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NORTH EUMERALLA-1

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NORTH EUMERALLA-1
(W678)

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+ 6 enclosures

NORTH EUMERALLA-1 WELL COMPLETION REPORT

(Otway Basin, PEP5)

by

SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

S.D.A. REPORT 182

MELBOURNE, APRIL 1974

CONTENTS

WIRELINE LOGS

LL-9 + SP	1133' to T.D. 9716'
GR	Surface to T.D.
BHC	1133' to T.D.
FDC	1133' to T.D.
HDT	3030' to T.D.
CBL	2600' to 6260'

SUMMARY

Drilling

Assembly of the National 1320 DE rig, after its move from Western Australia, was begun on the 14th November, 1973. North Eumeralla-1 was spudded on the 30th November, 1973 and a 26 inch hole was drilled to 1150 ft., progress being hampered by balling of the surface marls which had to be circulated out. The 20 inch casing was run and cemented at 1133 ft.

A 20" Hydril was installed and 17½" hole was drilled to 3050 ft. where logs were taken. The 13-3/8" casing was run and cemented at 3029 ft.

A 13-5/8", 5000 psi BOP stack was nippled up and 12¼ inch hole drilled to 6375 ft. Logs were taken and the 9-5/8 inch casing run and cemented at 6355 ft. Owing to the failure of the top cementing plug to leave the cementing head prior to displacement, the cement was slightly overdisplaced. The plug was located at 1994 ft., pushed to bottom with drill pipe and a successful pressure test of the casing was made. Since approximately 100 bbls of losses were noted during the displacement period of the cement job, a CBL was run which indicated the top and bottom of the cement to be at ca. 2800 ft. and 6200 ft. respectively.

On the 23rd December, 1973, a labour dispute, which had restricted working hours during the running and cementing of the 9-5/8" casing, precluded continuation of drilling operations, which were suspended until 3rd January, 1974. A total of 12.6 days was lost as a result of the dispute.

On resumption of operations, drilling was continued in 8½ inch hole. Between 7729' and 9570' four round trips were made prematurely to lay down washed-out components of the drill string; these included 2 stabilizers, 9 drill-collars and one bit.

At 9613', after a reduction in the penetration rate, a round trip showed that 2 bit cones had been left in the hole. Two runs of a reverse circulating junk basket and a milling bit cleared the junk off bottom.

Drilling continued to 9729' at which depth a core was cut which confirmed the presence of basement.

Logs were run and an abandonment plug set in the 9-5/8" casing. Two unsuccessfull attempts were made to recover some 9-5/8" casing by cutting at 2660' and 2030'. Despite obtaining full circulation through the cuts, the casing could not be pulled free with 310,000 lbs. A cement plug was set across the cut at 2030 ft. and also at surface.

North Eumeralla-1 was abandoned on the 25th January, 1974 after having drilled a total of 9737 ft.

Geological

North Eumeralla-1 tested the Lower Cretaceous fluviatile sandstones of the Otway Group in a dip-fault closure located in the coastal strip of the Victorian Otway Basin, within the inferred hydrocarbon generating zone. These sandstones were the only objective remaining to be tested after considerable drilling efforts had failed to prove any commercial petroleum accumulations within the higher reservoir section.

The well entered the objective at 7300 ft. b.d.f. after having penetrated 4000 ft. of Eumeralla Formation. The sequence was found to consist of subangular, fine to medium grained sandstones composed of quartz and lithic fragments, inter-

digitating with siltstones and shales having Eumeralla Formation affinities. This mixed succession of Pretty Hill sand facies and Eumeralla shale facies was first described from Eumeralla -1 (Edworthy, 1965) and Geltwood Beach-1 (Dellenbach, 1965) and is defined by BMR Geologists (Reynolds, 1971) as Geltwood Beach Formation. Within this unit which was drilled from 7300' to 8850', ± 400' of net sand of Pretty Hill facies was tested.

At 8850 ft. the well entered, without any marked drilling break, into a meta-arkosic basement severely weathered at the top.

The entire section below 8850 ft. is tentatively assigned to the Lower Palaeozoic.

Apart from traces of Methane recorded from the Eumeralla Formation and from the objective interval no hydrocarbons were noted in the well. Log analysis on the sandstones encountered between 7300 ft. and 8850 ft. indicates a water saturation of 100%.

Porosities within the reservoir objective were relatively poor. Due to their heterogeneous composition the sandstones were affected by burial diagenesis.

The test downgrades the nearby Lower Cretaceous prospects, Terka and Yambuk.

The Upper Cretaceous and Tertiary reservoirs were confirmed to be fresh-water flushed and not prospective in the area.

I. INTRODUCTION

North Eumeralla-1 (encl. 1 and 2) was programmed to further evaluate the hydrocarbon potential of the Lower Cretaceous reservoirs (Pretty Hill sandstone - Geltwood Beach Formation) in PEP5 and PEP6, the two Frome/Shell onshore permits of the Otway Basin.

Previous wells drilled within the onshore Victorian portion of the Otway Basin and which penetrated these reservoirs in a valid structural position were believed to be located too far from the inferred generating area, the deep basin sector in the south of the permits.

North Eumeralla-1 was proposed to test a more basinward structure where the porous Lower Cretaceous section was expected to be in a more favourable position to be charged by hydrocarbons.

II WELL HISTORY

1. GENERAL DATA

(i)	Well	:	North Eumeralla -1
(ii)	Operator	:	Shell Development (Australia) Pty. Ltd. 155 William Street, Melbourne, Victoria, 3000.
(iii)	Joint Tenement Holders	: :	Frome - Broken Hill Company Pty. Ltd. Mobil Centre 2 City Road, South Melbourne, Victoria, 3205. AND Shell Development (Australia) Pty. Ltd.
(iv)	Petroleum Tenement.	:	Petroleum Exploration Permit No. 5.
(v)	District	:	Portland (1: 250,000; sheet SJ 54-11)
(vi)	Location	:	Latitude 38 09' 51" S. Longitude 141 53' 30" E. (Australian National Spheroid)
(vii)	Elevation	:	Ground : 180 ft above sealevel Derrick floor : 208ft. (datum for depths).
(viii)	Total depth	: :	9737ft Driller 9716ft Schlumberger
(ix)	Date drilling Commenced	:	30th November 1973
(x)	Date total depth reached	:	21st January 1974
(xi)	Date well abandoned	:	25th January 1974
(xii)	Drilling time	:	56 days
(xiv)	Status	:	Plugged and abandoned Plugs : 1) 6120ft - 6550ft, 200 sacks 2) 2030ft - 1717ft, 200 sacks 3) 300ft - 50ft - 300 sacks
(xv)	Total Cost	:	Approximately A$550,000

2. DRILLING DATA

Detailed information is included in weekly drilling Reports (Appendix 6.)

2.1 General

(i) Drilling Contractor : Shelf Drilling Pty. Ltd.
Perry House, 131 Elizaberth St.,
Brisbane, Queensland, 4000.

(ii) Drilling Rig : National Type 1320 DE with 142 ft.
Lee C Moore Cantilever Mast nominal
capacity of 892,000 lbs, with 5"
Drillpipe.

(iii) Drawworks : National 1320 DE - 1-3/8" Grooved
National Automatic Catheads, 60"
Parkersburg Hydromatic.

(iv) Mud Pumps : No.1 National N 1300 HP Compound
Driven
No.2 National N 1100 HP Independant
Drive
with 2 - PTDS6 Turbocharged Superior
Engines

(v) Blowout Preventors : 1 - 20" 600 Series Hydril
1 - 20" 600 Series Cameron Q.R.C.
1 - 13-5/8 5000 GK Hydric
2 - 13-5/8" 5000 Cameron Single Gate

(vi) Hole Sizes and depths :

Hole Size Inches		Depth B.D.F. Feet
26"	to	1150
17½	"	3050
12¼	"	6375
8½	"	9737

For bit record see Table 1.

(vii) Casing

O.D. (inches)	Grade	Weight lbs/ft	Range	Joint Type	Depth Set B.D.F.	Length (feet)
20	H-40	94	3	Vetco-L	1133	1105
13-3/8	N80 & J55	68	3	Buttress	3029	3022 *
9-5/8	N80	47	3	Buttress	6355	6329 *

* Shoe Track Centralized.

(viii) Cementing

Hole	Casing		Cement				Theoretical fill to B.D.F.	Remarks
	Size	BDF	Type	Sacks	Additives	Weight lbs/Gal		
26"	20	1133	Class A	1100	2% Ben 2% CaCl2	13.4	Surface	-
17½	13-3/8	3029	Class A	1750	2% Ben 1% CaCl2	13.4	Surface	-
12¼	9-5/8	6355	Class D	1400	Nil	15.0	2800 *	**

* From Cement Bond Log.

** Top Cement Plug failed to release.

(ix) Drilling Fluid See Table No. 2 for mud properties and Figure 2 and Table 3 for mud costs.

(x) Water Supply

Two water wells within the location were drilled and cased to 40 feet.

(xi) Perforating and Shooting

None were performed.

(xii) Plugging Back and Squeeze Cementation Jobs:

The hole was plugged in accordance with Victorian Mines Department Regulations:-

Plug No.	Location of Plugs	Sacks of Cement	Tested
1	6120 - 6550	200	Pressure Tested to 1000 psi
2	2030 - 1717	200	-
3	300 - 50	100	-

(xiii) Fishing Operations

A Reverse circulation junk basket was run at 9617' to recover 2 cones left in hole. Minor quantities were recovered. The remaining junk was drilled up.

(xiv) Sidetrack Hole

No sidetracking operations were performed.

3. LOCATION:

(i) A drilling location of 300' x 400' was levelled, covered with scoria, and compacted. A drilling cellar, 8' x 8' x 3' deep was dug. A roadway 80 chains long and 15 feet wide was constructed to gain access to the location. The entire roadway and location was fenced off from adjoining paddocks.

(ii) Transportation of materials and goods to and from the location was by cartage contractor trucks. Personnel transport was provided by rented cars.

4. FORMATION SAMPLING

(i) Ditch Cuttings

Ditch Cutting were collected at the shale shaker at 10 feet intervals whilst drilling. Samples were distributed as follows:

1 sample washed and dried - Bureau of Mineral Resources,
Core and Cuttings Laboratory,
Collie Street,
FYSHWICK, CANBERRA, A.C.T.

1 sample washed and dried - Victorian Mines Department,
Core Laboratory,
Turner Street,
PORT MELBOURNE, VIC. 3000.

1 sample unwashed - Shell Development (Aust.)Pty.Ltd.
155 William Street,
MELBOURNE, VIC. 3000

(ii) Coring

One core of eight feet was cut from 9729' to 9737' (TD) with 100% recovery. One slice was sent to the Bureau of Mineral Resources and one to the Victorian Mines Department. The remainder is stored with Shell Development (Aust.) Pty.Ltd., in Melbourne.

(iii) Side Wall Sampling

A total of 85 side wall sample shots were taken of which 68 were recovered in acceptable condition. Interval samples are plotted on enclosure 5. The cores were studied palaeontologically and palynologically and the remainder are stored with Shell Development (Aust.) Pty.Ltd., in Melbourne.

5. LOGGING AND SURVEYS

(i) Wireline Logging

Performed by Schlumberger. Details of runs taken may be found in Table 4. A velocity survey was carried out at T.D. by Austral United Pty. Ltd. of Brisbane.

(ii) Penetration Rate and Gas logs

Geoservices Ltd. were responsible for recording penetration rate and mudlogging. A hot wire GMS detector, chromath-graph analyser were run continuously.

(iii) Deviation Surveys

TOTCO double recorders were used to measure hole deviation. Results were as follows:-

Depth Ft.	Deviation
128	1/8°
188	1/2°
400	3/8°
525	1/8°
708	0
840	1/8°
903	1/2°
1022	1/2°
1145	3/4°
1449	1/4°
1740	1/4°
2047	1/4°
2298	1°
2605	1°
2911	1°
3668	1°
4500	3°
4738	3°
5000	3-3/4°
5660	3-1/4°
6580	2-1/2°
7729	6°
9070	6°
9610	7-1/2°
9642	6°

The Recordings are in close agreement with Schlumberger HDT deviations.

(iv) Temperature Survey

No temperature survey was run. A bottom hole temperature of 230 F (110 C) was recorded 20½ hours after circulation.

6. TESTING

No drill stem testing or wireline testing was performed.

TABLE 1.

NORTH EUMERALLA - 1 BIT RECORD

BIT NO.	TYPE	SIZE	NOZZLES 1/32 nd.	FT DEPTH IN	FT DEPTH OUT	FOOTAGE	HOURS	PEN RATE FT/HR	BIT CONDITION	W.O.B. 000 lbs	R.P.M.	MUD WEIGHT lb/gal.	MUD VISC. sec.	PUMP PRESSURE P.S.I.	LITHOLOGY / REMARKS
1.	OSC-3A	26	CONV.	27	1150	1123	35	32.0	$T_3B_3O_{2/8}$	8	160	9.3	49	500	LIMESTONE AND MARL.
2.	OSC-3AJ	17½	3 x 16	1150	2389	1239	24.5	50.7	$T_3B_6O_{1/8}$	10	120	8.9	40	1000	DRILLED OUT 20" SHOE
3.	OSC-3A3	17½	3 x 18	2389	3050	661	23.5	28.0	$T_4B_5O_{1/8}$	20	120	9.3	50	900	SILTSTONE, SHALE SANDSTONE
3.RR	" "	"	"												CHECK TRIP
4.	OSC-3A3	12¼	NIL	3050	3171	121	4.5	26.8	$T_2B_4O_{1/8}$	15	120	9.1	35	425	DRILLED OUT 13 3/8" SHOE TRACK
5.	XDG	12¼	3 x 13	3171	4738	1567	38.25	40.9	$T_7B_4O_{1/8}$	30-40	80	9.2	43	1750	SILTSTONE, SHALE
6.	XDG	12¼	3 x 13	4738	5660	922	28.25	32.6	$T_6B_4O_{1/8}$	30-40	80	9.2	38	1800	SILTSTONE SANDSTONE SHALE.
7.	XDG	12¼	3 x 13	5660	6375	715	32.25	22.2	$T_4B_3O_{1/8}$	40	80	9.5	38	2000	SHALE SILTSTONE.
7.RR	"	"	"												CHECK TRIP
8.	M 44	8½	3 x 12	6375	6580	205	15	13.6	T_5B_5I	40	80	9.4	39	1400	DRILLED OUT 9 5/8" SHOE TRACK
9.	J 33	8½	3 x 10	6580	7729	1149	84.25	13.6	T_3B_3I	40	50	9.4	38	2200	SILTSTONE, SANDSTONE
10.	J 33	8½	3 x 10	7729	9070	1341	91.75	14.6	T_5B_3I	40	50	9.6	39	2300	SANDSTONE. SILTSTONE : BROKEN TEETH
11.	J 33	8½	3 x 10	9070	9496	426	29.00	14.6	$T_7B_5O_{2/8}$	40	50	9.5	39	2350	Pz METAMORPHICS " "
12.	XD 7	8½	3 x 10	9496	9613	117	13.5	8.6	$T_8B_8O_8$	35	60	9.5	42	2650	" " LOST 2 CONES
13.	H7UG3	8½	3 x 10	9613	REAMING		3.5	-	$T_4B_5O_2$	3 - 5	60	9.5	42	2200	" "
14.	W7R2J	8½	3 x 13	9613	9663	50	6.5	7.6	$T_8B_8O_2$	30	60	9.5	41	1500	" "
15.	J 44	8½	3 x 12	9663	9683	20	4.5	4.4	T_3B_1I	15-35	50	9.5	42	1600	" "
16.	J 55	8½	3 x 12	9683	9729	46	7	6.6	T_2B_1I	10	50	9.5	42	1700	" " PULLED TO CORE.
17.	D 33	6 1/8	-	9729	9737	8	3	2.6	-	5 - 8	35-50	9.5	42	900	DIABORD COREHEAD

TABLE 2. MUD PROPERTIES

MUD PROPERTIES IN EUMERALLA -1

1. DEPTH FEET BDF
2. CUM. COST A$
3. MUD WEIGHT lbs/gal.
4. FUNNEL VISC. SECS.
5. PLASTIC VISC. CP.
6. YIELD POINT 15/100 sq. ft.
7. GELS lb/100 sq. ft. 10 sec/10 min.
8. API WATER LOSS ml.
9. SAND %
10. DIESEL OIL %.
11. SOLIDS %.
12. pH
13. SALINITY PPM Cl.
14. REMARKS.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
407	660	9.2	45	15	14	2-12	13	2	NIL	7	10.0	400	Only possible to run desander or desilter.
1016	1078	9.2	42	8	13	9-16	16	½	NIL	12	9.0	400	Only possible to run desander or desilter.
1150	1078	9.3	49	7	10	10-16	16	3/4	NIL	12	8.0	300	Ran 20" casing. Shoe at 1133ft.
1239	1253	8.8	40	10	20	10-25	30	½	NIL	4	11.0	350	
2300	1987	8.9	38				25	Trace	NIL	4	10.0	300	
2736	3383	9.0	40	14	15	3-12	20	Trace	NIL	4	9.5	300	
3050	4284	9.3	50	19	15	2.5	15	Trace	NIL	6	9.5	300	Ran 13 3/8" casing
3171	4594	9.1	35	6	2	1-2	18	¼	NIL	6	10.0	300	

TABLE 2. MUD PROPERTIES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
3925	5280	9.3	43	14	16	2-6	13	Trace	NIL	7	9.5	300	
4665	5280	9.1	45	15	18	3-9	16	Trace	NIL	6	9.5	300	
5370	6076	9.2	42	13	14	2-6	12	Trace	NIL	6	9.5	300	
5660	6702	9.2	38	10	6	2-3	11	Trace	NIL	7	9.3	300	Tight hole on trip 4400' - 4700'
6221	7356	9.5	38	10	4	1-3	8	Trace	NIL	8	9.5	300	
6375	7677	9.5	38	13	10	1-3	8	Trace	NIL	7	9.5	300	Log and run 9 5/8" casing
6580	8400	9.4	39	13	10	2-5	8.6	Trace	NIL	5	10.0	400	
6807	9283	9.3	43	18	14	2-9	7.0	Trace	NIL	5	10.0	300	
7039	9623	9.3	41	15	13	2-5	6.0	Trace	NIL	5	9.0	300	
7392	9923	9.4	39	14	10	1-3	6.0	Trace	NIL	7	9.5	350	
7697	10331	9.4	40	13	7	1-2	6.0	Trace	NIL	7	9.5	350	
7780	10455	9.4	38	13	8	1-2	6.2	Trace	NIL	6	9.5	300	
7992	10809	9.4	39	12	5	1-2	6.2	Trace	NIL	6	9.5	300	

TABLE 2. MUD PROPERTIES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
8400	11530	9.6	42	15	11	1-2	6.0	Trace	NIL	7	9.0	350	
8776	12309	9.5	41	13	9	1-2	6.3	Trace	NIL	7	9.5	300	
9070	12725	9.6	42	14	11	1-3	6.3	Trace	NIL	7	10.0	350	
9136	12844	9.6	39	11	8	1-2	7.6	Trace	NIL	7	9.5	300	Wash out.
9496	14024	9.5	39	11	8	1-2	6.6	Trace	NIL	6	9.5	300	Wash out.
9570	14398	9.6	39	14	12	1-3	6.5	Trace	NIL	6	9.0	350	
9613	14504	9.5	42	14	10	1-2	6.6	Trace	NIL	6	9.5	350	
9617	14777	9.5	37	10	6	1-2	6.8	Trace	NIL	6	9.5	350	
9682	15761	9.5	41	14	11	1-3	5.6	Trace	NIL	7	9.5	350	
9729	16041	9.5	42	13	8	1-2	6.0	Trace	NIL	6	9.5	350	
9737	16041	9.5	42	13	8	1-2	5.6	Trace	NIL	7	9.5	350	Core # 1 + Log. TD.

TABLE 3

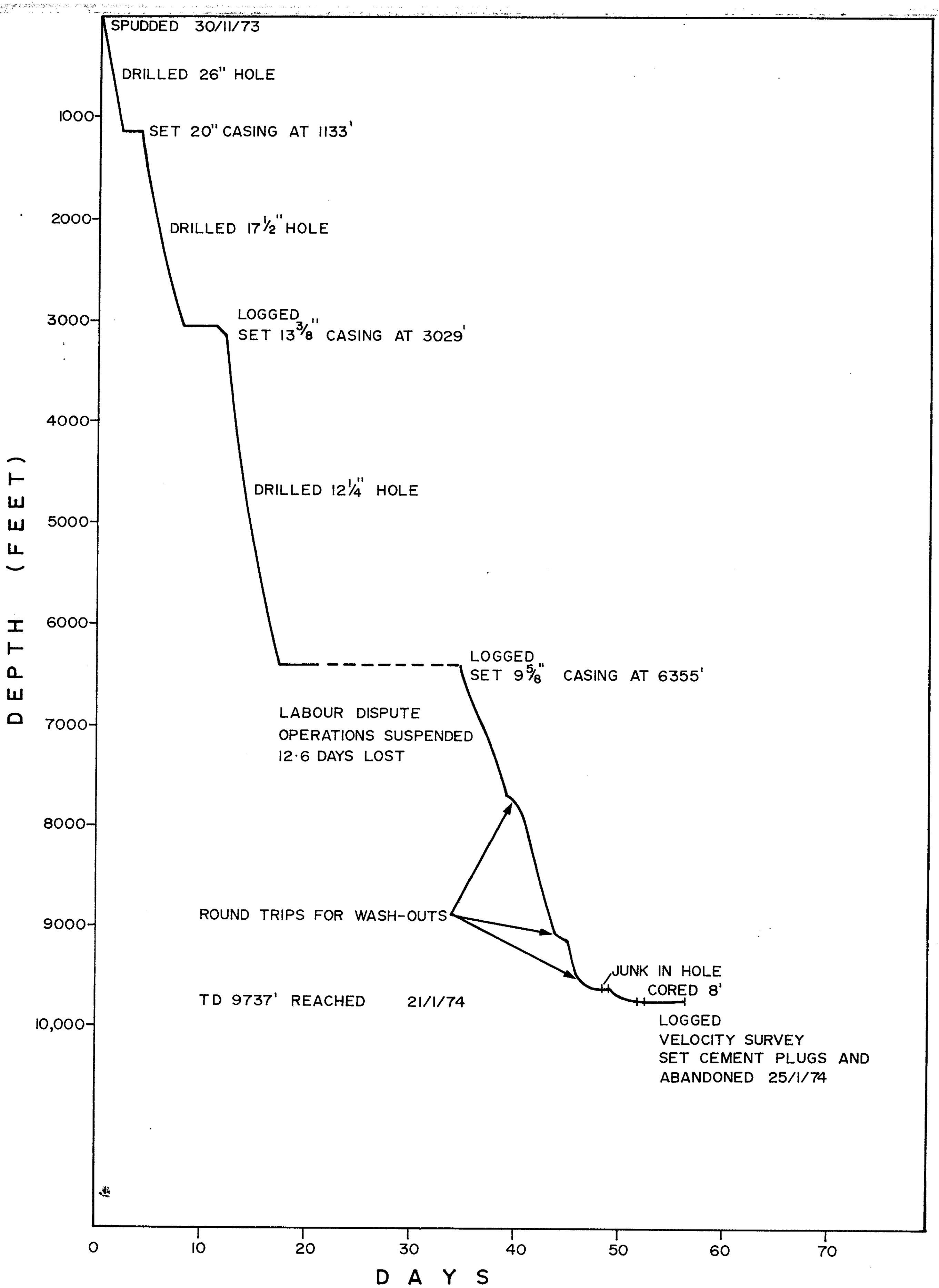
MUD CHEMICAL CONSUMPTION AND COST

CHEMICAL	CUMULATIVE CONSUMPTION				CUMULATIVE COST ($A)
Barytes	560	100	lb	bags	2,374
Bentonites	1327	100	lb	bags	7,099
Spersene	328	50	lb	bags	3,936
CMC - LV	175	50	lb	bags	3,500
Sodium Bicarbonate	12	931/3	lb	bags	95
Soda Ash	3	931/3	lb	bags	21
Aluminium Stearate	1	18	kg	bag$	27
D - D Compound	4	55	gal	drum	1,160
Caustic Soda	66	140	lb	drum	1,320
					19,532

TABLE 4

WIRELINE LOGGING OPERATIONS

DAT	LOG	DEPTH INTERVAL, FEET
8.12.73	LL-9 + SP	3032 - 1133
8.12.73	BHC + GR	3038 - 1133 (GR to surface)
8.12.73	FDC + CAL	3045 - 1133
9.12.73	CST	1 GUN
18.12.73	BHC + GR	6341 - 3030
19.12.73	FDC + CAL	6350 - 3030
19.12.73	HDT	6349 - 3030
19.12.73	CST	1 GUN
23.12.73	CBL	6260 - 2600
21. 1.74	LL-9d + SP	9717 - 6355
21. 1.74	BHC + GR	9706 - 6355
22. 1.74	FDC + CAL	9706 - 6334
22. 1.74	HDT	9705 - 6355
22. 1.74	CST	1 GUN
19. 12. 73	LL-9 + SP	6338 - 3030



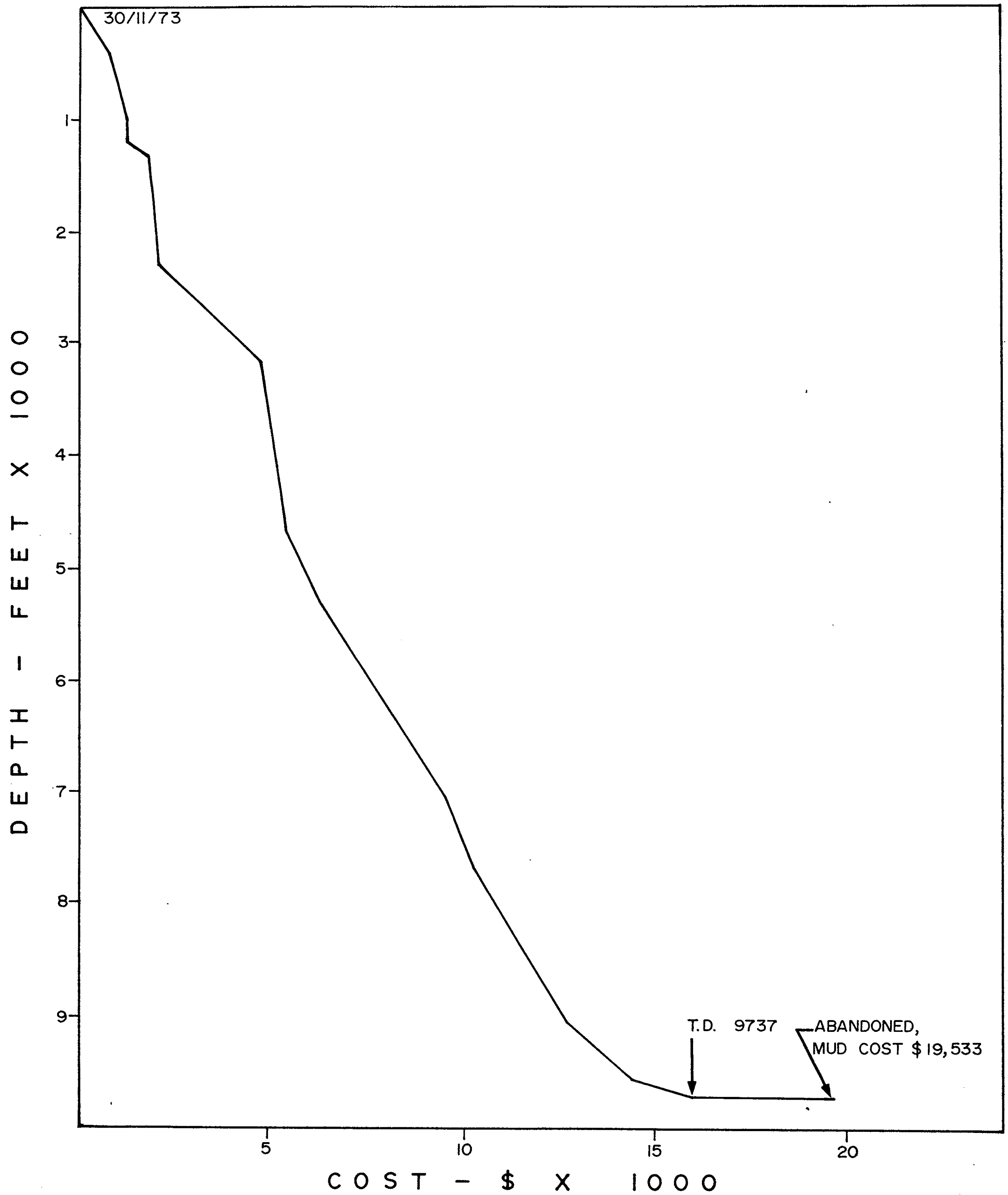
OTWAY BASIN

NORTH EUMERALLA - 1
TIME vs DEPTH

SDA 182 Fig I

February 1974

SDA Drg No. 7632



OTWAY BASIN

NORTH EUMERALLA-1

MUD COST Vs DEPTH

SDA 182 Fig 2

date February 1974

SDA Drg No 7634

III. GEOLOGY

1. REGIONAL GEOLOGY

The Otway Basin (encl. 1) is an east-west trending trough containing a thick Mesozoic/Tertiary section that extends from Cape Jaffa (South Australia) to the Mornington Peninsula (Victoria) and which is underlain by north/south trending Palaeozoic Basement rocks of the Tasman geosyncline.

The Otway Basin was probably initiated in the Upper Jurassic when continental sandstones, shales and basaltic volcanics accumulated locally (Basal unit). This episode was followed in the Lower Cretaceous by the deposition, apparently also local, of fluviatile quartz sandstones (Pretty Hill sandstone) often interbedded with continental lithic (volcanic) sandstones, siltstones and shales (Geltwood Beach Formation). The Lower Cretaceous sedimentation was completed with regional deposition of similar continental lithic (volcanic) sandstones, siltstones and shales (Eumeralla Formation). At least locally, deposition was interrupted by a short lived phase of uplift and erosion (Intra-Eumarella unconformity).

Basal unit, Pretty Hill/Geltwood Beach and Eumeralla Formations make up the Otway Group.

At the end of the Lower Cretaceous a widespread episode of block faulting affected the area, causing the formation of the Dartmoor Ridge, the Warrnambool High and the Otway Ranges (encl. 1).

During Upper Cretaceous and Lower Tertiary times these highs effectively divided the area into four sub-basins; the Torquay, Port Campbell, Tyrendarra and Gambier Embayments.

East of the Otway Ranges (Torquay Embayment) a continental, paralic and marine sequence of conglomerates, sandstones, coals, shales and dolomites accumulated.

West of the Otway Ranges (Port Campbell, Tyrendarra and Gambier Embayments) time equivalent sediments consist of marine sandstones and shales (Flaxmans and Belfast Formations) locally underlain by continental sandstones (Waarre Formation) and regionally overlain by marine and paralic sandstones, conglomerates and shales associated with minor coals (Paaratte, Curdies, Pebble Point and Dilwyn Formations). The Waarre, Flaxmans, Belfast, Paaratte, Curdies Formations form a transgressive-regressive Upper Cretaceous cycle, (Sherbrook Group). The Pebble Point and Dilwyn Formations represent a transgressive-regressive Paleocene to Lower Eocene cycle, (Wangerrip Group). The Wangerrip Group is locally capped by the marine sandstones, marls and carbonates of the Upper Eocene Nirranda Group.

During Oligocene and Pliocene a sequence of marine marls, carbonates and minor sandstones was deposited over the whole of the basin (Heytesbury Group).

From Pliocene to Recent, after a local episode of marine sandy carbonate deposition the area has undergone uplift and basaltic volcanism which probably started locally in Early Tertiary times resulted in flows, tuffs and scoria deposits.

Generally speaking the thickness of the sedimentary units increases toward the south. Normal faulting, often downthrown basinward is the dominant structural element of the Otway Basin. The Upper Jurassic/Lower Cretaceous sequence is thick and complexly faulted while the Upper Cretaceous and Tertiary section is thin and much less affected. Folding is uncommon. Palaeontological, palynological and seismic reflection data indicate that the major units (Heytesbury, Nirranda, Wangerrip, Sherbrook and Otway Group) are bounded by unconformities.

In addition seismic reflection shows an unconformity, probably more local, within the Eumeralla Formation.

2. PREVIOUS WORK

The two Frome/Shell onshore permits of the Otway Basin are entirely covered by gravity and magnetic surveys. In addition a considerable mileage of single fold seismic and about 300 miles of high multiplicity (6-12) fold lines have been recorded in the area (encl. 2).

Recognised traps are in general small and almost invariably associated with faulting.

Of the 51 wells drilled in the Otway Basin 10 were drilled in PEP5 and PEP6 (encl. 2).

Although no commercial quantities of hydrocarbons were discovered in the basin significant shows were recorded in the Port Campbell area from the basal Upper Cretaceous Waare sandstone and from the underlying Lower Cretaceous Eumeralla Formation.

Porous Tertiary and late Upper Cretaceous Formations were generally found to be freshwater flushed. They are no longer considered an objective throughout the permits.

Considerable drilling efforts failed to prove a commercial petroleum accumulation within the sealed Upper Cretaceous Waare sandstone. The hydrocarbon potential of this reservoir is now rated very low.

However the sandstones of the Lower Otway Group (Pretty Hill sandstone/ Geltwood Beach Formation) sealed by the Eumeralla Formation were only tested in a valid structural position near the basin margin (Pretty Hill-1 and north of the permits boundary Tullich-1, Casterton-1, Hawkesdale-1, Woolsthorpe-1 and Garvoc-1).

On present knowledge it is believed that hydrocarbons may have been generated in a more basinward position, within the Lower Cretaceous sequence. The absence of petroleum accumulations near the basin margin could be due to the strong faulting which affected Lower Cretaceous sediments and to the fluviatile nature of the reservoir, both preventing up dip migrations of hydrocarbons at least in appreciable quantities. So far only in Eumeralla-1 (T.D. 10,308 ft.) has the reservoir been encountered at the depth of expected hydrocarbon generation. However the structure, drilled in 1962, had been defined on poor singlefold data. Multifold lines shot across the area in 1970 and 1973 show that the well was drilled off structure and cannot be considered a valid test.

Exploration efforts in PEP5 and PEP6 are therefore concentrated on the coastal strip, where the Lower Cretaceous objective is deeper and hence in a more favourable position to be charged by hydrocarbons inferred to have been generated nearby.

3. NORTH EUMERALLA-1 STRATIGRAPHY

A. HEYTESBURY GROUP (D.F. to 1210 ft.)

A1. Port Campbell Limestone (D.F. to 300 ft.)

Lithology: Lime packestones to grainstones and associated wackestones;

mainly yellow in the upper part and and grey in the lower part. of the section; coarse to fine grained; generally friable; subrounded and moderately sorted; abundant fossil debris and Foraminifera; presence of limonite; traces of quartz, glauconite, pyrite, ?phosphate.

Minor argillaceous and dolomitic stringers

Age: ?Oligocene to Miocene.

Environment: Shallow marine.

A2. Gellibrand Marl (300 ft. to 1100')

Lithology: Soft marls; mainly grey; abundant fossil debris and Foraminifera; traces of glauconite, pyrite, limonite, quartz and carbonaceous matter.

Minor interbeds of limestones. As above.

Age: ?Oligocene to Miocene.

Environment: Shallow marine.

A3. Clifton Formation (1100 ft. to 1210 ft.)

Lithology: Quartz sandstones; red to brown; fine to medium; generally subrounded; moderately sorted; calcareous, dolomitic and sideritic; moderately hard; presence of limonite, glauconite, ?phosphate, chlorite, pyrite, fossil debris.

Minor conglomeratic layers of the same composition.

Interbeds of Marls and limestones as above but with more limonite and more quartz.

Age: Upper Eocene to ?Oligocene.

Environment: Shallow marine.

UNCONFORMITY

B. WANGERRIP GROUP (1210 ft. to 2895 ft.)

B1. Dilwyn Formation (1210 ft. to 2610 ft.)

Lithology: Quartz sandstone; mainly grey; predominantly coarse, occasionally conglomeratic in the upper section and fine below 1650 ft.; subangular to subrounded; poorly to well sorted; friable; silty, with a few carbonate cemented interbeds below 2300 ft.; presence of pyrite, minor feldspar, chert, metaquartzite and chloritic schist fragments; traces of limonite; traces of glauconite, fossil debris and Foraminifera below 2300 ft.

Siltstones; subordinated in the upper section but frequent below 2000 ft.; dark grey to dark brown; friable; carbonaceous; presence of pyrite; traces of glauconite, fossil debris and Foraminifera below 2300 ft.

Presence of coals

Traces of sideritic layers below 2300 ft.

Age: Lower Eocene.

Environment: Paralic.

B2. Pebble Point Formation (2610 ft. to 2895 ft.)

Lithology: Sandstones; commonly dark brown to dark green; fine to medium; subangular to subrounded; generally poorly sorted; composed of quartz, minor metaquartzite debris, micas and feldspar often coated with chlorite; limonitic and chloritic pellets very abundant in the upper part of the unit; silty with a few carbonate cemented interbeds; friable to moderately hard; presence of limonite, pyrite and ?phosphate; traces of glauconite, fossil debris and Foraminifera.

Subordinated siltstones; generally dark brown to dark grey, slightly carbonaceous, often pellety, odithic and micaceous; traces of glauconite, fossil debris and Foraminifera.

Traces of sideritic layers.

Age: Paleocene.

Environment: Shallow marine.

UNCONFORMITY

C. SHERBROOK GROUP (2895 ft. to 3315 ft.) 3315 2895 420

C1. Curdies Formation (2895 ft. to 3100 ft.)

Lithology: Quartz sandstones; mainly grey; coarse; friable; subangular to subrounded; poorly to well sorted; silty with rare carbonate cemented beds; presence of lithic fragments (metaquarzite, schists, aphanitic siliceous rocks); traces of feldspar, micas, pyrite and limonite.

Siltstones; dark grey to dark brown, often pyritic, micaceous and carbonaceous.

Presence of Coals

Age: Santonian/Coniacian

Environment: Paralic to alluvial.

C2. Paaratte Formation (3100 ft. to 3210 ft.)

Lithology: Sandstones; generally dark green and fine; subangular to subrounded; poorly to well sorted; composed of quartz and chloritic pellets; presence of feldspar and lithic grains (metaquartzite, chloritic rock fragments, aphanitic siliceous debris); generally silty with a few carbonate cemented layers; traces of pyrite, limonite, glauconite, fossil debris, ?phosphate; friable to moderately hard.

Subordinated siltstones; dark grey to dark green, often chloritic, slightly carbonaceous, pyritic; traces of fossil debris and glauconite.

Age: Santonian/Coniacian.

Environment: Marginal marine.

C3. Belfast Mudstone (3210 ft. to 3315 ft.)

Lithology: Mudstones, silty to sandy; dark grey, chloritic, glauconitic, friable; traces of pyrite, carbonaceous matter, siderite, fossil debris and Foraminifera.

Age: Santonian/Coniacian.

Environment: Restricted marine.

UNCONFORMITY

D. OTWAY GROUP (3315 ft. to 8850 ft.)

D1. Eumeralla Formation (3315 ft. to 7300 ft.)

3315 ft. to 7150 ft.

Lithology: Mudstones; mainly greenish above 6400 ft. and dark grey below this depth; loose; chloritic; often carbonaceous and pyritic.

Siltstones; mainly greenish above 6400 ft. and dark grey below this depth; loose to moderately hard; composed of lithic fragments, quartz, feldspar, koolinite and chloritic clay; presence of micas, carbonaceous matter and pyrite.

Subordinated sandstones; light coloured; fine to very fine; angular to subangular; moderately sorted; loose to moderately hard; composed of lithic fragments (mainly volcanic), feldspar, and quartz; silty to kaolinitic with a few carbonate cemented beds; presence of pyrite, micas and carbonaceous matter.

Presence of coal.

Age: Aptian - Albian

Environment: Continental.

*INTRA-EUMERALLA HORIZON (UNCONFORMITY)

7150 ft. to 7300 ft.

Lithology: as above unconformity.

Age: Aptian.

Environment: Continental.

*The Intra-Eumeralla unconformity is not palynologically confirmed. Evidence for it is based on seismic data (local erosion of tilted beds below the Intra-Eumeralla horizon, in PEP's 5 & 6.)

D2. Geltwood Beach Formation (7300 ft. to 8850 ft.)

Lithology: Similar to the Eumeralla Formation but the sandstones are more frequent and slightly coarser. They contain a higher percentage of quartz (occasionally >50%) and some metamorphic debris as well as rare garnets. Mudstones and siltstones are mainly dark grey. Coal is rare.

Age: Aptian - Neocomian

Environment: Continental (fluviatile)

E. BASEMENT (8850 ft. to T.D.)

E1. Weathered zone (8850 ft. to 8990 ft.)

Kaolinitic sandstone composed of quartz, feldspar and micas.

E2. Meta-arkose (8990 ft. to T.D.)

Homogeneous greenish to pink rock, very hard and composed of quartz, feldspar and thin, folded bands of micas (for details see Appendix 3).

Age: ?Paleozoic

3. NORTH EUMERALLA -1 STRATIGRAPHIC SUMMARY

Group	Formation	Age	Top b.d.f. (ft)	Thick-ness (ft)	Lithology
HEYTESBURY (Shallow marine)	Port Campbell Limestone	?OL-Mi	D.F.	300	Limestones
	Gellibrand Marl	?OL-Mi	300	800	Marls, Minor Lmst.
	Clifton Formation	Eo.U.-?OL	1100	100	Sst, Marls, Lmst.
			Unconformity		
WANGERRIP (sh.mar. to paralic)	Dilwyn Formation	Eo.L	1210	1400	Sst, minor siltst., coal.
	Pebble Point Form.	Pc	2610	285	Ool. Sst., minor siltst.
			Unconformity		
SHERBROOK (shallow mar. to paralic)	Curdies Form.	Sa-Co	2895	205	Sst, siltst., coal
	Paaratte Form.		3100	110	Pellety Sst. and Silst.
	Belfast Mudstone		3210	105	Silty Mudstones
			Unconformity		
OTWAY (Continental)	Eumeralla Formation	Ap-Ab	3315	3985	Mudstones, siltst., minor lithic sst, coal.
			Seismic Unconformity		
		Ap			
	Geltwood Beach Formation	Ap-Nc	7300	1550	Idem but sandstones contain a higher % age of quartz
			Unconformity		
	Basement	?Pz	8850	140	Weathered zone
			8990		meta-arkose

TABLE 5.

4. STRUCTURE

Two reflections were mapped at North Eumeralla:

1. the Intra-Eumeralla horizon, reflecting structure at the objective level (the underlying seismically not mappable Lower Otway Group sandstones)

2. a deeper event thought to represent the top of the basement.

North Eumeralla is a dip-fault combination trap (encl. 8). A major north, north-east hading normal fault separates an upthrown block in the south from a downthrown block in the north. The reservoir sequence, closed by west, south and south-east dips on the upthrown block, abuts against the sealing Eumeralla Formation in the downthrown block. The dipmeter corroborates the direction of dips shown by the seismic between Intra-Eumeralla and Basement reflections.

On the basis of seismic evidence (local truncation of underlying events, seen elsewhere in the permits) the Intra-Eumeralla horizon is related to an unconformity. The hiatus however could not be confirmed palynologically (Appendix 5) either in North Eumeralla-1 or in previous wells.

Well velocity data (Appendix 2) show that the Intra-Eumeralla unconformity is at 7150 ft. b.d.f.. This depth corresponds to a slight shift on the sonic log (decrease in transit time).

Basement was found at 9000 ft. b.d.f., approximately 2000 ft. higher than expected. In time, according to the well shoot its top is at 1.87 seconds (encl. 9) instead of the 2.05 seconds anticipated. Intra-basement reflections appear to originate from within the low grade metamorphic rocks which underlie the Mesozoic sedimentary section in the area (Appendix 3).

5. RELEVANCE TO OCCURRENCE OF PETROLEUM

Apart from sporadic traces of C_1 (less than 0.1%) recorded below 5000 ft. (encl. 4), in the Lower Cretaceous Otway Group, no hydrocarbons were noted in North Eumeralla-1.

Electrical logs show that all reservoirs are water saturated.

Water salinities in the marine porous Tertiary and Upper Cretaceous section are of 1200 to 1500 ppm (Appendix 1). As elsewhere in the permits the intercalated shales do not seal and the sequence is fresh-water flushed.

Water salinities in the continental Lower Cretaceous Otway Group are of 2000 ppm in the Eumeralla Formation and of 10,000 to 20,000 ppm in the Geltwood Beach Formation.

6. RESERVOIRS

Porosities in the Tertiary and Upper Cretaceous fresh-water flushed reservoirs are high, as much as 30% (Appendix 1).

Porosities in the Lower Cretaceous Eumeralla Formation are very poor to nil. As elsewhere in the permits extensive diagenetic alteration of the volcanic detritus, imparting a characteristic greenish colour to the rock, destroyed all reservoir potential in the sandstones of that formation which can be considered a good seal for the underlying objective (Pretty Hill sandstone/Geltwood Beach Formation).

Approximately 400 ft. of sandstones with poor to fair porosities (max. 15%) were found in the Geltwood Beach Formation. Similar reservoir characteristics exist within this interval at Eumeralla-1 (encl. 7), 6 km to the south-east. They stand in contrast with the excellent porosities measured in the Pretty Hill sandstone at Pretty Hill-1, 12 km to the east. Like in Eumeralla-1 the sandstones were heterogeneous in composition (quartz, volcanic and other lithic fragments) and like in other Otway Basin wells they were probably affected by burial diagenesis. In Pretty Hill-1 quartz is a major component of the section which lacks volcanic detritus and hence the sandstone escaped alteration.

7. CONTRIBUTION TO REGIONAL GEOLOGY

Owing to its position with regard to the basin margin the North Eumeralla-1 sedimentary sequence was prognosed to be more similar to Pretty Hill-1 than to Eumeralla-1, the two nearest control points in the area (encl. 7).

However drilling has shown that North Eumeralla-1 and Eumeralla-1 are stratigraphically comparable, differing from Pretty Hill-1 by:

- an absence of the Upper Cretaceous Flaxman Beds (probably due to non deposition)
- a considerably reduced development of the Lower Otway Group reservoirs; the Pretty Hill sandstone is replaced in the West by the Geltwood Beach Formation, an alternation of Eumeralla Formation and Pretty Hill sandstone lithologies (encl. 7).

The Pebble Point Formation which was known to be Upper Paleocene in the Otway Basin, contains in North Eumeralla-1 the Tricolpites longus zone (Appendix 5) indicating that the formation locally extends into the Lower Paleocene.

IV CONCLUSIONS

North Eumeralla-1 is thought to represent a valid test. The Lower Cretaceous reservoir objective is believed to be sealed, closed and at the depth of hydrocarbon generation.

The absence of hydrocarbons in the well is attributed to a lack of source rocks in the area.

Due to their content of volcanic and other lithic detritus the sandstones of the Lower Otway Group were affected by burial diagenesis and were much less porous than in Pretty Hill-1. Reservoir characteristics are likely to deteriorate in the deeper Terka and Yamabuk nearby prospects (encl. 3) in case the quartz content is not as high as in Pretty Hill-1.

The test therefore downgrades the hydrocarbon potential of the nearby Terka and Yamubuk prospects.

Once more in the permits the Tertiary and Upper Cretaceous porous section was found to be fresh-water flushed and not prospective.

Since Intra-Basement reflections appear to exist at North Eumeralla seismic interpretation done at basement level in the remainder of PEP's 5 and 6 is questionable.

GENERAL REFERENCES

Geology

1. B.M.R., 1966 — A preliminary review of the Otway Basin; B.M.R. Rec. 1966/1970.

2. Wopfner, H. and Douglas J.G. (eds), 1971. — The Otway Basin of Southeastern Australia, Spec. Bull. Geol. Survs. S.A. and Vic., 464 p.

Drilling

3. Bain J.S., 1962 — Well completion report Pretty Hill-1, Southwest Victoria; Frome-Broken Hill Co. Pty. Ltd., Report No. 7200-G-94.

4. Bain J.S., 1963 — Well completion report Eumeralla-1, Southwest Victoria; Frome-Broken Hill Co. Pty. Ltd., Report No. 7200-W-21.

Geophysics

5. Shell Dev. (Austr.) Pty. Ltd., 1973. — The 1973 coastal strip seismic survey, Otway Basin; S.D.A. Report No. 157.

APPENDIX 1

PETROPHYSICAL EVALUATION (by M. Russell)

The following logs were run in North Eumeralla-1:

Laterolog-9 Deep/SP	1133' - 9700'	
Sonic/Gamma Ray	1133' - 9706'	(Gamma Ray to surface)
FCD/Caliper	1133' - 9723'	
HDT	1133' - 9710'	

Additionally 85 sidewall samples were shot of which 68 were accepted. Bottom hole temperatures measured on each log indicate the static temperature gradient to be:

$$T^{o}F = 60^{o}F + .0175 \times \text{depth (ft.)}$$

A continuous gas monitoring by Geoservices of the mud returns indicated that no hydrocarbon bearing intervals were penetrated in this well, a similar conclusion being obtained from a petrophysical analysis of Schlumberger logs run subsequently.

Owing to the effect of shale, sonic transit times are high in most sands, consequently the porosity and water salinity estimates which follow are based predominantly on density-derived porosities and borehole corrected Laterolog-9 Deep readings.

Interval	Formation	Summary of Petrophysical Properties
0 - 300'	Port Campbell LST	)
300' - 1100'	Gellibrand Marl	)Fresh water flushed, poor reservoir
1100' - 1210'	Clifton Formation	)properties.
1210' - 2610'	Dilwyn Formation	Porous and permeable sands with increasingly thick shale interbeds, Ø = 30%, 1200 ppm NaCL equivalent.
2610'- 2895'	Pebble Point Formation	Shaly sands, permeable, with Ø = 25%, 1500 ppm NaCL equivalent.
2895' - 3100'	Curdies Formation	)Shaly sands, shale interbeds, Ø = 20%,
3100' - 3210'	Paaratte Formation	)1500 ppm NaCL equivalent.
3210' - 3315'	Belfast Mudstone	)Very shaly lithic sandstone, shale and
3315' - 7300'	Eumeralla Formation	)coal interbeds, poor reservoir characteristics down to 5000', below which all effective porosity and permeability has been destroyed by the abundant argillaceous and siliceous cement. Salinity of the formation water appears to increase with depth from 2000 to ± 10,000 ppm NaCL equivalent.
7300' - 8850'	Geltwood Beach Formation	Sand shale ratio of ± 1:3 but sands exhibit poor reservoir characteristics. Porosities range from 5-15% with an average of 8%. Formation water becoming still more saline, 10-20,000 ppm NaCL equivalent.
8850' - 9737' (TD)	?Palaeozoic Basement	Nil porosity nor permeability.

Conclusions

The formations penetrated by this well are interpreted as being fresh water bearing (flushed) down to the top of the Belfast Mudstone at 3210'. Below this depth reservoir characteristics of the sands are poor owing to an ever increasing amount of argillaceous and silicious cement which has destroyed most of the effective porosity. The absence of any resistivity anomalies and the lack of hydrocarbon shows while drilling lead one to conclude that no hydrocarbon bearing intervals were penetrated by North Eumeralla-1.

APPENDIX 2

WELL VELOCITY SURVEY (by J. Frazer)

On 23rd January 1974 the North Eumeralla-1 Well Velocity Survey was conducted by personnel from Austral United Geophysical. Dynamite was used as an energy source. An experiment using small charges in the mud pit was successful. The down-hole geophone used was a velocity sensitive, wall-lock type.

A total of 13 levels were shot over a period of 6 hours. A reversed refraction spread and uphole survey were conducted for weathering control.

With the exception of two shallow levels which showed casing breaks, record quality was good.

SURVEY INFORMATION

Date of Survey	23rd January, 1974
Interval Surveyed	1016' to 9720' B.K.B.
Number of Shots	26
Levels Shot	13
Levels Checked	10
Charge size	10 lb. in shot holes 2 & 4 lb. in mud pit
Depth of shot	48' to 61' in shot holes 6' in mud pit
Equipment	Recorder-SIE-RS4 Well Geophone - Geospace Velocity sensitive Wall-Lock with 13" arm. Reference Geophones - HSJ-14 Cable - Schlumberger Explosives - Anzite Blue Gelignite - Boosters and Detonators Drill - Mahew 1000
Personnel	Observer - John Larsen Shooter - Keith Hunt
Trace Arrangement	Trace No. 1 - Well Geophone - high gain Trace No. 2 - " " - medium gain Trace No. 3 - " " - low gain Trace No. 4 - Reference Geophone Trace No. 5 - Uphole Geophone Trace No. 6 - Timebreak

OPERATIONS

United Geophysical advised SDA that they now use small charges (2-4 lb) in the mud pit for onshore velocity surveys. SDA decided to test this method. However, because the deepest well surveyed with this technique by United was 8000', and North Eumeralla-1 was expected to be considerably deeper it was necessary to be prepared to shoot dynamite in shot holes to guarantee breaks at deeper levels. Holes were drilled to 64' about 500' to the north and south of the well and loaded with 10 lb. of Anzite Blue.

The Southern Australia Team programmed the levels to be shot from sonic logs and preliminary lithology. The 13" arm on the locking geophone was too long to firmly set in the casing. It was necessary to catch on a joint or rough spot before the arm would hold the weight of the geophone. As a result it was generally not possibly to be exactly on the programmed level. The first series of shots were from the mud pit to assess the penetration of the small charges. Breaks were good down to TD with this method and as it was much easier for the shooter to fire these shots than the shot holes the majority of the survey was conducted in this manner. At 8850' B.K.B. both shot holes to north and south and a mud pit shot were taken to compare weathering statics and relative energy levels.

All channels on the 10 lb. shots showed considerable crossfeed. A shunt resistance on the uphole geophone decreased this effect somewhat. Some records showed crossfeed from a 100 Hz. signal, presumably from the timing line generator, however the waveform was regular so breaks were easily picked. Inspection of the records at 1016' and 1511' showed that the casing break was too strong to easily pick the formation break. A last shot at 2000' again had a strong casing break. This record was improperly fixed and was not useable.

WEATHERING CONTROL

After the velocity survey a reversed refraction profile and an uphole survey were shot to give weathering control.

The refraction spread was laid out from the mud pit to the north using 12 stations with a 50' interval. Three 2 lb. shots were taken, 2 from the mud pit and 1 at the other end of the spread.

An uphole survey using shots every 10' down to 84' was then conducted using 2 boosters for each level.

COMPUTING

The sonic curve on the preliminary field T-Z plot was tied to the shot taken at the 2700' b.k.b. level and showed a maximum variation of 7 milliseconds for all levels down to TD. Shots above 2700' were obscurred by a strong casing break. The break picked for 1500' b.k.b. is questionable and that for 1000' b.k.b. is not identifiable. All other levels gave good breaks and except for the shot from hole N-3 at the 7503' b.k.b. level the difference was consistently within 5 milliseconds. The 7500' level was reshot and a consistent result obtained (Table 6). A plot of the integrated sonic curve tied to the well shoot levels is enclosed (encl. 10). The average interval velocity from the sonic log over each 10 millisecond interval below 2000' is plotted on the same graph.

The depth and velocity of the first refractor was computed from the refraction spread (fig. 4) which showed a shallow weathered layer <17' and a velocity of 5800 ft/sec. This was very close to the velocity used for calculation of the datum static on the seismic section (6000 ft/sec). The uphole shoot gave similar results.

RECOMMENDATIONS AND RESULTS

The velocity survey showed good agreement between shots at all levels with one exception. Only small adjustments to the integrated sonic curve were required to tie all levels.

Good breaks were obtained with both shot holes and charges in the mud pit.

The mud pit shots gave more consistent times to each level than those in shot holes. This result was not unexpected because of the variation in shooting medium and larger horizontal component of travel path when shooting from shot holes.

It is recommended that the RS4 recorder not be used for future surveys. The camera showed occasional weak or missing timing lines and the "dry-write" system is inappropriate for this type of survey. The recorder had a relatively high level of crossfeed on all channels.

If it is essential to tie shallow levels it is necessary to use a pressure sensitive geophone to avoid strong casing breaks. It should be possible to run in a pressure geophone for shallow levels then change over to the wall-locking geophone without undue loss of time.

The 13" arm was too long for the 9-5/8" casing. To avoid slipping the arm should be no longer than 10".

OBSERVERS LOG
North Eumeralla -1
Date of Survey 23/1/74

Record Number	Geophone Depth (kb)	Shot Depth	Charge (lb)	Shot Location	Time	Remarks
1	1016	6	2	mudpit	0200	survey commenced 2am
2	1511	6	2	"	0230	
2a	1511	6	2	"	0235	
3	2694	6	2	"	0245	
4	3214	6	2	"	0300	
5	3718	6	2	"	0315	
6	5008	6	2	"	0325	
7	5994	6	2	"	0335	
8	5994	60	10	N1	0355	
9	6500	48	10	N2	0420	
10	6500	6	2	mudpit	0440	
11	7500	6	2	"	0500	
12	7503	61	10	N3	0515	
13	8200	56	10	N4	0525	
14	8850	60	10	N5	0540	
15	9720	6	4	mudpit	0600	
16	8850	6	2	"	0615	
17	8850	60	10	S1	0625	
18	8203	53	10	S1	0636	reload
19	7500	6	2	mudpit	0650	
20	5996	6	2	"	0710	
21	5004	6	2	"	0725	
22	3711	6	2	"	0740	
23	3203	6	2	"	0750	
24	2711	6	2	"	0800	
25	1997	6	2	"	0810	no record

Uphole survey commenced 0930 completed 1020

shots	8
spacing	10'
levels	14' to 84'
charge	2 boosters

Refraction survey commenced 1100 completed 1300

shots	3
position	N and S of spread S - on trace no. 1 N - 50' off no. 12
charge	2 lb.
traces	12
interval	50'

OBSERVER: J. Larsen
SHOOTER : K. Hunt

TABLE 6.

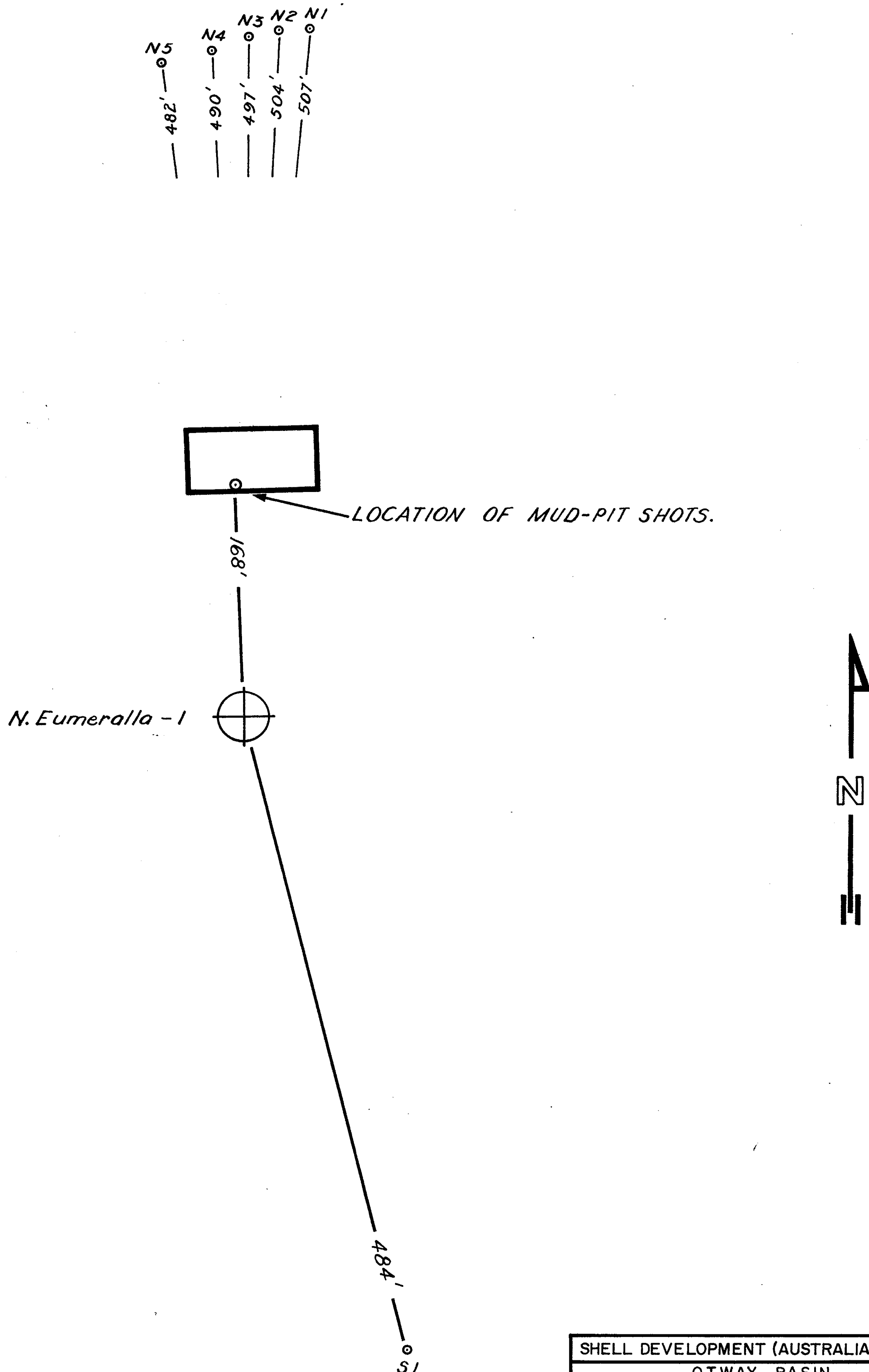
PE905833

This is an enclosure indicator page.
The enclosure PE905833 is enclosed within the container PE902312 at this location in this document.

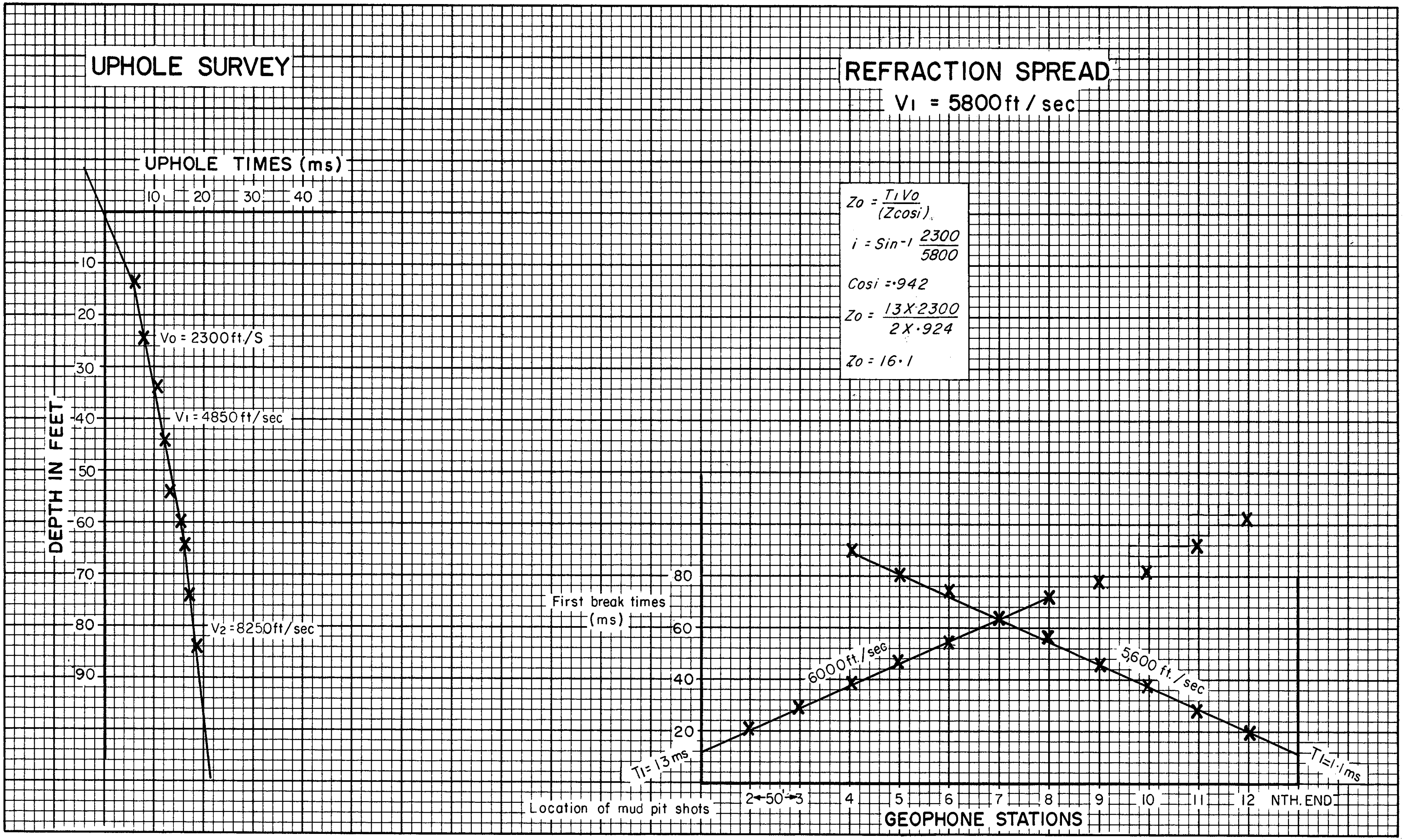
The enclosure PE905833 has the following characteristics:

ITEM_BARCODE = PE905833
CONTAINER_BARCODE = PE902312
NAME = Well Velocity Calculation Form (Computation Sheet)
BASIN = OTWAY BASIN
PERMIT = PEP/5
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Well Velocity Calculation Form (from appendix 2 --Well Velocity Survey-- of WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
W_NO = W678
WELL_NAME = NORTH EUMERALLA-1
CONTRACTOR =
CLIENT_OP_CO = SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

(Inserted by DNRE - Vic Govt Mines Dept)



SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.		
OTWAY BASIN		
NORTH EUMERALLA - I SHOT LOCATION DIAGRAM		
Author: S Aust. Team		Date: April 1974
Report No: SDA 182	Fig. 3	Draw No.: 7731



OTWAY BASIN
NORTH EUMERALLA

WEATHERING CALCULATIONS

SDA 182 Fig. 4

S.D.A. Drg. No. 7730

APPENDIX 3

SIDEWALL SAMPLES AND BOTTOM CORE DESCRIPTIONS

1172'	grey marl with traces of glauconite, pyrite, fossil fragments, quartz and carbonaceous matter.
1244'	dark grey carbonaceous silty shale.
1316'	dark grey carbonaceous siltstone with traces of micas.
1423'	dark brown carbonaceous siltstone with traces of micas.
1552'	brown carbonaceous siltstone.
1636'	idem 1552'
1771'	dark grey strongly carbonaceous and micaceous siltstone.
1815'	dark grey clayey siltstone strongly carbonaceous; traces of micas.
1896'	light grey sandy siltstone, friable, subangular to subrounded; Constituents are quartz and micas; presence of carbonaceous matter.
1990'	dark brown carbonaceous siltstone with traces of micas.
2069'	light grey micaceous siltstone with laminae of dark brown carbonaceous clayey siltstone.
2212'	light grey sandy siltstone, friable, subangular to subrounded.
2283'	light grey micaceous siltstone with laminae of black carbonaceous matter.
2431'	dark grey carbonaceous siltstone with laminae of light grey micaceous siltstone.
2526'	dark brown, pyritic and carbonaceous siltstone.
2632'	dark green siltstone containing abundant chloritic pellets and traces of carbonaceous matter.
2706'	dark brown siltstone containing abundant chloritic pellets and limonitic ooliths
2792'	idem 2706'
2852'	brown sandy siltstone containing a few limonitic ooliths
2946'	light grey siltstone, pyritic, micaceous with strongly carbonaceous laminae

3020'	dark grey siltstone, micaceous and carbonaceous.
3079'	idem 3020'
3111'	light grey to light brown sandy siltstone;traces of chloritic pellets.
3151'	dark grey siltstone, micaceous and carbonaceous - Traces of chloritic pellets.
3217'	idem 3151' but presence of glauconite.
3241'	dark green siltstone. Abundant glauconitic pellets.
3332'	greenish siltstone.
3402'	greenish silty mudstone.
3534'	idem 3402'
3596'	idem 3402'
3706'	greenish carbonaceous siltstone mainly composed of quartz and lithic fragments. Presence of micas and chloritic matter.
3790'	greenish silty mudstone.
3920'	idem 3790'
4042'	greenish carbonaceous silty mudstone.
4150'	greenish silty mudstone.
4308'	idem 4150'
4686'	greenish fine sandstone, angular, well sorted; containing quartz, feldspar, lithic fragments (mainly volcanic) and various accessory minerals. The cement is clayey (mainly chloritic).
4842'	light green mudstone.
4953'	greenish silty sandstones containing quartz and lithic fragments and various accessory minerals. The cement is clayey.
5227'	light green mudstone.
5269'	green silty sandstone containing quartz and lithic fragments, various accessory minerals and pyrite. The cement is clayey.
5467'	green silty mudstone.
5594'	idem 5467'
5729'	light green mudstone.
5884'	green silty mudstone.
6100'	light green mudstone.
6196'	light grey silty mudstone.

6294'	idem 6196'
6650'	light green silty mudstone.
6707'	grey mudstone.
6815'	dark grey calcareous mudstone.
7055'	light grey silty mudstone.
7134'	greenish siltstone containing quartz, feldspar and lithic fragments (mainly volcanic).
7300'	dark green silty mudstone.
7477'	dark carbonaceous and calcareous siltstone.
7544'	idem 7477'
7580'	light brown, fine to medium sandstone, moderately sorted, composed of quartz, rare lithic fragments and feldspar. The matrix is clay.
7770'	light grey silty mudstone.
7893'	light grey fine sandstone, moderately sorted containing quartz, lithic fragments, feldspar. Presence of various minerals. The cementing medium is carbonate mainly.
8100'	greenish silty mudstone.
8289'	grey silty and carbonaceous mudstone.
8365'	yellowish fine sandstone, moderately sorted, containing quartz, lithic fragments, feldspar; carbonate cemented.
8560'	idem 8365'.
8570'	idem 8365'.
8575'	dark grey carbonaceous and calcareous siltstone.
8647'	grey silty mudstone.
8777'	idem 8647.
8892'	friable medium to coarse grained sandstone containing quartz, feldspar, and biotite; clay matrix.
9729-9737'	Core: homogeneous rock of greyish colour with pink coloured zones, very hard with no predominant cleavage or joints. Quartz and feldspar grains of granule size were recognised and intensely folded thin bands of dark mica.

Petrographical Determination (by W. Wachsmuth)

Rock name: Meta-Arkose
Essential Minerals: Quartz, feldspar (microcline, Micro-perthite, albite), chlorite (after biotite), sericite, carbonate.
Accessory Minerals: Zircon, opaque minerals.

Grain size: Mode 0.4-1.0 mm, maximum 2.5 mm.

The rocks consists of quartz and feldspar essentially with minor chloritized biotite. The quartz is shapeless polycrystalline and the feldspar is partially replaced by sericite, carbonate and quartz or is a secondary albite. The original shape of the remnant feldspar grains is thus strongly transformed but some less corroded feldspar grains remain being well rounded and of sand to granule size. The former biotite is completely chloritised and often bent or broken and occurs isolated or in stringers. The texture shows interlocking grains with no visible porosity. It can be concluded that this rock was a clastic sediment subjected to a metamorphism of the green-schist facies (Albite-Epidote-Chlorite-Facies). As the estimated feldspar content was originally about 30%, the rock has been determined as Meta-Arkose.

APPENDIX 4

PALAEONTOLOGICAL REPORT (by D.J. Taylor, Sydney)

36 sidewall cores were examined between 1178' and 5269' in North Eumeralla-1. Only those at 1636', 1815' and 2526' contained any foraminifera and these were not biostratigraphical diagnostic. Rotary cutting samples were examined at 100' intervals down to 3500'. At some levels this was increased to 10' intervals (see distribution chart, Encl. 11). The distribution chart lists grains (including fauna) retained in the 78 μ screen, from 1100' to 3200'. Below 3200' no fauna was found in cutting samples, except at 8560'-8570' where a rich bryozoal and foraminifera fauna was observed. This fauna was definitely of early Miocene age. It probably represents Zone 'F' (Taylor, Ref. 5) from the top of the early Miocene and has most likely derived from surface or near surface contamination.

Rotary cuttings down to 1800' were heavily contaminated. Zone 'F' was present at or near the top of the section and the preceeding early Miocene Zones were apparent above 1100'. No Oligocene planktonic elements were observed, which leads to the assumption that the Oligocene was either not present or was represented by the apparent dune sand of the sidewall core at 1172'. There is a general Oligocene regression in the Otway Basin.

Sidewall cores at 1636' and 1815' contained a purely arenaceous Haplophragmoides fauna, including H. rotundata, which does not extend above the Eocene (Taylor, Ref. 4). This fauna and the presence of charophyte fruiting bodies in cuttings below 1230' suggests lagoonal, polyhaline (8‰ - 15‰) conditions to 1815'.

There is a barren interval between 1815' and 2410' which marks the regression at the top of the early Eocene which extended into the mid Eocene Bock and Glenie, Ref. 1).

Benthonic species described by McGowran (Ref. 2) appear at 2410'. He regarded these species as being of a late Paleocene age but this dating has been revised to early Eocene in Stover and Evans (Ref. 3).

An arenaceous fauna at 2600' contains Haplophragmoides complanata which is unique to the Rivernook Member of the Dilwyn clay or to its shoreward equivalents (Taylor, Ref. 4). The "Rivernook fauna" is at or just above the Eocene/ Paleocene boundary. The low specific diversity of the early Eocene fauna and the total absence of planktonic species suggests a lagoonal or estaurine environment.

No Paleocene or Upper Cretaceous faunas were found.

The general impression of the sequence, in comparison with Eumeralla-1 and Pretty Hill-1, is that it was deposited in an extremely marginal position from Upper Cretaceous to Oligocene times. This view is supported by the weak expression of the Upper Cretaceous and "Rivernook" (early Eocene) transgression, lagoonal conditions in the mid to late Eocene instead of shelf carbonates, and the lack of faunal evidence of Oligocene sediments. Even the early Miocene carbonates are of an extremely shallow water origin.

REF. 1 BOCK, P.E., & GLENIE, R.C. 1965. Late Cretaceous and Tertiary depositional cycles in south westwern Victoria. Proc. Roy. Soc. Vict. 79, 153-163.

REF. 2 McGOWRAN, B., 1965. Two Paleocene foraminiferal faunas from the Wangerrip Group, Pebble Point coastal section, western Vict. Proc. Roy. Soc. Vict., 79 pp 9-74.

REF. 3 STOVER, L.E.,& EVANS, P.R., 1973. Upper Cretaceous-Eocene spore-pollen zonation, offshore Gippsland Basin, Australia. Geol. Soc. Aust. Spec. Publ. 4: 55-72

REF. 4 TAYLOR, D.J., 1965. Preservation, composition and significance of Victorian lower Tertiary 'Cyclammina faunas'. Proc. Roy. Soc. Vict., 78(2): 143-160.

REF. 5 TAYLOR, D.J., 1971. Foraminifera and the Cretaceous and Tertiary Depositional History in the Otway Basin in Victoria. Geol. Surv. South. Aust. & Vict., Spec. Bull: 217-234.

APPENDIX 5

PALYNOLOGICAL REPORT (by J.G. Wilschut)

SUMMARY

Palynological investigations of sidewall samples taken in well North Eumeralla-1 have resulted in the recognition of Neocomian to Upper Eocene strata.

Hiatuses were observed between Upper and Lower Eocene, Lower Paleocene and Upper Cretaceous and Upper and Lower Cretaceous. For a significant hiatus on seismic evidence present in the Lower Cretaceous no time break could be established but a change of sporomorph colours could be observed around that level.

The investigations confirmed environmental evidence observed in earlier wells in the basin.

INTRODUCTION

A total of 56 sidewall samples suitable for palynological investigations were analysed in well North Eumeralla-1. They are listed below.

The samples were subjected to a standard chemical treatment by means of hydrochloric and hydrofluoric acid and zinc bromide. Usually one standard slide of 4 x 2 cm was counted yielding sufficient sporomorphs for identification and in only few instances had the number of slides to be increased.

Determinations were made using types published in various palynological publications on South and Southeastern Australia (see references). All determinations are plotted on a distribution chart presented in Enclosure 12 showing the actual amounts counted.

For early Cretaceous and Tertiary sediments use was made of the zonal scheme presented by Stover and Evans (Ref. 43) while in the remainder of the Cretaceous the one established by Dettmann and Playford (Ref. 34) and Dettmann (Ref. 32) applies. The biostratigraphy derived from these schemes is presented in Text Figure 5 together with hiatuses determined palynologically but placed on marked lithologic breaks between the limits. To facilitate comparison with nearby wells Eumeralla-1 and Pretty Hill-1 a penetration chart is presented in Text Figure 6 using the same palynological criteria in these wells.

LIST OF SAMPLES STUDIED

SWS 1172'	SWS 2431'	SWS 3241'	SWS 4686'	SWS 6294'
" 1244'	" 2526'	" 3332'	" 4892'	" 6707'
" 1316'	" 2632'	" 3402'	" 4953'	" 6815'
" 1423'	" 2706'	" 3534'	" 5227'	" 6934'
" 1552'	" 2792'	" 3596'	" 5269'	" 7300'
" 1636'	" 2852'	" 3706'	" 5467'	" 7477'
" 1771'	" 2946'	" 3790'	" 5594'	" 7544'
" 1815'	" 3020'	" 3920'	" 5729'	" 8100'
" 1990'	" 3079'	" 4042'	" 5884'	" 8289'
" 2069'	" 3151'	" 4150'	" 6100'	" 8575'
" 2283'	" 3217'	" 4308'	" 6196'	" 8647'
				" 8777'

For detailed description of these samples see under Appendix 3.

TEXT FIGURE 5

BIO-STRATIGRAPHY NORTH EUMERALLA-1

(based on palynological data)

0 - 1100'	no sidewall samples available
1172'	Upper Eocene
disconformity ~~~~~~ circa	1210'
1244'-2526'	Lower Eocene
2632'-2792'	Upper Paleocene
2852'	Lower Paleocene
disconformity ~~~~~~ circa	2895'
2946'-3241'	Santonian - Coniacian
disconformity ~~~~~~ circa	3315'
3332'-5729'	Albian
5884'-8289'	Aptian
probable disconformity ~~ circa	6300'
probable disconformity ~~ circa	7300'
8575'-8777'	Lower Aptian-Neocomian

MICROFLORAL SUBDIVISION

Generally speaking samples were rich to very rich in particular those in the Tertiary section of the well where they were rich both in species and specimen. A deterioration in the preservation of sporomorphs was noted below 6300'. Reworked sporomorphs from Permian-Triassic were noted in a considerable number of samples of Cretaceous and Tertiary age indicating at least partly the source material for these sediments. They have not been included in the counts and as a result are not represented on the distribution chart.

Only the Tertiary and Upper Cretaceous strata present in the well contained some microplankton although often very scarce. In the thick Lower Cretaceous section below 3315' only one specimen of Michrystridium was observed at 8289'. On basis of the microfloras determined the following subdivisions could be established (from young to old):

1172' Upper Eocene

In contrast to samples below this depth the microfloras are dominated by Nothofagidites spp notably Nothofagidites emarcidus and N. heterus. Triorites harrisii on the other hand occurs less frequent than before. Significant species recorded are:

Kuylisporites waterbolkii, Myrtaceidites parvus, M. verrucoscus Malvacipollis subtilis, Nothofagidites emarcidus, N. heterus, N. flemingii, N. asperus, N. vansteenisii, Proteacidites clintonensis, P. annularis, Rugulatisporites mallatus, Triporopollenites chnozus, Triorites harrisii, P. rectomarginus.

The microfloras closely resemble these described by Evans and Stover in the Nothofagidites asperus zone of the Gippsland Basin who noted a sudden and dramatic influx of Nothofagidites spp at the base of that zone (Ref. 43).No specimen of Aglaoreidia spp and Malvacipollis diversus were observed. Only a few mostly indeterminable microplankton species were noted. Worth mentioning is the presence of Diphyes colligerum believed restricted to Eocene and Paleocene strata. The presence of well mixed microfloras and scarce microplankton would point to a brackish - marine near shore depositional environment.

MICROFLORAL ZONATION : NOTHOFAGIDITES ASPERUS ZONE
DEPOSITIONAL ENVIRONMENT : LAGOONAL - NEAR SHORE FACIES

1244' - 2526' LOWER EOCENE

Microfloras encountered on this interval were rich to very rich. Significant sporomorphs recorded are:

Baculatisporites disconformis, Beaupreaidites elegansiformis, Dryptopollenites semilunatus, Casuarinidites cainozoicus, Cupaneidites orthoteichus, Malvacipollis diversus, Myrtaceidites eugenoides, M. tenuis , Proteacidites dilwynensis, P. grandis, P. pachypolus, Peromonolites densus, ____________ esobalteus, Sapotaceidites rotundus, Spinizonocolpites prominatus, Tiliaepollenites notabilis.

Unlike the overlying sample of the Nothofagidites asperus zone all samples in this interval were generally poor in Nothofagidites spp. Proteacidites species are well represented as are Triorites harrissi and Malvacipollis diversus. At 1552' a specimen of Dryptopollenites semilunatus was found. According to Stover and Evans this species is restricted to the Proteacidites asperopolus zone but Stover and Partridge (Ref. 44) indicate it to be present also in the uppermost part of the Malvacipollis diversus zone. Nothofagidites goniatus was also observed at this depth. The samples between 1244' and 1552' were generally richer in Nothofagidites spp. than in the deeper part of the interval. Proteacites asperopolus was not observed. As this type usually occurs in abundance in the Proteacidites asperopolus zone this zone is therefore believed to be absent in North Eumeralla-1 although its presence between 1244' and 1552' cannot be ruled out entirely.

Rare microplankton includes species as Deflandrea obliquipes, Deflandrea pachyceros and Wetzeliella homomorpha. The depositional environment is considered similar as that mentioned for sample 1172'.

MICROFLORAL ZONATION: MALVACIPOLLIS DIVERSUS ZONE

DEPOSITIONAL ENVIRONMENT: LAGOONAL - NEAR SHORE FACIES

2632'-2792' UPPER PALEOCENE

This interval was generally rich in sporomorphs. Microplankton occurred scarce with the exception of the highest sample at 2632' which contained a fair amount of microplankton. Significant sporomorphs recorded are:

Camarazonosporites bullatus, Ericipites scabratus, Krauselisporites papillatus, Lygistepollenites balmei, L. ellipticus, L. australiensis, Tricolpites philipsii.

Microplankton species recorded are:

Baltispaeridium liniferum, B. septatum, Cyclonephelium retiintextin, Diphyes colligerum, Deflandrea dartmooria and an unidentified well preserved species belonging to Lejeunia spp.
Diphyes colligerum, observed regular only at 2632', is believed restricted to Paleocene/Eocene strata. Deflandrea dartmooria was only present at 2706'. It was believed to occur not older than Lower Eocene (Ref. 42). However, since these strata are undoubtedly of Paleocene age its range may have to be extended into the Upper Paleocene.
The micro floras in this interval only partly compare with those described from Paleocene outcrops in the Princetown area of Victoria (Harris, Ref. 36). Triorites edwardsii is not observed in quantities in this interval and Triorites harrisii was absent. Co-occurrences of Triorites edwardsii and Cupaneidites orthoteidius were not observed.

MICROFLORAL ZONATION : LYGISTEPOLLENITES BALMEI ZONE

DEPOSITIONAL ENVIRONMENT : LAGOONAL - NEAR SHORE FACIES

2852' LOWER PALEOCENE

Only one sample could be determined to belong to this interval. It was rich in sporomorphs but unfortunately only a few indeterminable microplankton species were observed. Significant sporomorphs recorded were:

Camarazonosporites amplus, Dilwynites granulatus, D. tuberculatus, Latrobosporites crassus, Liliacidites lanceolatus, Proteacidites crassus, Tricolpites longus, T. fissilus, T. pachyexinus, T. pannosus, Triorites edwardsii, Tripunctisporites sp.

The deepest occurrences of both Dilwynites spp and Tripunctisporites sp were found in this sample in which also the only occurrence of Tricolpites longus in this well was determined. In the Gippsland basin these species are believed to indicate the basal Tertiary unit. The samples in which this microflora occurs has been included in the Pebble Point because of its Tertiary age. These microfloras were absent from the Pebble Point Formation outcrop in the Princetown area. However it could well represent a formation of rare or extremely thin occurrence in the Otway Basin between Pebble Point formation and Upper Cretaceous unconformity.

MICROFLORAL ZONATION : TRICOLPITES LONGUS ZONE

DEPOSITIONAL ENVIRONMENT : LAGOONAL - NEAR SHORE FACIES

2946' - 3241' SANTONIAN-CONIACIAN

Samples in this interval were generally rich in sporomorphs, while microplankton was observed in all of them often in fair quantities. Significant sporomorphs recorded are:

Beaupreaidites verrucosus, Camarazonosporites ohaiensis, Cicatricosisporites autraliensis, Clavifera triplex, Cyathidites splendens, Klukisporites scaberis, Krauselisporites jubatus, K. papillatus, Leptolepidites verrucosus, Ornamentifera sentosa, Phyllocladidites verrucosus, Proteacidites amolosexinus, Stephanopollenites obscurus, Tricolpites lilliei, T. simatus, Vitreisporites pallidus.

Significant microplankton observed are:

Areoligera cf. medusettiformis, Cyclonephelium variabilis, Deflandrea bakeri, D. cf. cretacea, D. belfastensis, Dinogymmium spp.,Heterosphaeridium conjunctum, Nelsoniella aceras, Odontochitina operculata.

Phyllodadidites mawsonii, Microcachriidites antarcticus and Stephanopollenites obscurus occur regular and often in appreciable quantities. Tricolpites spp and Tricolporites spp are well represented in this interval. Deflandrea belfastensis, found at 3217', indicates this interval to be not older than Coniacian, the presence of Odontochitina operculata in the top sample that Maastrichtian strata are absent.

However, microplankton characteristic of Maastrichtian and Campanian such as Gillinea hymenophora was not observed and a Santonian-Coniacian age seems therefore most likely. This would agree with sporomorph evidence since both Nothofagidites senectus and Tricolpites lilliei zones (Nothofagidites microflora of Dettmann) were not observed.

MICROFLORAL ZONATION : TRICOLPITES PACHYEXINUS ZONE

DEPOSITIONAL ENVIRONMENT : NEAR SHORE FACIES

3332' - 5729' ALBIAN

With only few exceptions most samples were poor to fair in sporomorphs. Unfavourable lithologies in this interval may in part account for this. Microplankton was not observed. Significant sporomorphs recorded are:

Aequitriradites spinulosus, Cicatricosisporites hughesi, C. ludbrooki, C. pseudotripartitus, Classopollis spp, Coptospora sp. A, C. paradoxa, Coronatispora perforata, C. telata, Cribelosporites striatus, Densoisporites velata, Dictyophylledites concavus, Dictyotosporites complex, Foraminisporis asymmetricus, F. dailyi, F. wonthaggiensis, Ischyosporites punctatus, Krauselisporites major, Leptolepidites major, L. verrucosus, Rouseisporites reticulatus, R. simplex, Schizosporis parvus, Trilobosporites trioreticulatus.

The first introduction of angiospermous elements in the microfloras is observed in the upper part of this interval, allowing for the recognition of the Tricolpites pannosus zone. Reworked elements from the Dictyotosporites speciosus zone were noted here. Coptospora spp. were found regular although in small quantities. Below 5467' Dictyotosporites speciosus makes its first appearance. A hiatus at the top of this interval is indicated by the absence of the overlying Appendicisporites distocarinatus and Clavifera triplex zones. The absence of Appendicisporites distocarinatus and Cicatricosisporites cuneiformis from the top part of this interval could indicate the absence of the uppermost part of the Tricolpites pannosus zone too.

MICROFLORAL ZONATION:	3332'-3534'	TRICOLPITES PANNOSUS ZONE
	3596'-5269'	COPTOSPORA PARADOXA ZONE
	5467'-5729'	DICTYOTOSPORITES SPECIOSUS ZONE (UPPER PART).

DEPOSITIONAL ENVIRONMENT: CONTINENTAL.

5884' - 8289' APTIAN

As for the previous interval samples were in general poor to fair. No microplankton was recorded except for a single specimen of Michrystridium at 8289'. Significant sporomorphs are:

Beretisporites spectabilis, Cyclosporites hughesi, Dictyotosporites filosus, D. speciosus, Pilosisporites notensis, Tsugaepollenites dampieri, T. segmentatus, T. trilobatus, Velosporites triguetrus.

A change in microfloras possibly related to a hiatus is noted below 6294'. Cicatricosporites spp., notably Cicatricosisporites australiensis which occur regular and often in high quantities above this depth have not been observed in the deeper part of the well despite an effort was made to detect these types. Paucity of the microfloras could not be considered as an explanation. Cicatricosisporites spp. are the main criteria to distinguish Neocomian from Upper Jurassic strata in Australian Mesozoic palyno-stratigraphy. In case of its absence and poor representation of types as Cyclosporites hughesi, Cribelosporites stylosus and Dictyotosporites speciosus, as is the case in this well, these strata may well be considered as Upper Jurassic. Cicatricosisporites spp. exhibit a similar distribution pattern in well Pretty Hill-1 where a base was observed between 6070' and 6370'.

Seismic records indicate a hiatus intersected in this well at ± 7100'. Palynological investigations were unable to detect any break in the sequence at that level although a slight darkening of sporomorphs was observed from 7300' downwards.

MICROFLORAL ZONATION	:	DICTYOTOSPORITES SPECIOSUS ZONE (FORAM.ASYMMETRICUS/ROUS RETICULATUS UNIT)
DEPOSITIONAL ENVIRONMENT	:	CONTINENTAL

8575' - 8777' EARLY APTIAN - NEOCOMIAN

The presence of Murospora florida in this interval indicates that the Murospora florida unit of the Dictyotosporites speciosus zone has been penetrated. Besides its presence little difference is noted with the microfloras of the overlying strata. Samples were generally rich. Most common types observed were Baculatisporites comaumensis, Ceratosporites equalis and Lycopodiumsporites spp which often dominate the microfloras. Contignisporites spp. such as Contignisporites cooksonae, C. fornicatus and C. multimuratus were observed for the first time in this interval in North Eumeralla-1. Metamorphic rocks of a possible Palaeozoic age were penetrated below 8850' marking an end to palynological age determinations.

MICROFLORAL ZONATION	:	DICTYOTOSPORITES SPECIOSUS ZONE - MUROSPORA FLORIDA UNIT.
DEPOSITIONAL ENVIRONMENT	:	CONTINENTAL.

CONCLUSIONS

All suitable sidewall samples analysed in well North Eumeralla-1 contained microfloras and only very few samples proved barren or practically so. The Tertiary section closely compared with that reported from the Gippsland Basin and the palynological scheme presented by Stover and Evans there could easily be applied. Microplankton present in North Eumeralla-1 supported their age in terms of Time stratigraphy.

The presence of over 5600' of Lower Cretaceous strata were determined ranging in age from Neocomian to Albian. The possible Neocomian interval in the well is thin and cannot exceed 500'.

The Upper Cretaceous was incomplete with Cenomanian-Turonian and Campanian-Maastrichtian strata not observed. The total thickness is approximately 300'.

Though a number of diastems occur sedimentation was more continuous from early Tertiary to Upper Eocene times. The absence of proven middle Eocene sediments may be the result of differences developing in the microfloras of the Otway region as compared with Gippsland in the Eocene. However, microfloras believed by Harris to represent middle Eocene (Ref. 38) also were observed.

On the absence of any marine indications in Lower Cretaceous the depositional environment is believed continental. These sediments are unconformably overlain by Lower Senonian strata deposited in a near shore possibly shallow marine depositional environment. Near shore to lagoonal conditions prevailed during the Tertiary period studied palynologically in this well.

A number of important regional hiatuses were recognised in the well. Sedimentation during Neocomian - Albian times is believed continuous as for the only clearly indicated hiatus on seismic evidence no time gap could be determined palynologically. Upper Cretaceous strata are incomplete and only during a possibly short period were sediments deposited.

AGE	MICROFLORAL ZONATION: ZONE	SUB-ZONE	UNIT	NORTH EUMERALLA-1	EUMERALLA-1	PRETTY HILL-1
EOCENE, MIDDLE-UPPER	NOTHOFAGID. ASPERUS			? 1172'		
EOCENE, MIDDLE-UPPER	PROTEACIDIT. ASPEROPOLUS					
EOCENE, LOWER	MALVACIPOLLIS DIVERSUS			1244' 1552' 2526'		
PALEOCENE, UPPER	LYGISTEPOLL. BALMEI			2632' 2792'		
PALEOCENE, LOWER	TRICOLPITES LONGUS			2852'		
UPPER CRETACEOUS	TRICOLPITES LILLIEI					
UPPER CRETACEOUS	NOTHOFAGID. SENECTUS					
UPPER CRETACEOUS	TRICOLPITES PACHYEXINUS			2946' 3241'	2835'	2726'
UPPER CRETACEOUS	CLAVIFERA TRIPLEX					
UPPER CRETACEOUS	APPENDICISP. DISTOCARINAT.					
ALBIAN	TRICOLPITES PANNOSUS			3332' 3534'	3311'	2928'
ALBIAN	COPTOSPORA PARADOXA			3596' …	3800' 5816'	3340' 4655'
ALBIAN	COPTOSPORA PARADOXA		DICTYOTOSPOR. FILOSUS	5269'		4940'
ALBIAN	DICTYOTOSPOR. SPECIOSUS	CRIBELOSPORIT. STRIATUS		5467' 5729'	6034' 6720'	
APTIAN	DICTYOTOSPOR. SPECIOSUS	CYCLOSPORIT. HUGHESI	FORAMINISPOR. ASYMMETRICUS	5884' …	7225' 7717'	5420' 5947'
APTIAN	DICTYOTOSPOR. SPECIOSUS	CYCLOSPORIT. HUGHESI	ROUSEISPORIT. RETICULATUS	8289'	8143' 9890'	6070' …
NEOCOMIAN-LOWER APTIAN	DICTYOTOSPOR. SPECIOSUS	CYCLOSPORIT. HUGHESI	MUROSPORA FLORIDA	8575' 8777'	10.300'	6388'
NEOCOMIAN-LOWER APTIAN	CRIBELOSPOR. STYLOSUS					6690' ? 7214'
JUR.	TOP BASEMENT			8850'	NR	7874'
	TOTAL DEPTH			9737'	10308'	8124'

REMARKS

DETERMINATION CERTAIN

DETERMINATION UNCERT.

NR : NOT REACHED

ALL DEPTHS BELOW D.F.

TEXT-FIGURE 6

REFERENCES

1. COOKSON, I.C., 1946: Pollen of Nothofagus Blume from Tertiary deposits in Australia. Proc. Linn. Soc. N.S.W., 71, pp. 49-63.

2. 1947a: On fossil leaves (Oleaceae) and new type of fossil pollen grain from Australian brown coal deposits. Proc. Linn. Soc. N.S.W., 72, pp. 183-197.

3. 1947b: Plant microfossils from the lignites of Kerguelen Archipelago. Br. Aust.N.Z. Antarctic Res. Exped., 1929-1931, Reps., ser. A, 2, (8), pp.129-142.

4. 1950: Fossil pollen grains of proteaceous type from Tertiary deposits in Australia. Aust. J. Res., ser. B, 3, pp. 166-176.

5. 1953 : The identification of the sporomorph Phyllocladidites with Dacrydium and its distribution in southern Tertiary deposits. Aust. J. Bot., I, pp. 64-70.

6. 1953. Difference in microspore composition of some samples from a bore at Comaum, South Australia. Ibid. 1: 462-73.

7. 1954 : The Cainozoic occurrence of Acacia in Australia. Ibid. 2: 52-59.

8. 1954. A palynological examination of No. 1 bore, Birregurra, Victoria. Proc. R. Soc. Vict. 66: 119-28.

9. 1957: On some Australian Tertiary spores and pollen that extend the geological and geographical distribution of living genera. Proc. R. Soc. Vict., 69, pp. 41-53.

10. 1959: Fossil pollen grains of Nothofagus from Australia. Proc. R. Soc. Vict., 71, pp 25-30.

11. 1965a: Cretaceous and Tertiary microplankton from southeastern Australia. Proc. R.Soc. Vict., 78, pp.85-93.

12. 1965b: Microplankton from the Paleocene Pebble Point Formation, south-western Victoria, Pt 1, Proc. R. Soc. Vict., 78, pp. 137-141.

13. COOKSON, I.C. & CRANWELL, L.M., 1967. Lower Tertiary microplankton, spores and pollen grains from southmost Chile. Micropaleontology 13: 204-16.

14. COOKSON, I.C. & DETTMANN, M.E., 1958. Some trilete spores from Upper Mesozoic deposits in the eastern Australia region. Proc. R. Soc. Vict. 70: 95-128.

15. 1959. Microfloras in bore cores from Alberton West, Victoria. Ibid. 71: 31-38.

16. COOKSON, I.C. & EISENACK, A., 1958: Microplankton from Australian and New Guinea Upper Mesozoic sediments. Proc. R. Soc. Vict., 70, pp. 19-79.

17. 1965a: Microplankton from the Browns Creek Clays, SW Victoria. Proc. R. Soc. Vict., 79, pp.119-131.

18. 1965b: Microplankton from the Dartmoor Formation, SW Victoria. Proc. R. Soc. Vict., 79, pp. 133-137.

19. 1965c: Microplankton from the Paleocene Pebble Point Formation, southwestern Victoria, Pt. 2. Proc. R. Soc. Vict., 79, pp. 139-146.

20. 1967a: Some Early Tertiary microplankton and pollen grains from a deposit near Strahan, western Tasmania. Proc. R. Soc. Vict., 80, pp. 131-140.

21. 1967b: Some microplankton from the Paleocene Rivernook Bed. Proc. R. Soc. Vict., 80, pp. 247-257.

22. COOKSON, I.C. & PIKE, K, 1953. Tertiary occurrence and distribution of Podocarpus (section Dacrycarpus) in Australia and Tasmania. Aust. J. Bot. 1: 71-82.

23. 1953: A contribution to the Tertiary occurrence of the genus Dacrydium in the Australian region. Aust. J. Bot. 1, pp. 474-484.

24. 1954: Some dicotyledonous pollen types from Cainozoic deposits in the Australian region. Aust. J. Bot., 2, pp. 197-219.

25. 1955: The pollen morphology of Nothofagus B1. subsection Bipartitae Steen. Aust. J. Bot., 3. pp. 197-206.

26. COUPER, R.A., 1953: Upper Mesozoic and Cainozoic spores and pollen grains from New Zealand. Paleont. Bull., Wellington, 22, pp. 1- 77.

27. 1954: Plant microfossils from N.Z. No. 1. Trans R. Soc. N.Z. 81 : 479-83.

28. 1958. British Mesozoic microspores and pollen grains a systematic and stratigraphic study. Palaeontographica (B) 103 : 75-179.

29. 1960: New Zealand Mesozoic and Cainozoic plant microfossils. Pal. Bull. Geol. Surv. N.Z. 32: 1- 88.

30. DEFLANDRE, G. & COOKSON, I.C., 1955: Fossil microplankton from Australian Late Mesozoic and Tertiary sediments. Aust. J. Mar. Freshwat. Res, 6, pp. 242-313.

31. DETTMANN, M.E. 1963. Upper Mesozoic microfloras from south-eastern Australia. Proc. R. Soc. Vict. 77: 1-148.

32. DETTMANN, M.E. 1969. Palynological zonation of Lower Cretaceous sediments of the Otway Basin, Victoria. Sdareport 1817 (unpublished).

33. DETTMANN, M.E., & PLAYFORD, G., 1968: Taxonomy of some Cretaceous spores and pollen grains from eastern Australia. Proc. R. Soc. Vict., 81, pp. 69-94.

34. 1969: Palynology of the Australian Cretaceous - a review: in Campbell, K.S.W. (Ed.), Stratigraphy and Palaeontology: Essays in Honour of Dorothy Hill. A.N.U. Press, Canberra.

35. EVANS, P.R., 1966. Mesozoic stratigraphic palynology of the Otway Basin. Rec. Bur. Miner. Resour. Geol. Geophys. Aust. 1966/69 (unpublished).

36. HARRIS, W.K. 1965. Basal Tertiary microfloras from the Princetown area, Victoria, Australia. Palaeontographica (B) 115: 75-106.

37. 1966. Proteacidites latrobensis. Taxon, 15: 332-33.

38. 1971. Tertiary stratigraphic palynology, Otway Basin. Ch in The Otway Basin of south east Australia. Spec. Bull. Geol. Surv. S. Aust. & Vict.

39. 1972. New form species of pollen from southern Australian early Tertiary sediments. Trans. R. Soc. S. Aust. 96: 53-65.

40. MCINTYRE, D.J., 1965. Some new pollen species from New Zealand Tertiary deposits. N.Z. J. Bot. 3: 204-14.

41. 1968. Further new pollen species from New Zealand Tertiary and uppermost Cretaceous deposits Ibid. 6: 177-204.

42. STOVER, L.E. 1973: Palaeocene and Eocene species of Deflandrea (Dinophyceae) in Victorian coastal and offshore basins, Australia. Spec. Publs. geol. Soc. Aust., 4, pp. 167-188.

43. STOVER, L.E., & PARTRIDGE, A.D. 1973. Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, southeastern Australia. Proc. Roy. Soc. Vict. 85 (2) : 237-286.

44. STOVER, L.E. & EVANS, P.R. 1973. Upper Cretaceous - Eocene spore-pollen xonation offshore Gippsland Basin, Australia Geol. Soc. Aust. Spec. Publ. No. 4.

45. WILSON G.J., 1967: Some species of Wetzeliella Eisenack (Dinophyceae) from New Zealand Eocene and Paleocene strata (N.Z. Jl. Bot., 5, pp. 469-497.

APPENDIX 6 WEEKLY DRILLING REPORTS

SHELL INT. PETROLEUM MAATSCHAPPIJ N.V.	CONCESSION PEP-5	WELL N-Eumeralla-1
WEEKLY DRILLING REPORT No. 1 from 30/11 to 7/12 19 73	RIG NAT 1320 DE.	

		CASING					
Reference point: Top of 16 3/4" housing							
Rotary table ft. above R.P. at MSL conditions	Size	20"					
Rotary table ft. above MSL	Depth	1133					

Date	DEPTH (PROGRESS) (feet)	MUD Weight lb/gal ph	Viscosity (MF secs)	Waterloss (cc/30)	OPERATIONS

DRILLING ASSEMBLIES

NO.1 26" OSC 3A + 3 DC 10" + 6 DC 7¾" + DP 5". Drilled surface to 1150'.

NO.2 17½" OSC 3AJ + 3 DC 10" + 6 DC 7¾" + 9 HWDP + DP 5". Drilling.

BIT RECORD.

BIT NO.	SIZE + TYPE	WOB x1000lbs.	RPM	FT.	HOURS.	FT/HR.	SPM	JET.VEL FT/MIN	ANN.VEL ft/min.	PRESSURE
1	26" OSC 3A	8	160	1123	35	32	120	Conven	40	500
2	17½" OSC 3AJ	10	120	drill -ing			65	290	46	1000

CONDITION
T3 B3 G2
drilling.

CHEMICAL CONSUMPTION

Bentonite 267 x 100 lbs.
Caustic Soda 7 x 140 lbs.
Spersene 9 x 50 lbs.
Soda Ash 3 x 93⅓ lbs.
D - D Compound 1 x 55 gallons.

SHELL INT. PETROLEUM MAATSCHAPPIJ N.V.	CONCESSION PEP-5	WELL N-Sumeralla-1
WEEKLY DRILLING REPORT No. 1	from 30/11 to 7/12 1973	RIG NAT. 1320 DE.

Reference point: Top of 16 3/4" housing	CASING					
Rotary table ft. above R.P. at MSL conditions	Size	20"				
Rotary table 207 ft. above MSL	Depth	1133				

Date	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	MUD Viscosity (MF secs)	MUD Waterloss (cc/30)	OPERATIONS
30/11	407 (380)	9.2 10.0	45 NIL	15 400	Spudded well as North Sumeralla-1 at 1600 on 30th November 1973. Drilled with 26" bit NO.1 to 407'.
1/12	1016 (609)	9.2 9.0	42 NIL	16 400	Drilled to 834'. Circulated out excessive clay. Drilled to 1016'.
2/12	1150 (134)	9.3 8.0	49 NIL	16 300	Drilled to 1032'. Circulated out mud rings and built up mud volume (water shortage). Drilled to 1150'. Made wiper trip to 261'. Pulled out of hole. Rigged up and ran 20" casing.
3/12	1150 (NIL)	9.3 10.0	55 NIL	20 300	Completed running 20" casing to 1133'. Ran 3½" tubing stinger to 1056'. Cemented with 1100 sx class A + 2% bentonite + 2% Calcium chloride. Slurry weight 13.4 lbs/gallon. Good cement returns to surface. Waited on cement.
4/12	1150 (NIL)	9.0 10.0	45 NIL	15 300	Waited on cement (total 18¾ hrs.) Backed off 20" landing joint and pulled stinger. Nippled up 20" Hydril and flow riser.
5/12	1239 (89)	8.8 11.0	40 NIL	30 350	Ran in hole with 17 ½" bit NO.2, drill collars and one joint HWDP. Successfully tested casing, Hydril, choke- and kill- lines, choke manifold, kelly cocks and all valves to 450 psi. Picked up 9 joints HWDP and layed down 10 joints standard DP. Ran in hole. Located TOC 1083'. Drilled out cement and shoe. Drilled to 1239'.
6/12	2300 (1061)	8.9 10.0	38 NIL	25 300	Drilled to 2300'.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5	WELL N-Eumeralla 1
WEEKLY DRILLING REPORT No. 2 from 7-12 to 14-12-73		RIG NAT. 1320 DE

R. T. Elevation ± 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"				
Depth	1133	3029				

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS

DRILLING ASSEMBLIES.

NO.2 17½" OSC 3AJ + 3 DC 10" + 6 DC 7¾" + 9 HWDP + 5" DP. Drilled to 2389'.

NO.3 17½" OSC 3AJ + 3 DC 10" + 6 DC 7¾" + 9 HWDP + 5" DP. Drilled to 3050'.

NO.4 12¼" OSC 3AJ + 3 DC 10" + 6 DC 7¾" + 9 HWDP + 5" DP. Drilled cement + pocket for stablizers.

NO.5 12¼" XDG + stab. + 1 DC + stab. + 1 DC + stab. + 14 x 7¾" DC + 9 HWDP + 5" DP. Drilling.

BIT RECORD.

BIT NO.	SIZE + TYPE.	WOB 1000lbs	RPM	FOOTAGE	HOURS	FT/HR	SPM	JET VEL FT/SEC	ANN.VEL FT/MIN	PRESSURE	CONDITION
2	17½"OSC 3AJ	10	120	1239	24¼	51	65	290	46	1000	T3 B6 G1
3	17½"OSC 3AJ	20	120	661	23½	28	65	230	46	900	T4 B5 G1
4	12¼"OSC 3AJ	15	120	121	4½	27	65	NO JET	110	425	T2 B4 G1
5	12¼"XDG	20-30	80	DRILLING			60	405	96	1750	DRILLING

CHEMICAL CONSUMPTION

Bentonite 388 sx.

Barytes 125 sx.

Spersene 28 sx.

Caustic 10 drums.

Sodium Bicarb 12 sx.

D-D compound 1 drum.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5	WELL N-Eumeralla - 1
WEEKLY DRILLING REPORT No. 2 from 7-12 to 14-12-73	RIG NAT. 1320 DE	

R.T. Elevation ± 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"				
Depth	1133	3029				

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
7-12	2736 (436)	9.0 9.5	40 NIL	20 300	Drilled 17½" bit NO.2 to 2389'. Drilled 17½" bit NO. 3 to 2736'.
8-12	3050 (314)	9.3 9.5	50 NIL	15 300	Drilled to 3050'. Made 10 stand wiper trip. Pulled out for logging. Schlumberger ran: LL-9+SP 3032' - 1133' BHC+GR 3038' - 1133' FDC+CAL 3045' - 1133'
9-12	3050 (NIL)	9.3 9.5	50 NIL	15 300	Schlumberger ran CST NO.1. Fired 25, recovered 20, 5 empty. Made wiper trip; free to bottom. Ran 78 joints 13 3/8" 68 lbs/ft N80/J55 shoe at 3029'.
10-12	3050 (NIL)	9.3 9.5	48 NIL	15 300	Cemented casing with 1550 sx Class 'A' + 2% prehydrated Bentonite + 1% Calcium chloride, slurry weight 13.1 lbs/gal tailed in with 200 sx Class 'A' + 1% Calcium chloride slurry weight 15.6 lbs/gal. Mixing time 100 minutes displacing time 30 minutes. Displacing pressures 450 - 900psi. Bumped plug, tested casing to 2000 psi - O.K. Released pressure-float equipment O.K. Waited on cement 14 hours. Backed off landing joint. Removed 20" Hydril.
11-12	3050 (NIL)	9.3 9.5	48 NIL	15 300	Flanged up BOP's, choke and kill lines, hydraulic lines, flow riser and flowline.
12-12	3171 (121)	9.1 10.0	35 NIL	18 300	Successfully pressure tested blind rams, choke line and manifold, kill line and valves to 2000psi. Ran in hole. Successfully tested Hydril to 1500psi. Drilled with cement. Drilled to 3171'. Pulled out of hole to change bottom hole assembly.
13-12	3925 (754)	9.3 9.5	45 NIL	15 300	Ran in hole with 12¼" bit NO.5 and modified bottom hole assembly. Drilled to 3925'. Drilling.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5 N-Sumeralla	WELL 1
WEEKLY DRILLING REPORT No. 5	from 14-12 to 21-12-73	RIG NAT. 1320 DE

R.T. Elevation + 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
14-12	4665 (740)	9.1 9.5	45 NIL	16 300	Drilled 12¼" bit NO.5 to 4665'.
15-12	5390 (725)	9.2 9.5	42 NIL	12 300	Drilled to 4738'. Pulled out of hole. Hole swabbing after 12 stands. Circulated hole clean. Pulled out of hole. Ran in hole with 12¼" bit NO.6 Drilled to 5390'.
16-12	5660	9.2	38	11	Drilled to 5660'. Ran in hole with 12¼" bit NO.7 Reamed 4400' - 4700'. Reamed last 35' to bottom.
17-12	6221 (561)	9.5 9.5	38 NIL	8 300	Drilled to 6221'.
18-12	6375	9.5	38	8	Drilled to 6375'. Made 25 stand wiper trip. Reamed 40'.Fill. Circulated clean. Pulled out of hole. Schlumberger ran BHC/GR 6341' - 3030'. LL-9/SP 6338' - 3030'.
19-12	6375 (NIL)	9.5 9.5	40 NIL	8 300	Schlumberger ran FDC/CAL 6350' - 3030' HDT 6349' - 3030'. Took 1 gun sidewall samples. Recovered 27, 3 misfires. Rigged down Schlumberger and made wiper trip. Ran 9 5/8", 47 lbs/ft, N80 casing.
20-12	6375 (NIL)	9.5 9.5	40 NIL	8 300	Completed 9 5/8" casing. Cemented with 1400 sx Class 'D' slurry weight 15.0 lbs/gallon. Mixing time 70 minutes, displacing time 35 minutes. Displacing pressure 1000 - 1300 psi. While displacing last 100 bbls, pressure increased to 1750 psi and returns were lost. Pressure fell off gradually to 1300 psi. Plug not bumped after 2985 strokes (calculated displacement 2058 strokes @ 100%). Stopped displacement. Suspended operations at 1930 hrs due to labour dispute.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD | PERMIT: PEP-5 N-Eumeralla | WELL 1

WEEKLY DRILLING REPORT No. 3 from 14-12 to 21-12-73 | RIG NAT 1320 DE

R T Elevation ± 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS

DRILLING ASSEMBLIES

NO.5 12¼" XDG + STAB + 1 x 7¾" DC + STAB + 1 x 7¾" DC + STAB + 14 x 7¾" DC + 9 H.DP + 5" DP.

NO.6 as NO.5

NO.7 as NO.5

BIT RECORD

BIT NO	SIZE & TYPE	WOB 1000lbs	RPM	FOOTAGE	HOURS	FT/HR	SPM	JET VEL FT/SEC	ANN.VEL FT/MIN	PRESSURE psi	CONDITION
5	12¼"XDG	20-30	80	1567	38¼	41	65	435	105	1750	T7:B4:01/8"
6	12¼"XDG	30-40	80	922	28¼	32	65	435	105	1800	T6:B4:01/8"
7	12¼"XDG	30-40	80	715	32¼	22	65	435	105	1800	T4:B3:01/8"

CHEMICAL CONSUMPTION

Bentonite 20 units.
Barytes 138 "
Spersene 30 "
Caustic 10 "
CMC 60 "
D-D Compound 1 "
Aluminium Stearate 1 unit

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD | PERMIT: PEP-5 N-Eumeralla WELL 1

WEEKLY DRILLING REPORT No. 4 from 21-12 to 28-12-73

RIG NAT 1320 DE

R. T. Elevation ± 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
21-12	6375 nil				Resumed operations 0800 hrs with skeleton crew. Lifted BOP'S, installed and set slip-seal assembly with 170,000 lbs tension in casing. Installed 12" x 10" spool and cross-over. Flanged up BOP'S. Pressure tested casing-pumping 1-2 bbls/min at 1500-1600 psi. Schlumberger made sinker-bar run. Located top plug at 1994'. suspended operations at 1915 hrs due to labour dispute.
22-12	6375 nil				Resumed operations at 0800 hrs with skeleton crew. Nippled up BOP'S. Ran in hole with open ended drill pipe, pushed top cement plug down to collar at 6312' with 2000-5000 lbs. Successfully tested casing to 3000 psi. Suspended operations at 1600 hrs due to labour dispute.
23-12	6375 nil				Resumed operations at 0800 hrs with skeleton crew. Pulled out of hole. Schlumberger ran CBL. Located top cement at 2800' and bottom at 6200'. Rigged down Schlumberger. Successfully pressure tested blind rams, pipe rams, choke and kill lines, choke manifold and all valves 5000 psi. Suspended operations at 1830 hrs due to labour dispute.
24-12	6375 nil				Operations suspended due to labour dispute.
25-12	6375 nil				Operations suspended due to labour dispute.
26-12	6375 nil				Operations suspended due to labour dispute.
27-12	6375 nil				Operations suspended due to labour dispute.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD | PERMIT PEP-5 N-Eumeralla WELL 1

WEEKLY DRILLING REPORT No. 5 from 28-12 to 4-1-74 RIG N.T. 1320 DE

R.T. Elevation ± 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
28-12	6375 NIL				Operations suspended due to labour dispute.
29-12	6375 NIL				Operations suspended due to labour dispute.
30-12	6735 NIL				Operations suspended due to labour dispute.
31-12	6735 NIL				Operations suspended due to labour dispute.
1-1	6735 NIL				Operations suspended due to labour dispute.
2-1	6375 NIL				Operations suspended due to labour dispute.
3-1	6375 NIL				Resumed operations at 1600 hrs. Layed down 7¾" collars. Picked up 7" collars. Ran in hole with 8½" bit NO.8.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5 N-Eumeralla WELL 1
WEEKLY DRILLING REPORT No. 6 from 4-1 to 11-1-74	RIG NAT. 1320 DE

R. T. Elevation +207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133'	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS

DRILLING ASSEMBLIES

NO.8 8½"M44 + 15x7"DC + 21 HWDP + 5"DP. (Depth out 6580').
NO.9 8½"J33 + STAB + DC + STAB + DC + STAB + 13x7" DC + 21 HWDP + 5" DP (to 7729')
NO.10 8½"J33 + DC + STAB + DC + STAB + 11x7" DC + 21 HWDP + 5" (to 7780').
NO.10 8½"J33 + 2x7" DC + STAB + 11x7" DC + 21 HWDP + 5" DP (Drilling).

BIT RECORD

BIT NO.	SIZE & TYPE	WOB 1000lbs	RPM	FOOTAGE	HOURS	FT/HR	SPM	JET VEL FT/SEC	ANN VEL FT/MIN	PRESSURE PSI	BIT CONDITION
8	8½"M44	40	80	205	15	14	60x5¾"	295	183	1400	5-5-0
9	8½"J33	40	50	1149	84¼	14	65x5¾"	540	200	2200	3-3-0
10	8½"J33	40	50	263	23½	11	65x5¾"	540	200	2200	Drilling

CHEMICAL CONSUMPTION

Bentonite	182
Spersene	70
Caustic Soda	10
D-D Compound	1
Barytes	130
CMC	40

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD | PERMIT: PEP-5 N-Eumeralla | WELL 1

WEEKLY DRILLING REPORT No. 6 from 4-1 to 11-1-74 | RIG NAT 1320 DE

R. T. Elevation +207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
4-1	6580 (205)	9.4 / 10.0	39 / NIL	8.6 / 400	Ran in hole. Located top plug at 6315'. Drilled collar and shoe. Drilled to 6580'. Pulled out of hole for bit change. Made up 8½" drilling assembly. Ran in hole with bit NO.9.
5-1	6807 (227)	9.3 / 10.0	43 / NIL	7.0 / 300	Drilled to 6807'. Lost 40,000 lbs hook weight. No change in pump pressure. Pulled out of hole.
6-1	7039 (232)	9.3 / 9.0	41 / NIL	6.0 / 300	Pulled out of hole. String O.K. Ran in hole with BIT. NO. 9RR. Drilled to 7039'.
7-1	7392 (353)	9.4 / 9.5	39 / NIL	6.0 / 350	Drilled to 7342'. Circualted out sample from drilling break. Drilled to 7392'.
8-1	7697 (305)	9.4 / 9.5	40 / NIL	6.1 / 350	Drilled to 7697'.
9-1	7780 (83)	9.4 / 9.5	38 / NIL	6.2 / 300	Drilled to 7729'. Lost 300 psi pump pressure. Pulled out of hole. Layed out washed out collars. Ran in hole with bit NO. 10. Drilled to 7780'. Lost 1000 psi pump pressure. Pulled out of hole.
10-1	7992 (212)	9.5 / 9.5	39 / NIL	6.2 / 300	Pulled out of hole. Layed out washed stabilizer at 30'. Ran in hole. Drilled to 7992'.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5	N-Cumeralla	WELL 1
WEEKLY DRILLING REPORT No. 7	from 11-1 to 18-1-74	RIG	NAT. 1320 DE

R. T. Elevation + 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS

DRILLING ASSEMBLIES

NO.10 8½" J33 + 2x7" DC + STAB + 11x7" DC + 21 HWDP + 5" DP (to 9070').

NO.11 8½" J33 + 2x7" DC + STAB + 11x7" DC + 21 HWDP + 5" DP (to 9103').

NO.11RR 8½" J33 + 13x7" DC + 21 HWDP + 5" DP (to 9496').

NO.12 8½" XD7+11x7" DC + 21 HWDP + 5" DP (to 9613').

NO.13 8½" H7UGJ + junk sub + 11x7" DC + 21 HWDP + 5" DP (Reaming drilling on junk).

BIT RECORD

BIT NO.	SIZE & TYPE	WOB 1000lbs	RPM	FOOTAGE	HOURS	FT/HR	SPM	FT/SEC JET/VEL	FT/MIN ANN/VEL	PRESSURE PSI	BIT CONDITION
10	8½" J33	40	50	1341	91¾	15	65x 5¾"	540	200	2300	T5:33: I Broken Teeth
11	8½" J33	40	50	33	3½	9	65x 5¾"	540	200	2100	
11RR	8½" J33	40	50	393	25½	15	65x 5¾"	540	200	2350	T7:35: 02 Broken Teeth
12	8½" XD7	30	60	117	13½	9	65x 5¾"	540	200	2650	T8:B8: 08 Lost 2 cones
13	8½"H7UGJ	3-5	60	-			65x 5¾"	450	200	2200	in hole reaming.

CHEMICAL CONSUMPTION

Bentonite	160
Spersene	30
Caustic Soda	12
Barytes	93
CMC	55

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD | PERMIT: PEP-5 N-Eumeralla-1 WELL

WEEKLY DRILLING REPORT No. 7 from 11-1 to 18-1-1974 | RIG NAT. 1320 DE

R. T. Elevation ± 207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133'	3029'	6355'			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
11-1	8400 (408)	9.6 9.0	42 NIL	6.0 350	Drilled to 8400'.
12-1	8776 (376)	9.5 9.5	41 NIL	6.3 300	Drilled to 8483'. Made 8 stand check trip. Drilled to 8776'.
13-1	9070 (294)	9.6 10.0	42 NIL	6.3 350	Drilled to 8783'. Made 5 stand check trip. Drilled to 9070'. Pulled out of hole.
14-1	9136 (66)	9.6 9.5	39 NIL	7.6 300	Ran bit NO.11. Drilled to 9103'. Lost 250 psi pump pressure. Pulled out of hole. Layed out washed out string stabilizer. Ran in hole. Drilled to 9136'.
15-1	9496 (360)	9.5 9.5	39 NIL	6.6 300	Drilled to 9496'. Lost 800 psi pump pressure. Pulled out of hole.
16-1	9570 (74)	9.6 9.0	39 NIL	6.5 350	Layed out 6 slightly washed out DC's and 1 washed out DP. Bit washed out through weld between shanks. Picked up 4 new DC. Ran bit NO.12 Drilled to 9570'.
17-1	9613 (43)	9.5 9.5	42 NIL	6.6 350	Drilled to 9613'. Pulled out of hole. Lost 2 cones in hole. Ran reverse circulation junk basket. Reamed under-gauge hole from 9538' to 9568'. No more progress. Pulled out of hole. Ran bit NO.13 with junk sub. Reamed undergauge hole from 9532' to 9593'.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5 N-Sumeralla	WELL 1
WEEKLY DRILLING REPORT No. 8 from 18-1 to 25-1-74	RIG NAT. 1320 DE	

R. T. Elevation +207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3029	6355			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS

DRILLING ASSEMBLIES

NO.13 8½" H7UGJ + junk sub + 11 x 7" DC + 21 HWDP + 5" DP.

NO.14 8½" W7R2J + 11 x 7" DC + 21 HWDP + 5" DP

NO.15 8½" J44 + 18 x 7" DC + stab + 13 x 7" DC +21 HWDP + 5" DP

NO.16 8½" J55 + 14 x 7" DC + 21 HWDP + 5" DP

CH 1 61/8" DC 33 + jar + 14 x 7" DC + 21 HWDP + 5" DP

BIT RECORD

BIT NO.	SIZE & TYPE	WOB 1000lbs	RPM	FOOTAGE	HOURS	FT/HR	SPM	JET.VEL FT/SEC	ANN.VEL FT/MIN	PRESSURE PSI	BIT CONDITION
13	8½"H7UGJ	3-5	60	81(R)	3¼		65	450	200	2200	T4B502
14	8½"W7R2J	25-30	60	50	6½	8	65	320	200	1500	T8B802
15	8½" J44	35	50	20	4½	4	65	375	200	1600	T3B1I
16	8½" J55	40	50	46	7	7	65	375	200	1700	T2B1I
CH 1	61/8"DC33	5-8	35-50	8	3	3	40	-	120	900	15%wear

CHEMICAL CONSUMPTION

Bentonite	310
Spersene	111
Caustic Soda	17
Barytes	74
CMC	20

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT. PEP-5 N-Eumeralla WELL 1
WEEKLY DRILLING REPORT No. 8 from 18-1 to 25-1-74	RIG NAT. 1320 DE

R. T. Elevation ±207 ft above MSL

Sea Bottom Depth ft below MSL

CASING						
Size	20"	13 3/8"	9 5/8"			
Depth	1133	3019	6335			

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
18-1	9617 (4)	9.5 9.5	37 NIL	6.8 350	Reamed to 9613' and drilled on junk with junk sub. Ran reverse circulation junk basket. Cut 1' core. Recovered core - no junk. Ran 8½" bit NO.14. Washed down 9495' to 9613'. Drilled to 9617'.
19-1	9682 (65)	9.5 9.5	41 NIL	5.6 350	Drilled to 9663'. Pulled out of hole. Picked up 3 DC and stabilizer. Ran 8½" bit NO. 15. Reamed to 9682'.
20-1	9729 (47)	9.7 9.5	42 NIL	6.0 350	Drilled to 9683'. High torque. Pulled out and layed out stabilizer. Ran 8½" bit NO. 16. Washed 30' to bottom. Drilled to 9729'.
21-1	9737 (8)	9.5 9.5	42 NIL	5.6 350	Ran core barrel. Cut core NO.1 9729' - 9739'. Recovered 100%. Waited on Schlumberger. Schlumberger ran BHC + GR. LL-9(d) + SP.
22-1	9737 (NIL)	9.5 9.5	42 NIL	5.6 350	Schlumberger ran FDC + CAL HDT Took 1 gun CST. 30 fired, 20 recovered, 2 lost, 7 empty, 1 misfire. Made velocity survey.
23-1	9737 (NIL)				Completed velocity survey. Layed down HWDP + DC's Picked up 300' x 3½" tubing stinger. Ran in to 6550'. Set plug NO.1 with 200 sx class A cement, slurry weight 15.2 lbs/gal. Pulled out laying down excess DP and tubing stinger. Tagged plug at 6120'. Successfully pressure tested 1000 psi. Pulled out of hole laying down Drillpipe.
24-1	9737 (NIL)				Layed down drillpipe. Schlumberger cut 9 5/8" casing at 2660'. Unable to pull casing. Circulated through 9 5/8" and up 13 3/8"/9 5/8" annulus with 250 psi at 350 gal/min. Schlumberger cut casing at 2030'. Unable to pull casing. Cut off casing head housing.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD	PERMIT: PEP-5 N-Eumeralla	WELL 1
WEEKLY DRILLING REPORT No. 9 from to 25-1-74	RIG NAT. 1320 DE	

R. T. Elevation +207 ft above MSL	CASING					
Sea Bottom Depth ft below MSL	Size	20"	13 3/8"	9 5/8"		
	Depth	1133	3029	6355		

DATE	DEPTH (PROGRESS) (feet)	MUD Weight (lb/gal) / pH	Viscosity (MF secs) / oil (%)	Waterloss (cc/30 mins) / Cl (ppm)	OPERATIONS
25-1	9737 (nil)				Plugged off casing cut at 2030' with 200 sx class A cement, slurry weight 15.2 lbs.gal. Waited on cement 4 hrs. Ran in to 300' with open ended D.P. Set plug NO.3 with 100 sx class A cement. Slurry weight 15.5 lbs/gal. Pulled back to 50'. Circulated clean. Welded plate on top 13 3/8" and 9 5/8" casing. Abandoned North Eumeralla-1 at 17.30 hours on 25th January, 1974.

APPENDIX 7.

CUTTING DESCRIPTIONS

0 - 90'	100% LIMESTONE; coarse calcarenite, yellow, buff to white fossiliferous, moderate to fair porosity, glauconite and pyrite.
90 - 310	100% LIMESTONE; as above with decreasing porosity.
310 - 407	40% LIMESTONE; as above. 60% MARL; grey, plastic, fossiliferous.
407 - 1150	100% MARL; grey, plastic, loaded with fine fossil debris, glauconitic and pyritic, occasional fine sand. Trace LIMESTONE.
1150 - 1300	50% SAND; clear, white, milky, green and yellow, fine to coarse, round, sorted. 50% CLAY; dark brown, soft, calcareous, sandy, pyritic, fossiliferous. Trace loose fossil debris and PYRITE nodules.
1300 - 1340	100% SAND; clear, occasionally milky, medium to coarse, rounded, sorted, micaceous.
1340 - 1520	60% SAND; as above, occasional granules. 40% SHALE; brown to black, fissile, micaceous, lignitic.
1520 - 1640	100% SAND; as above.
1640 - 1980	95% SAND; as above. 5% LIGNITE; black, soft, occasionally brittle, micaceous and pyritic.
1980 - 2100	70% SAND; as above. 30% LIGNITE; as above.
2100 - 2370	95% SAND; as above. 5% LIGNITE; as above.
2370 - 2600	100% SAND; as above.
2600 - 2640	100% SILTSTONE; brown, argillaceous, hard, pyritic and sandy.
2640 - 2670	100% METAMORPHIC FRAGMENTS; dark grey, with multicoloured ash-like pellets.
2670 - 2790	80% MINERAL PELLETS; golden brown, medium sand size, sorted, rounded. 20% SAND; green, pink, blue, yellow, medium, angular to rounded, sorted.
2790 - 2870	80% SAND; multicoloured, often with golden brown mineral coating, sorted, angular to rounded. 10% SHALE; light to dark blue, pea green, hard, brittle.

		10% MINERAL PELLETS; golden brown, lustrous, metallic aspect, medium sand size, rounded and sorted.
2870	- 2950'	100% SAND; clear, white, yellow, golden, fine to coarse, angular to sub-angular, sorted, pyritic, micaceous, rare fossil debris.
2950	- 3050	80% SAND; as above. 10% SHALE; brown, green silty, sandy, soft, sub-fissile, pyritic. 10% LIGNITE; black, hard, pyritic.
3050	- 3110	100% SHALE; light grey, brown, soft, micaceous.
3110	- 3290	100% SAND; clear, occasionally white, yellow, fine, angular to sub-rounded, sorted, pyritic, glauconite, rare mica flakes.
3290	- 3320	100% LIGNITE; black, hard, brittle.
3320	- 3390	10% LIGNITE; as above. 45% SILTSTONE; white, light grey and green, hard, pyrite, calcareous and carbonaceous. 45% SHALE; light grey, soft, sandy and pyritic.
3390	- 3480	10% LIGNITE; as above. 35% SILTSTONE; as above. 35% SHALE; as above. 20% SAND; white, yellow, fine to coarse.
3480	- 3620	50% SILTSTONE; as above. 50% SHALE; as above.
3620	- 3700	100% SANDSTONE; white, fine, sub-rounded, sorted, calcareous cement, pyritic and micaceous.
3700	- 3780	100% SHALE; as above.
3780	- 3920	80% SANDSTONE; as above. 20% SHALE; as above.
3920	- 4280	50% SHALE; white to light grey, soft, plastic. 30% SILTSTONE; white to grey, calcareous cement, hard, grading in part to fine sandstone. 20% SANDSTONE; light grey and dark grey, fine, sorted, angular, glauconitic, micaceous, with calcareous cement.
4280	- 4350	100% SHALE; as above, with dark grey silty fraction, hard, brittle.

4350 –	4500'	70% SHALE; as above. 30% SILTSTONE; grey, mauve, brown, tight, hard, calcareous, carbonaceous, occasionally grading to tight calcareous sandstone.
4500 –	4570	50% SHALE; as above, with increasing green, firm to hard, brittle fraction. 50% SILTSTONE; as above.
4570 –	4660	30% SHALE; as above. 40% SILTSTONE; as above. 30% SANDSTONE; as above. Trace LIGNITE; brown to black, hard, brittle.
4660 –	4860	30% SHALE; light grey, soft, plastic, increasing green silty fraction. 50% SILTSTONE; light and darkgrey, brown, brittle, calcareous cement, micaceous, glauconitic, pyritic. 20% SANDSTONE; multicoloured, fine to medium, angular to sub-rounded, sorted, hard.
4860 –	5290	50% SHALE; as above. 50% SILTSTONE; as above.
5290 –	5360	100% SANDSTONE; as above.
5360 –	5390	40% SANDSTONE; as above. 50% QUARTZ; crystals, sub-angular, clear. 10% SILTSTONE; as above.
5390 –	5580	30% SHALE; light grey, plastic, with increasing green, grey and brown fraction, hard, fissile, silty, carbonaceous. 30% SANDSTONE; white, light grey, friable fine, sorted, round, multicoloured grains. 20% QUARTZ; as above. 20% SILTSTONE; light to dark grey, green, white, friable, grading to fine sandstone, calcareous, pyritic, carbonaceous. Trace LIGNITE.
5580 –	5660	60% SHALE; as above with trace of glauconite pellets. 20% SANDSTONE; as above. 20% SILTSTONE; as above.
5660 –	6220	40% SANDSTONE; grey, fine to medium, angular to sub-rounded, sorted, calcareous cement, pyritic, fair porosity.

		30% SILTSTONE; green to grey, silica cemented, consolidated. 30% SHALE; grey, brown and green, fissile Trace COAL, LIGNITE, GLAUCONITE, PYRITE AND CALCITE.
6220 -	6370'	60% SANDSTONE; as above. 20% SILTSTONE; as above. 20% SHALE; as above. Trace PYRITE, CALCITE, LIGNITE.
6370 -	6580	70% CLAY; light grey, soft. 15% SILTSTONE; white, occasionally grey brown, calcareous cement, sandy, micaceous, hard 15% SHALE; black, hard.
6580 -	7030	40% CLAY; grey, soft occasionally off-white, pink. 40% SANDSTONE; clear, white, grey, fine, sub-angular to sub-rounded, sorted, friable, very poor porosity. 10% SHALE; dark grey, brown, green, hard, fissile, silty, sandy, carbonaceous, micaceous. 10% LIGNITE; black, dark brown, bright, lustrous, brittle.
7030 -	7160	40% CLAY; as above. 40% SANDSTONE; as above. 20% SILTSTONE; as above.
7160 -	7290	20% CLAY; as above. 50% SANDSTONE; as above. 10% SILTSTONE; as above. 20% SHALE; light to dark grey, buff and dark brown, hard, fissile, occasionally silty, carbonaceous.
7290 -	7340	20% CLAY; as above. 20% SHALE; as above. 60% SANDSTONE; as above.
7340 -	7390	10% SHALE; as above. 20% CLAY; as above. 35% SANDSTONE; as above. 35% SAND; clear, white, cloudy and light green, medium to coarse, sub-angular to sub-rounded, sorted.
7390 -	7490	10% SAND; as above. 45% SANDSTONE; as above. 20% CLAY; as above. 20% SILTSTONE; dark grey, hard, silica cemented, speckled orange, limonitic. 5% SHALE; as above.

7490	-	7550'	70% SANDSTONE; as above. 20% CLAY; as above. 10% SILTSTONE; as above.
7550	-	7610	20% SANDSTONE; as above. 80% CLAY; as above.
7610	-	7690	30% SANDSTONE; as above. 40% SILTSTONE; as above. 30% CLAY; as above.
7690	-	7780	60% SHALE; as above. 20% SILTSTONE; as above. 20% SANDSTONE, white, light and dark grey, fine to medium, sub-angular to sub-rounded, sorted, friable, silica cemented. calcareous, no porosity.
7780	-	7990	50% SHALE; grey to dark grey, occasionally blue-grey, hard, sandy. 30% SANDSTONE; as above. 20% SILTSTONE; grey to dark grey, hard, sandy.
7990	-	8360	50% SHALE; as above. 30% SANDSTONE; as above. 20% SILTSTONE; as above.
8360	-	8400	5% SHALE; as above. 5% SILTSTONE; as above. 5% SAND; clear, white, occasionally light pink, granules. 85% SANDSTONE; clear, fine to medium, sub-angular to sub-rounded, sorted, abundent silica cement, hard, very poor porosity.
8400	-	8560	100% SAND; clear, fine to coarse, angular to sub-angular, sorted.
8560	-	8770	70% SANDSTONE; clear, white, bright orange, fine to coarse, sub-angular to sub-rounded, sorted, calcareous cement, rare garnets. 15% SILTSTONE; as above. 15% SHALE; as above. Trace PYRITE.
8770	-	8900	50% SILTSTONE; as above. 20% SHALE; as above. 30% SANDSTONE; clear, white, light brown and orange, medium to coarse, angular, sorted, abundent calcareous cement, no porosity.

8900 - 9070'	70% SANDSTONE; as above but often with green and silver, lustrous phyllite and dark mineral inclusions. 20% ANHYDRITE; white, occasionally green mineral stained, carbonaceous, soft. 10% SHALE; as above, occasionally mauve.
9070 - 9130	10% SHALE; as above. 10% ANHYDRITE; as above. 80% SANDSTONE; clear, coarse, angular, carbonaceous, occasional dark blue staining, hard. Trace MICA, COAL, PYRITE.
9130 - 9540	90% SANDSTONE; as above but with rare garnets. 10% GYPSUM/ANHYDRITE; white, amorphous, carbonaceous.
9540 - 9570	60% SANDSTONE; as above. 30% SHALE; brown, light to dark grey, hard, carbonaceous, occasionally grading to siltstone. 10% SILTSTONE; light to dark grey, sandy, hard. Trace GYPSUM/ANHYDRITE, COAL.
9570 - 9610	50% SANDSTONE; clear, white, orange, green, medium to coarse, angular, sorted, carbonaceous, hard, occasional green staining. 50% SHALE; brown, light to dark grey, carbonaceous, grading to siltstone, hard.
9610 - 9680	70% SANDSTONE; as above. 20% SHALE; as above. 10% SILTSTONE;as above.
9680 - 9729	90% SANDSTONE; as above 10% GYPSUM/ANHYDRITE; as above.
9729 - 9737 TD	CORE (see Appendix. 3).

PE902319

This is an enclosure indicator page.
The enclosure PE902319 is enclosed within the container PE902312 at this location in this document.

The enclosure PE902319 has the following characteristics:

ITEM_BARCODE =	PE902319
CONTAINER_BARCODE =	PE902312
NAME =	Geological Framework
BASIN =	OTWAY
PERMIT =	
TYPE =	WELL
SUBTYPE =	MAP
DESCRIPTION =	Geological Framework (enclosure 1 of WCR) for North Eumeralla-1
REMARKS =	
DATE_CREATED =	30/04/1974
DATE_RECEIVED =	
W_NO =	W678
WELL_NAME =	North Eumeralla-1
CONTRACTOR =	SHELL
CLIENT_OP_CO =	SHELL

PE902317

This is an enclosure indicator page.
The enclosure PE902317 is enclosed within the container PE902312 at this location in this document.

The enclosure PE902317 has the following characteristics:

ITEM_BARCODE =	PE902317
CONTAINER_BARCODE =	PE902312
NAME =	Exploration Density Map
BASIN =	OTWAY
PERMIT =	
TYPE =	WELL
SUBTYPE =	MAP
DESCRIPTION =	Exploration Density Map (enclosure 2 of WCR) for North Eumeralla-1
REMARKS =	
DATE_CREATED =	30/04/1974
DATE_RECEIVED =	
W_NO =	W678
WELL_NAME =	North Eumeralla-1
CONTRACTOR =	SHELL
CLIENT_OP_CO =	SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE902314

This is an enclosure indicator page.
The enclosure PE902314 is enclosed within the container PE902312 at this location in this document.

The enclosure PE902314 has the following characteristics:

ITEM_BARCODE = PE902314
CONTAINER_BARCODE = PE902312
NAME = Play Map Reflection Time Contours Lower Cretaceous Intra - Eumeralla
BASIN = OTWAY
PERMIT =
TYPE = WELL
SUBTYPE = CONTOUR_MAP
DESCRIPTION = Play Map Reflection Time Contours Lower Cretaceous Intra - Eumeralla (enclosure 3 of WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 30/04/1974
DATE_RECEIVED =
W_NO = W678
WELL_NAME = North Eumeralla-1
CONTRACTOR =
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE601436

This is an enclosure indicator page.
The enclosure PE601436 is enclosed within the container PE902312 at this location in this document.

The enclosure PE601436 has the following characteristics:

ITEM_BARCODE = PE601436
CONTAINER_BARCODE = PE902312
NAME = Geoservices Master Log Mud Log
BASIN = OTWAY
PERMIT =
TYPE = WELL
SUBTYPE = MUD_LOG
DESCRIPTION = Geoservices Master Log Mud Log (enclosure 4 from WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 30/04/1974
DATE_RECEIVED =
W_NO = W678
WELL_NAME = North Eumeralla-1
CONTRACTOR = GEOSERVICES
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE601435

This is an enclosure indicator page.
The enclosure PE601435 is enclosed within the container PE902312 at this location in this document.

The enclosure PE601435 has the following characteristics:

ITEM_BARCODE = PE601435
CONTAINER_BARCODE = PE902312
NAME = Composite Well Log
BASIN = OTWAY
PERMIT =
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Composite Well Log(enclosure 5 from WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 30/04/1974
DATE_RECEIVED =
W_NO = W678
WELL_NAME = North Eumeralla-1
CONTRACTOR = SHELL
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE902315

This is an enclosure indicator page.
The enclosure PE902315 is enclosed within the container PE902312 at this location in this document.

The enclosure PE902315 has the following characteristics:

ITEM_BARCODE = PE902315
CONTAINER_BARCODE = PE902312
NAME = Well Correlation Diagram North Eumeralla Area
BASIN = OTWAY
PERMIT =
TYPE = WELL
SUBTYPE = CROSS_SECTION
DESCRIPTION = Well Correlation Diagram North Eumeralla Area (enclosure 7 of WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 30/04/1974
DATE_RECEIVED =
W_NO = W678
WELL_NAME = North Eumeralla-1
CONTRACTOR = SHELL
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE601437

This is an enclosure indicator page.
The enclosure PE601437 is enclosed within the container PE902312 at this location in this document.

The enclosure PE601437 has the following characteristics:

ITEM_BARCODE = PE601437
CONTAINER_BARCODE = PE902312
NAME = Stratigraphy Summary Log
BASIN = OTWAY
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Stratigraphy Summary Log (enclosure 6 of WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 25/01/1974
DATE_RECEIVED =
W_NO = W678
WELL_NAME = North Eumeralla-1
CONTRACTOR = SHELL
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE601438

This is an enclosure indicator page.
The enclosure PE601438 is enclosed within the container PE902312 at this location in this document.

The enclosure PE601438 has the following characteristics:

```
     ITEM_BARCODE = PE601438
CONTAINER_BARCODE = PE902312
             NAME = North Eumeralla 1 Summary Sheet
            BASIN = OTWAY
           PERMIT =
             TYPE = WELL
          SUBTYPE = MONTAGE
      DESCRIPTION = North Eumeralla 1 Summary
          Sheet(enclosure 8 from WCR) for North Eumeralla-1
          REMARKS =
     DATE_CREATED = 30/04/1974
    DATE_RECEIVED =
             W_NO = W678
        WELL_NAME = North Eumeralla-1
       CONTRACTOR = SHELL
     CLIENT_OP_CO = SHELL
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE902316

This is an enclosure indicator page.
The enclosure PE902316 is enclosed within the container PE902312 at this location in this document.

The enclosure PE902316 has the following characteristics:

ITEM_BARCODE =	PE902316
CONTAINER_BARCODE =	PE902312
NAME =	North Eumeralla Area Interpreted Seismic Line
BASIN =	OTWAY
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	SECTION
DESCRIPTION =	North Eumeralla Area Interpreted Seismic Line (enclosure 9 of WCR) for Norh Eumeralla-1
REMARKS =	
DATE_CREATED =	30/04/1974
DATE_RECEIVED =	
W_NO =	W678
WELL_NAME =	North Eumeralla-1
CONTRACTOR =	SHELL
CLIENT_OP_CO =	SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE902318

This is an enclosure indicator page.
The enclosure PE902318 is enclosed within the container PE902312 at this location in this document.

The enclosure PE902318 has the following characteristics:

ITEM_BARCODE = PE902318
CONTAINER_BARCODE = PE902312
NAME = T-Z Curve & Sonic Internal Velocities
BASIN = OTWAY
PERMIT =
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = T-Z Curve & Sonic Internal Velocities (enclosure 10 of WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 30/04/1974
DATE_RECEIVED =
W_NO = W678
WELL_NAME = North Eumeralla-1
CONTRACTOR = SHELL
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE900503

This is an enclosure indicator page.
The enclosure PE900503 is enclosed within the container PE902312 at this location in this document.

The enclosure PE900503 has the following characteristics:

ITEM_BARCODE =	PE900503
CONTAINER_BARCODE =	PE902312
NAME =	Distribution of Microfauna Paleontological Chart
BASIN =	OTWAY BASIN
PERMIT =	PEP/5
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Paleontological Chart showing the Disribution of Microfauna (enclosure 11 from WCR) for North Eumeralla-1
REMARKS =	
DATE_CREATED =	30/04/74
DATE_RECEIVED =	
W_NO =	W678
WELL_NAME =	NORTH EUMERALLA-1
CONTRACTOR =	SHELL
CLIENT_OP_CO =	SHELL

(Inserted by DNRE - Vic Govt Mines Dept)

PE900504

This is an enclosure indicator page.
The enclosure PE900504 is enclosed within the container PE902312 at this location in this document.

The enclosure PE900504 has the following characteristics:

ITEM_BARCODE = PE900504
CONTAINER_BARCODE = PE902312
NAME = Distribution of Sporomorph & Microplankton Paleontological Chart
BASIN = OTWAY BASIN
PERMIT = PEP/5
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Paleontological Chart showing the Disribution of Sporomorph and Microplankton (enclosure 12 from WCR) for North Eumeralla-1
REMARKS =
DATE_CREATED = 30/04/74
DATE_RECEIVED =
W_NO = W678
WELL_NAME = NORTH EUMERALLA-1
CONTRACTOR = SHELL
CLIENT_OP_CO = SHELL

(Inserted by DNRE - Vic Govt Mines Dept)