 p.s.i.g. at 75°F. The metered rate was 2,510 MCF/day. Total gas produced was 1,885 MCF. Clear condensate produced was 9.75 barrels or 0.224 gallons per thousand cubic feet. A.P.I. gravity 65.3 at 60°F. No water produced.

Changed choke to ½ inch and flowed for 6.5 hours during which time the well-head pressure gradually decreased to 870 p.s.i.g. at 85°F. The

metered rate was 4,360 MCF/day. Total gas produced on this rate 1,185 MCF. Clear condensate produced was 6 barrels or 0.212 G.P.Mcf. No water produced. Changed choke to $\frac{1}{4}$" and flowed for 11 hours during which time the wellhead pressure gradually decreased to 1265 p.s.i.g. at 65°F. Metered rate was 1,360 MCF/day. Total gas produced on this rate 623 MCF. Clear condensate produced was 3 barrels or 0.202 G.P.Mcf. API Gravity 64.8 at 60°F. No water produced. Changed choke to 1/8 inch and flowed for 5 hours during which time the wellhead pressure remained steady at 1300 p.s.i.g. at 68°F. Metered rate was 615 MCF/day, total gas produced being 128 MCF. Well was shut in from 2.00 pm until 5.45 pm to extend flare line and change choke and meter run plate. Opened well on 5/16 inch choke at 5.45 pm January 22. At 5.00 pm on January 23, the wellhead pressure had decreased to 1075 p.s.i. at 78°F. The metered rate was 2,200 MCF/day.

Well started making salt water at 12.00 noon on January 23. Salinity of water 5041 mg Cl/litre. Water rate 0.306 G.P.Mcf. Clear condensate rate 0.115 G.P.Mcf. A.P.I. gravity 65.2 at 60°F. Continued to flow on 5/16 inch choke until 10.00 am on January 24, at which time wellhead pressure had decreased to 1010 p.s.i.g. at 80°F. Metered rate was 2,020 MCF/day. Gas produced on this rate 4,220 MCF. Clear condensate rate 0.134 G.P.Mcf. Water rate 0.268 G.P.Mcf. Salinity of water at 10.00 am 7694 mg Cl/litre.

Changed choke to $\frac{1}{2}$ inch to make sure well was not loading up and would be clean for bottom hole pressure survey. Flowed well for 5 hours during which time wellhead pressure steadily dropped to 660 p.s.i.g. at 76°F. Metered rate 3,260 MCF/day. Gas produced 680 MCF. Clear condensate produced 1.5 bbl.or 0.0925 G.P.Mcf. A.P.I. Gravity 62.7 at 60°F. Water produced 9.5 barrels or 0.585 G.P.Mcf. Salinity 8520 mg Cl/litre.

Well shut-in at 3.00 pm on January 24 for build-up prior to taking bottom hole static pressure survey. Total gas produced since last pressure survey is 8,131 MCF. Total condensate produced 34 barrels; total water produced 17.5 barrels. When the previous 5/16 inch choke was pulled it was a yellow-green colour which indicates that the water being produced is coming from below at 5695 to 5701 feet. Fluoresceine dye of this colour had previously been squeezed in the water sand at that depth ahead of the cement squeeze job.

After a shut-in time of 19 hours an Amerada gauge and maximum thermometer were run to 5630 feet. Stops were made at 0, 1500, 3000, 4500, 5000, 5250, 5500, 5600 and 5630 feet. The top shut-in pressure was 1115 p.s.i.g. which agreed with the test gauge on wellhead. The static pressure at 5630 feet was 1355 p s.i.g. The gradient showed no liquid in the tubing. Extrapolated to 5660 feet the sand face static pressure is 1357 p.s.i.g. The bottom hole temperature is 158°F.

With the production of 8,131 MCF of gas the reservoir pressure was decreased 365 p.s.i. This is a decrease of 44.8 p.s.i.per MMCF which is indicative of a very small gas reservoir or possibly a small gas cap of an oil reservoir. The well was again flowed in an effort to obtain four nearly stable rates to calculate an absolute open flow potential. Opened on $\frac{1}{2}$ inch choke for one hour the wellhead pressure declined to 560 p s.i.g. and then increased to 590 p.s.i.g. at 78°F. A longer period of flow may have seen a slightly greater rise. Metered rate was 3090 MCF/day. Clear condensate rate 0.0597 G.P.Mcf A.P.I. gravity 61 at 60°F. Water rate 0.362 G.P.Mcf. Salinity 7684 mg Cl/litre.

Changed choke to 5/16 inch and flowed for 2 hours and 15 minutes during which time the wellhead pressure steadily dropped to 918 p.s.i.g. at 82°F. The metered rate was 1860 MCF/day.

Changed choke to $\frac{1}{4}$ inch and flowed for one hour during which time the wellhead pressure declined to 975 p.s.i.g. at 81°F. Metered rate was 1,132 MCF/day.

Changed choke to 1/8 inch and flowed for three hours during which time the wellhead pressure decreased to 1015 p.s.i.g. at 73°F. Metered rate was .241 MCF/day. This rate is slightly low due to the small volume passing through a too large orifice plate and thereby being metered near the minimum range of the differential meter.

The above four flow rates were used to calculate a four point "Back Pressure Test". These calculations are attached along with a "back pressure curve". As can be seen on the curve, the points do not line up properly. This is due to the inability of the well to stabilize on a rate. Rate number one would probably have come more in line given a little more time. Rate number 4 is probably a little low and would be more in line. Regardless of the fact that a smooth curve was not obtained, the "absolute open flow" of 4150 MCF/day is close to the well's true "absolute flow" since the slope of the curve would be less than 1.0 and would have to be drawn with a slope of 1.0 through the highest rate of flow anyway.

The rate of flow taken earlier in the tests could not be used because the shut in pressure of the well was pulled down too much between the rates taken.

D.S.T. No. 5 Interval 4815 to 4820 feet and 4830 to 4840 feet.

After setting a Baker Model 'K' cast iron cement retainer as a bridge plug at 5644 feet, the intervals 4815 to 4820 and 4830 to 4840 feet were perforated with 59 shots on January 31, 1960. Went in hole with Johnston tester and set packer at 4814 feet. Opened tool at 9.55 am. Received very slight blow which diminished to nil after 3 hours and 15 minutes. Closed tool and pulled out of hole. Recovered 2880 feet of water diluted gas cut mud and 720 feet of gas cut salt water. Salinity of water 4934 mg Cl/litre.

I.M.P.	2600 psig
F.M.P.	2500 psig
I.F.P.	700 psig
F.F.P. and Static Pressure	1850 psig

On pulling the test tool out of the hole one slip was missing from the $5\frac{1}{2}$" packer.

Ran Baker Model 'K' cast iron cement retainer and set at 4810 feet. Squeeze cemented perforation with 15 sacks. Squeeze pressure 2200 psi. Backed off to retainer and circulated while waiting on another packer to arrive since no slips were available to repair packer.

February 1st spent circulating waiting on packer.

D.S.T. NO. 6 Interval 4696 to 4702 feet.

On February 2nd, pulled out of hole and perforated interval 4696 to 4702 feet with 24 shots. A $5\frac{3}{4}$" packer arrived instead of a $5\frac{1}{2}$" as ordered. Since the I.D. of the $5\frac{1}{2}$" 14 pound casing was large enough, the $5\frac{3}{4}$" packer was run but it held up at 2122 feet. Pulled out of hole and found 'J' slot pin sheared off. While repairing packer ran bit and scraper to 4700 feet to check for obstructions. While running scraper, drilling line fouled and had to be replaced.

February 4th. Ran $5\frac{3}{4}$" packer to 2122 feet where it stood up. Marks on packer indicated a joint of 20 pound casing at 2122 feet. Removed one slip from $5\frac{3}{4}$" packer and had it cut down to fit $5\frac{1}{2}$" packer. Ran Johnston tester and set at 4690 feet. Opened tool at 11.20 am. Received very light blow.

February 5th. Shut well in at 3.30 am for build-up. No top pressure received. Closed tool and unseated packer at 4.30 am. Recovered 180 feet of water diluted, slightly gas cut mud and 270 feet of slightly gas cut water. Water salinity 1065 mg Cl/litre, pH eleven.

I.M.P.	2500 psig
F.M.P.	2450 psig
I.F.P.	0 psig
F.F.P.	too low to read on chart .
S.I.P.	too low to read on chart.

Ran baker Model 'K' cast iron cement retainer and set at 4690 feet. Squeezed perforations with 15 sacks of cement. Pulled out of hole and perforated shale interval at 4440 to 4442 feet with 7 shots. Went in hole with open end drill pipe and bradenhead squeezed interval 4440 to 4442 feet with 15 sacks.

D.S.T. No. 7 Interval 4498 to 4515 feet.

February 6th. Laid down tubing while waiting on cement. Went in hole with bit and cleaned out small amount of cement. Attempted to perforate interval 4498 to 4515 feet. Perforating gun would not fire.

February 7th. Located and repaired short circuit after 14 hours. Perforated interval 4498 to 4515 feet with 59 shots. Went in hole with Johnston Tester and set at 4487 feet. Opened tool at 6.45 pm. Received fair blow immediately. Left tool open for 1 hour and 45 minutes. Blow had became nil. Shut-in for 30 minutes. Opened top bleed valve and received slight blow of gas which burned with good flame. Top pressure too low to register on gauge. Closed tool and unseated packer. Recovered 270 feet of gas cut mud and 3690 feet of gas cut water. Gas had a sharp smell. Water salinity 1136 mg Cl/litre. A considerable amount of medium grain sand was present in the liquid. Last 90 feet of string filled with medium grain, well sorted sand.

I.M.P.	2325 psig
F.M.P.	2175 psig
I.F.P.	1600 psig
F.F.P.	1750 psig
Shut-in bottom hole pressure	1750 psig

February 8th. Ran Baker Model 'K' cast iron cement retainer and set at 4485 feet. Squeezed perforations with 20 sacks of cement at pressure 2100 psi.

D.S.T. NO. 8 Interval 4463 to 4475 feet.

Pulled out of hole and perforated interval 4463 to 4475 feet with 44 shots. Ran Johnston tester and set at 4456 feet. Opened tool at 8.00 pm. Received fair blow which diminished to nil after one hour. Shut in for 30 minutes. No top shut-in pressure registered. Recovered 210 feet of slightly gas cut mud and 3600 feet of slightly gas cut water. Salinity of water 994 mg Cl/litre. Considerable amount of very fine grain sand in liquid.

I.M.P.	2130 psig
F.M.P.	2050 psig
I.F.P.	1300 psig
F.F.P.	1735 psig
Shut-in Bottom Hole Pressure	1735 psig

All of the four preceeding tests were taken with no bottom choke in tool and with no water cushion in string. A sample of the water from each test was obtained. None of the tests indicated any liquid hydrocarbons. The first interval tested produced salt water and the last three intervals produced fresh water.

Tuesday 9th. Squeezed interval 4463-4475 feet with 20 sacks of cement at pressure 2000 psig. Laid down all drill pipe and tubing. Well left in suspended status as follows: All perforations in the hole are squeeze cemented except interval 5657 to 5663 feet which has a bridging plug above and below. Casing left full of mud with a blind flange bolted to the top of the casing head. The following inscription was welded on the blind flange "FROME-BROKEN HILL PTY. LTD. PORT CAMPBELL NO. 1"

APPENDIX 5

DETAILED LITHOLOGICAL DESCRIPTION

APPENDIX 5.

PORT CAMPBELL NO. 1, EXPLORATION WELL

DETAILED LITHOLOGICAL DESCRIPTION

Heytesbury Group

Surface to 1050 feet	Dominantly soft, grey, clayey, extremely fossiliferous marl with minor amounts of white limestone and a little sand near the top.
1050 to 1150 feet	Sand, brown and clear and medium to coarse grained comes into the section with the above clayey marls, and a hard fossiliferous sandy limestone band is present at 1057 to 1067 feet.
1150 to 1410 feet	Brown calcareous silty clays with minor loose fine to coarse sand and some limestone and marl. Samples very fossiliferous. From 1280 to 1410 feet samples are very glauconitic.

Wangerrip Group

1410 to 2557 feet	Sand and sandy siltstone; dirty, white and some clear, fine to coarse subangular to subrounded, probably in a brown silty clay matrix which washes away. Hard calcareous sandstone 1457 to 1493 feet. Gravel and very coarse sand bands 1570 to 1580, 1640 to 1670, 1770 to 1790 and 2110 to 2120. Some white clayey limestone; hard, compact, slightly glauconitic 1710 to 1735 feet. All this interval contains pyrite and is sparsely fossiliferous to approximately 1520 feet. Below 1520 feet no fossils have been found.
2557 to 3290 feet	Sand, gravel and conglomerate; white, clear, light brown, loose, fine to very coarse, subangular to rounded. Pyrite present. Gravel, pebble conglomerate 2690 to 2700, 2730 to 2790, 2840 to 2850, 2915 to 2916, 3020 to 3090, 3200 to 3210, 3230 to 3240. Pebbles and granules in the conglomerates were made up of white and clear quartz, green chert, red mudstone and black-green pebbles of ?metamorphic origin. Pebbles are usually rounded to well rounded. Matrix is silty in places and in others the granules and pebbles are cemented by pyrite, but mostly there is no matrix at all. These beds appear to be the fresh water aquifers.
3290 to 3720 feet	Sandy siltstone and sand, probably with a silty clay matrix washed out, light brown to grey, very fine to medium grained, few coarse bands, subangular to subrounded. Pyrite, mica and carbonaceous matter. Carbonaceous material is probably present in stringers through the sandy siltstone as cores show evidence of lamination. Formation usually fairly tight. Cross bedding is present in some of the cores. No fossils noted.

Wangerrip Group (Contd.)

3720 to 4002 feet	Sandy siltstone; usually very fine to medium grained, light grey, dark grey and brown and some black subangular to subrounded, harder than interval 3290 to 3720 feet, and with some coal and carbonaceous matter. Coal decreasing from 3900 to 4002 feet and some mica in the sediments. Dolomitic matrix in intervals 3720 to 3730, 3910 to 3930 and 3940 to 3950 feet.
4002 to 4245 feet	Sandstone; grey, white, compact, fairly hard, fine to medium grained, calcareous, with minor black siltstone. Brown very hard dolomite 4190 to 4200 feet. Slight porosity.

Paaratte Formation

4245 to 4450 feet	Sandy siltstone and interbedded sandstone, light brown to black, very fine to fine grained, subangular to subrounded, well sorted in places. In places grades into a claystone. Slightly glauconitic in Core No. 15 (4284 to 4293 feet) and a few forams in cuttings at 4284 feet (? contaminated). Dolomite 4320 to 4340 feet.
4450 to 4460 feet	Mudstone, orange brown, tight, compact, slightly glauconitic, some forams. ? Marker bed. Note: This lithology was not confirmed by the sidewall core taken at 4450 feet.
4460 to 4697 feet	Silty sandstone and sandy siltstone, grading to mudstone in places. Brown and black, very fine to medium grained, tight. Little glauconite, some mica and pyrite. Dolomite 4480 to 4490 feet; massive nodules in Core No. 16 (4518 to 4536 feet), 4610 to 4620 feet and 4670 to 4680 feet. Few broken shell fragments but generally sparse fossils.
4697 to 4710 feet	Sandstone; light brown to grey, slightly calcareous, very fine to medium grained, subangular to subrounded. Also loose sand, clear white and light brown, slightly glauconitic.
4710 to 4830 feet	Mudstone; silty in places, black, tight, with little carbonaceous material, some glauconite and little pyrite, fossiliferous. Minor brown very hard dolomite, 4710 to 4730, 4750 to 4760, 4780 to 4790 and 4810 to 4820 feet. Minor amount of loose fine to medium grained sand, subrounded at 4820 to 4830 feet.
4830 to 4910 feet	Sandstone; light grey, brown and few white patches, calcareous, very fine to fine grained - in places siltstone - compact, subangular to rounded, slightly glauconitic and micaceous. Little pyrite, fossiliferous. Brown, very hard dolomitic fragments in most of the interval.
4910 to 4930 feet	Dolomite and some dolomitic sandstone; brown, very hard, tight, compact. Minor sandstone as for 4830 to 4910 feet and some black, compact mudstone, slightly glauconitic.

Belfast Mudstone

4930 to 5005 feet	Mudstone; black, compact, fairly hard, slightly glauconitic and micaceous. Minor loose sand and sandstone, white and clear, very fine to medium grained, subangular to subrounded. Minor dolomite in this interval with approximately 40% in 4980 to 4990 feet.
5005 to 5060 feet	Mudstone; very glauconitic, dark grey to green to black, sandy in patches (5031 to 5040 feet), fairly tight, fossiliferous. Evidence of gas in cores from 5018 to 5031 feet. Very minor brown dolomite.
5060 to 5090 feet	Mudstone as for 5005 to 5060 feet except not quite as glauconitic.
5090 to 5587 feet	Mudstone; black, very glauconitic, compact, dense, some fossils with very minor sand patches. Very fine to medium grained. Little pyrite and few shell remains. Little dolomite 5390 to 5400; 5440 to 5470, and 5480 to 5500 feet.
5587 to 5656 feet	Mudstone; black, very glauconitic as for 5090 to 5590 feet and minor sandstone-siltstone, light brown to brown, hard, calcareous in parts and some calcite, slightly glauconitic, mainly fine to medium grained.

Warre Formation

5656 to 5670 feet	Sandstone and top six inches pebble conglomerate; light grey to white, clean, very porous and permeable, friable. Pyrite and coal lenses. Slightly calcareous in parts.
5670 to 5965 feet	Mudstone-siltstone; black, carbonaceous, glauconitic in places with sandstones, light grey, fine to medium grained, subangular to subrounded, fairly porous and permeable, abundant pyrite and coal in parts. Laminated with white sandstone in parts. Dip in Core No. 23 (5700 to 5718 feet) 10°. Brown hard dolomite 5860 to 5865 feet. Evidence of gas cutting in cores. Some jointing and slickensiding. Sandstone has a felspathic or slightly calcareous matrix in parts.

New Well X
Workover
Test
Reclassified
Oil to Gas

BACK PRESSURE TEST

Field _____ Reservoir _____ County _____
Well Owner Frome-Broken Hill Co Pty Ltd. Lease _____ Well No. Pt. Campbell No 1
Section _____ Block _____ Survey _____ Location _____
Date of Test 25/1/60 Acres _____ Pipe Line Conn _____
Gravity (Raw Gas) 0.770 Avg. Shut-in Temp 65°F Bottom Hole Temp 158°F @ 5660
Size CSG 5½ " Wt./Ft. 14 & 20 Lbs. I. D. CSG _____ Set at 5962
Size TBG 2⅜ Wt./Ft. 4.7 Lbs. I. D. TBG 1.995 Set at 5638
Prod. Section From 5657 - 5663 Avg. Prod. Length. (L) 5660
Elevation 347' [redacted] K3 Date of Completion _____ Producing through Tubing x Casing _____

FIELD DATA

Run No.	Time of Run Min	Choke Size	Coefficient	Choke Press. PSIA	Choke Temp. °F	Wellhead Press P_w PSIA	Wellhead Flow Temp. °F	P_w^2 (Thousands)
Shut-In		√ 9 hours				1130	65	1277
1		¼				605	78	366
2		5/16				933	82	870
3		¼				990	81	980
4		⅛				1030	73	1061
5								

VOLUME CALCULATIONS

Run No.	Size Line Fig. - Tap	Size Orifice	Meter Coeff. 24 Hrs.	Static $\sqrt{P_m}$	Diff. $\sqrt{h_w}$	Flow Temp. °F	Temp. Factor Ftf	Gravity Factor Fg	Compress. Factor Fpv	Volume MCF / Day
1	4	2.5"	43543.2	16.9	4.62	68	.9924	.8827	1.040	3,090
2	4	2.5	43543.2	13.05	3.65	61	.9990	"	1.027	1,860
3	4	2.0	25922.4	10.50	4.70	69	.9915	"	1.011	1,132
4	4	2.0	25922.4	7.55	1.4	70	.9905	"	1.005	241
5										

S.P.G. of gas = 0.77.

Gas Liquid Hydrocarbon Ratio 470 MCF per Bbl.
Gravity of Liquid Hydrocarbons 61 Deg A.P.I.
Gas produced into pipe line during test _____ MCF

PRESSURE CALCULATIONS

$(D\ eff)^{8/3} = 6.310$ $\sqrt{T_f} = \sqrt{573} = 23.94$

$C = \frac{1118 \times (D\ eff)^{8/3}}{\sqrt{T_f}} = \frac{1118\ (6.310)}{23.94} = 296$

$\sqrt{GL} = \sqrt{(.77)(5660)} = 66.0$ $\frac{\sqrt{GL}}{C} = \frac{66.0}{296} = 0.223$

$G_{mix} = .77$ $\theta = 45°$ $N = 1.000$

Run No.	R	R^2 (Thousands)	P_t	P_w/P_t	F	K	$S = \frac{1}{Z}$	E^{KS}	$\frac{P_t}{P_s}$ * a	$\frac{P_t^2}{P_s^2}$ a	$P_t^2 - P_s^2$
Shut-In						.143	1.316	1.2075	1372	1882	
1	690.0	476	917.5	.660	.897	.1265	1.228	[redacted]1.1685	708	501	1381
2	415.0	172	1021.0	.914	.958	.1350	1.270	1.1870	1107	1225	657
3	252.5	64	1022.0	.968	.984	.1388	1.277	1.1938	1182	1397	485
4	53.7	3	1032.0	.995	.997	.1413	1.286	1.1995	1237	1530	352
5											

Absolute Open Flow 4,150 MCF/Day

* P_s is the Sand face pressure

Run & Calculated by: A.P. Hansen.

A.P. Hansen

PRESSURE - DEPTH GRAPH

Pt. Campbell No 1

20/1/60

Amerada Gauge No 9837.

B.H.T. 157°F

Curve A

PRESSURE - DEPTH GRAPH

Pt Campbell No 1

25/1/60

Amerada Gauge No 9537

B.H.T. 158°F

Curve B

BHP at 5660
1722 PSIG Liquid

BHP at 5660'
1387 PSIG

Curve A
Avg Gas Gradient 0.0696

Curve B
Avg. Gas Gradient 0.0428

Depth ft →

Pressure psig →

by: A.F. HANSEN

PE907711

This is an enclosure indicator page.
The enclosure PE907711 is enclosed within the container PE907709 at this location in this document.

The enclosure PE907711 has the following characteristics:

ITEM_BARCODE	= PE907711
CONTAINER_BARCODE	= PE907709
NAME	= Geological Section
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Geological Section through site of Port Campbell-1 Well, based on information available prior to drilling (Plate 3 from WCR), A.F.McQueen, March 1960.
REMARKS	=
DATE_CREATED	= 31/03/60
DATE_RECEIVED	=
W_NO	= W460
WELL_NAME	= Port Campbell-1
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

Pe907710

This is an enclosure indicator page.
The enclosure PE907710 is enclosed within the container PE907709 at this location in this document.

The enclosure PE907710 has the following characteristics:

ITEM_BARCODE	= PE907710
CONTAINER_BARCODE	= PE907709
NAME	= Geological Section
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Geological Section through Port Campbell-1 Well/ Port Campbell Structure(Plate 4 from WCR), Frome-Broken Hill Co. Pty. Ltd.
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	= 31/03/60
W_NO	= W460
WELL_NAME	= Port Campbell-1
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE602887

This is an enclosure indicator page.
The enclosure PE602887 is enclosed within the container PE907709 at this location in this document.

The enclosure PE602887 has the following characteristics:

ITEM_BARCODE	= PE602887
CONTAINER_BARCODE	= PE907709
NAME	= Electric Well Log
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Electric Well Log, Reduced Composite Log Tracing 100' = 1" (Plate 8 from WCR), by Oil Drilling and Exploration Ltd. For Frome-Broken Hill Co. Pty. Ltd., 7 December 1959, for Port Campbell-1.
REMARKS	=
DATE_CREATED	= 07/12/59
DATE_RECEIVED	=
W_NO	= W460
WELL_NAME	= Port Campbell-1
CONTRACTOR	= Oil Drilling & Exploration Ltd.
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE602888

This is an enclosure indicator page.
The enclosure PE602888 is enclosed within the container PE907709 at this location in this document.

The enclosure PE602888 has the following characteristics:

ITEM_BARCODE	= PE602888
CONTAINER_BARCODE	= PE907709
NAME	= Composite Electric Log
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Electric Log, 50' = 1" (Plate 6 from WCR), J.S.Bain, Frome-Broken Hill Co. Pty. Ltd., March 1960, for Port Campbell-1.
REMARKS	= Colour
DATE_CREATED	= 31/03/60
DATE_RECEIVED	=
W_NO	= W460
WELL_NAME	= Port Campbell-1
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE904985

This is an enclosure indicator page.
The enclosure PE904985 is enclosed within the container PE907709 at this location in this document.

The enclosure PE904985 has the following characteristics:

ITEM_BARCODE	= PE904985
CONTAINER_BARCODE	= PE907709
NAME	= Microfossil Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Microfossil Distribution Chart(Plate 10 from WCR), Bureau of Mineral Resources Geology and Geophysics, April 1961, for Port Campbell-1.
REMARKS	= Colour
DATE_CREATED	= 30/04/61
DATE_RECEIVED	=
W_NO	= W460
WELL_NAME	= Port Campbell-1
CONTRACTOR	= Bureau of Mineral Resources Geology and Geophysics
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE907712

This is an enclosure indicator page.
The enclosure PE907712 is enclosed within the container PE907709 at this location in this document.

The enclosure PE904985 has the following characteristics:

ITEM_BARCODE	= PE907712
CONTAINER_BARCODE	= PE907709
NAME	= Microfloral Zonation Chart
BASIN	= OTWAY
PERMIT	= PEP6
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Microfloral Zonation Chart(Plate 11 from WCR), for Port Campbell-1.
REMARKS	= Colour
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W460
WELL_NAME	= Port Campbell-1
CONTRACTOR	=
CLIENT_OP_CO	= Frome-Broken Hill Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)