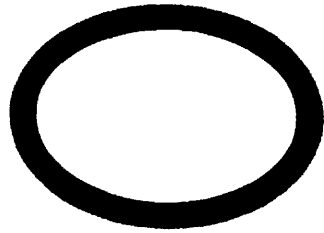


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DEPT. NAT. RES & ENV



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WCR VOL 1

TARWHINE - 1

W760

ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.

3

142. PAGES & 3 ENCLOSURES.

29 DEC 1982

WELL COMPLETION REPORT

TARWHINE - 1

OIL and GAS DIVISION

VOL 1

PART 1 of 2

GIPPSLAND BASIN

VICTORIA

ESSO AUSTRALIA LIMITED

TARWHINE-1

WELL COMPLETION REPORT

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ESSO AUSTRALIA LTD.

COMPLETION REPORT

1. WELL DATA RECORD

LOCATION

WELL NAME TARWHINE#1	STATE VIC.	PERMIT or LICENCE VIC/L1	GEOLOGICAL BASIN GIPPSLAND	FIELD TARWHINE
CO-ORDINATES LATITUDE 38° 24' 17.35"S LONGITUDE 147° 31' 41.28"E X 546113M E Y 5749121MN			MAP PROJECTION AMG ZONE 55	GEOGRAPHICAL LOCATION BASS STRAIT VICTORIA
<u>ELEVATIONS & DEPTHS</u>				
ELEVATIONS KB 21m RT Sea Level	WATER DEPTH 43m	TOTAL DEPTH 2955m MEASURED DEPTH 2955m	Average Angle Vertical well	
	PLUG BACK TYPE Suspended oil well.	REASONS FOR PLUGGING BACK Suspended oil well.		
<u>DATES</u>				
MOVE IN 19/11/81	RIG UP 20/11/81	SPUDED 20/11/81		
RIG DOWN COMPLETE 20/1 /82	RIG RELEASED 20/1 /82	PRODUCTION UNIT - RIG UP -		
PRODUCTION UNIT - RIG DOWN -		INITIAL PRODUCTION ESTABLISHED -		
<u>MISCELLANEOUS</u>				
OPERATOR ESSO AUST. LTD.	PERMITTEE or LICENCE EEPA, HEMATITE PETROLEUM PTY. LTD.	ESSO INTEREST 50% OTHER INTEREST 50%		
CONTRACTOR South Seas Drilling Co.	RIG NAME Southern Cross	EQUIPMENT TYPE Oilwell E-2000		
TOTAL RIG DAYS 62.4	DRILLING AFE NO. 231-009	COMPLETION NO. -	TYPE COMPLETION -	
WELL CLASSIFICATION	Before Drilling After Drilling	New field wildcat (Suspended oil well) New Field Discovery		

3. CEMENT DATA

WELL Tarwhine-1

DATE	DEPTH METRES	TYPE JOB	TYPE CEMENT	AMOUNT	ADDITIVES	REMARKS
Nov. 21	190.63	Cement 20" Casing	Class 'N'	627 sx	12% gel 2% CaCl ₂ Freshwater	Lead Slurry 1.51 SG (12.6 ppg)
			Class 'N'	350 sx	Neat w/ sea- water.	Tail Slurry 1.87 SG (15.6 ppg).
Nov. 24	784.07	Cement 13 3/8" Casing	Class 'N'	643 sx	Neat w/ seawater.	Lead Slurry 1.57 SG (15.6 ppg).
			Class 'N'	300 sx	Neat w/ seawater.	Tail Slurry 1.87 SG (15.6 ppg).
Jan. 1	2930	Two Stage 9 5/8" Csg. Stage 1	Class 'N'	900 sx	2.0% HR6L w/ fresh- water	Slurry wt 1.87 SG (15.6ppg) Unable to dis- place out of shoe.
		Stage 2	Class 'N'	710 sx	0.8% HR6L w/ fresh- water	Slurry wt. 1.87 SG (15.6ppg).
Jan. 6	Perfs @ 2890 & 1800 m	Recement Stage 1 thru perfs. Balanced Plug	Class 'N' Class 'N'	900 sx 100 sx	2.0% HR6L w/ fresh- water w/ F.W.	
Jan. 14	2640	Plug #1 Balanced Plug on top of Model 'D' packer.	Class 'N'	114 sx	1.8% HR6L w/ fresh- water.	Slurry wt. 1.87 SG (15.6 ppg).
Jan. 15	1450	Plug #2 9 5/8" EZSV				
Jan. 17	1372	Plug #3 Balanced Plug on top of Model 'D' packer.	Class 'N'	114 sx	Neat w/ fresh- water.	Slurry wt. 1.87 SG (15.6 ppg).
Jan. 17	1000	Plug #4 9 5/8" EZSV				
Jan. 17	780-680m	Plug #5 Balance plug	Class 'N'	114 sx	Neat w/ seawater	Slurry wt. 1.91 SG (15.9 ppg)

WELL : TARWHINE#1

4. SAMPLES, CONVENTIONAL CORES, SIDEWALL CORES.			
INTERVAL (mKB)	TYPE	INTERVAL (mKB)	TYPE
235-245m	Cuttings (5m)	2285-2290m	No Sample
245-260m	No Sample	2290-2660m	Cuttings (5m)
260-1392m	Cuttings (5m)	2663-2669m	Conventional Core#3
1392-1405m	Conventional Core#1		
1405-1418m	Conventional Core#2	2670-2955m	Cuttings (5m)
		2948.5-815m	SWC
1418-1420m	Cuttings	2955-235m	Geochem Samples (15m)
1420-2285m	Cuttings (5m)		

5. WIRELINE LOGS AND SURVEYS					
Type & Scale	From	To	Type & Scale	From	To
<u>SUITE 1</u>					
ISF/SONIC/GR 1:200	792m	- 68	Cyberdip 1:200	2520	- 1950m
ISF/SONIC/GR 1:500	792m	- 68	BHC/GR 1:200	2518	- 784m
<u>SUITE 2</u>					
DLL/MSFL/GR 1:200	1582m	- 783.8	BHC/GR 1:500	2518	- 784m
DLL/MSFL/GR 1:500	1582m	- 783.8	RFT 6-8 HP 1:200	2503	- 1552m
LDT/CNL/GR 1:200	1582m	- 784	RFT 6-8 SCH 1:200	2503	- 1552m
LDT/CNL/GR 1:500	1582m	- 784	CST Runs 1-3 1:200	2507	- 815m
RFT 1-3 SCH 1:200	1560m	- 1390.5	VEL. SURVEY 9 levels	2520	- 1150m
RFT 1-3 HP 1:200	1560m	- 1390.5	<u>SUITE 5</u>		
<u>SUITE 3</u>					
RFT 4-5 SCH 1:200	1407m	- 1388	DLL/MSFL/GR 1:200	2809	- 2510m
RFT 4-5 HP 1:200	1403m	- 1388	DLL/MSFL/GR 1:500	2809	- 2510m
VEL. SURVEY 12 levels	1980	- 840	LDT/CNL/GR 1:200	2813	- 2515m
<u>SUITE 4</u>					
DLL/MSFL/GR 1:200	2518	- 1522m	LDT/CNL/GR 1:500	2813	- 2515m
DLL/MSFL/GR 1:500	2518	- 1522m	BHC/GR 1:200	2813	- 784m
LDT/CNL/GR 1:200	2519	- 1575m	BHC/GR 1:500	2813	- 784m
LDT/CNL/GR 1:500	2519	- 1575m	HDT/GR 1:200	2815	- 2520m
HDT/GR 1:200	2520	- 1300m	RFT 9-10 SCH 1:200	2803	- 2489m
			RFT 9-10 HP 1:200	2803	- 2489m
			RFT 11-12 SCH 1:200	2803	- 2489m
			RFT 11-12 HP 1:200	2803	- 2489m

(continued next page)

WELL: TARWHINE#1

5. WIRELINE LOGS AND SURVEYS			
Type & Scale	From	To	Type & Scale
<u>SUITE 6</u>			
DLL/MSFL/GR 1:200	2951	2809m	
DLL/MSFL/GR 1:500	2951	2809m	
LDT/CNL/GR 1:200	2953	2813m	
LDT/CNL/GR 1:500	2953	2813m	
BHC/GR/SP 1:200	2953	2813m	
BHC/GR/SP 1:500	2953	2813m	
HDT/GR 1:200	2955	2815m	
RFT 13-14 HP 1:200	2927	2664m	
RFT 13-14 SCH 1:200	2927	2664m	
CST Runs 4-5 1:200	2948	2486m	
VEL. SURVEY 10 levels	2953	1503.5	
<u>CASED HOLE LOGS</u>			
GR/CCL 1:200	2892	1200m	
CBL/VDL 1:200	2862	778m	
Temperature 1:200	2870	1800m	
Survey 1:500			

TARWHINE-1

6. GEOLOGICAL AND GEOPHYSICAL ANALYSIS

<u>AGE</u>	<u>UNIT/HORIZON</u>	<u>DEPTH (m)</u>			<u>THICKNESS</u> (m)
		<u>PREDICTED</u>	<u>ACTUAL</u>	<u>SUBSEA</u>	
Pliocene/Miocene	Gippsland Limestone	69	64	-43	1016
Miocene/Oligocene	Lakes Entrance Formation	1121	1080	-1059	265
Eocene/Maastrichtian	Latrobe Group (Gurnard Fm)	1406	1345	-1324	41m
	("Coarse Clastics")	1436	1386	-1365	1569+
	Lower <u>N. asperus</u> Seismic Marker	1638			
	<u>T. longus</u> Seismic Marker	2451			
	Total Depth	2521	2955	-2934	

INTRODUCTION

Tarwhine-1 was drilled to test an anticlinal closure on a trend with the Barracouta field and the Perch and Dolphin oil discoveries. The well encountered a gross oil column of 22 metres at the top of the Latrobe Group "coarse clastics", and hydrocarbon shows were also encountered deeper in the Latrobe Group. However, only minor gas and condensate was recovered from the intra-Latrobe section during wireline and production testing.

PREVIOUS DRILLING HISTORY

No previous wells have been drilled on the Tarwhine structure. The nearest wells to Tarwhine-1 are Barracouta-3 (12.1km NE) which encountered gas and Dolphin-1 (16.5km SW) which encountered oil.

GEOLOGICAL ANALYSIS

Structure

The Tarwhine structure is one of a series of en echelon anticlines along the Perch-Dolphin-Tarwhine-Barracouta trend. At the top of the Latrobe Group it is a simple, unfaulted northeast-southwest trending anticline about 4.5 kilometres long by 2.5 kilometres wide, with a vertical closure of 30 metres (Enclosure 1). Tarwhine-1 was drilled on the crest of this anticline.

Stratigraphy

Tarwhine-1 drilled the predicted limestones and calcareous sediments of the Gippsland Limestone and Lakes Entrance Formation.

Micropalaeontological analysis suggests that the Middle Miocene to early Pliocene is either missing or represented by a condensed sequence.

The Gurnard Formation at the top of the Latrobe Group is composed of glauconitic claystone and siltstone and is non-net in Tarwhine-1. No time break could be identified between the Gurnard Formation and the Lakes Entrance Formation.

Similarly, no significant unconformity is present between the Gurnard Formation and underlying N. asperus sandstones of the Latrobe Group "coarse clastics", which provide the reservoir at Tarwhine. The presence of dinoflagellates as deep as 139lm (ss) suggests marine incursion during the Middle Eocene.

Beneath the "top of Latrobe" reservoir section, the lower N. asperus to M. diversus zones consist of fluvial sandstones, siltstones, shales and coals.

The underlying L. balmei zone contains thicker non marine sandstones with some siltstone and shale but only minor coal.

The T. longus and T. lilliei zones consist of non marine sandstones, shales, siltstones and coals.

No major periods of erosion or non deposition are evident within the Latrobe Group, although mean sedimentation rates decrease up the section, and anomalously low deposition rates in the upper N. asperus and P. asperopolus zones may suggest that minor periods of erosion or non deposition have occurred. (Appendix 5).

Tarwhine-1 was extended past the original proposed Total Depth of 2500m (ss) when hydrocarbons were encountered in the intra-Latrobe section.

HYDROCARBONS

Tarwhine-1 penetrated a 22 metre gross hydrocarbon column at the top of the Latrobe Group "coarse clastics". The sandstone in this section has an average porosity of 22-23%, with a net to gross ratio of 54%. Log analysis indicates the oil-water contact to be in a 3 metre shale between 1386 metres (ss) and 1389 metres (ss). Pressure data suggests the contact to be between 1386 metres (ss) and 1387 metres (ss).

A 2.5 metre sand (1377m(ss) to 1379.5m(ss)) was production tested and flowed for 5 hours on a 42/64" choke at a rate of 2604 barrels per day (GOR 1135:1). The oil is extremely light (62^o -66^oAPI gravity).

Several thin hydrocarbon bearing sands were encountered deeper in the Latrobe Group, and produced minor amounts of gas and condensate during RFT testing. No oil was recovered during these tests. Good cut and fluorescence were observed in Core 3 (2642m to 2648m (SS)) but RFT, FIT and production testing over the interval failed to recover oil and only minor amounts of gas were recovered.

GEOPHYSICAL ANALYSIS

Top of Latrobe Group "coarse clastics" was penetrated at 1365 metres (ss), 50m high to prediction. The conversion factor used to calculate the average velocities over the prospect was underestimated by 2.7%. The conversion factor used over Tarwhine-1 was based on conversion factors calculated at Barracouta-3 (12.1km NE) and Dolphin-1 (16.5km SW).

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7. SUMMARY OF FORMATION TEST PROGRAMME

TEST	SEAT	DEPTH (METRES) K. B.	CHAMBER (Lit)	RECOVERY					SCHLUMBERGER GAUGE FORMATION PRESSURE		SCHLUMBERGER GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPag	Psig	MPag	Psig	millidarcys	
1	1	1560	PRETEST											
1	2	1559.5	"						15.327	2223	18.831	2731		SEAL FAILURE
1	3	1552	"						15.258	2213	18.837	2732		
1	4	1538	"						15.100	2190	18.741	2718		
1	5	1529	"						15.100	2190	18.548	2690		
1	6	1522.5	"						15.018	2178	18.444	2675		
1	7	1515.5	"						14.956	2169	18.369	2664		
1	8	1515.5	"						14.893	2160	18.293	2653		
1	9	1508.5	"						14.811	2148	18.203	2640		
1	10	1498	"						14.700	2132	18.065	2620		
1	11	1489.5	"						14.631	2122	17.969	2606		
1	12	1480	"						14.631	2122	17.858	2590		
1	13	1470	"						14.962	2107	17.741	2573		
1	14	1460	"						14.431	2093	17.603	2553		
1	15	1439	"						14.335	2079	17.369	2519		
1	16	1439	"						14.142	2051	17.079	2477		
1	17	1416.5	"						13.921	2019	17.031	2470		
1	18	1412	"						13.880	2013	17.231	2499		
1	19	1431	"						14.059	2039	16.976	2462		
1	20	1407	"						13.832	2006	16.914	2453		
1	20	1402	"						13.804	2002	16.914	2453		TIGHT TEST

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

* psia

TEST	SEAT	DEPTH (METRES) K.B.	CHAMBER (Lit)	RECOVERY					SCHLUMBERGER GAUGE FORMATION PRESSURE		SCHLUMBERGER GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPag	Psig	MPag	Psig	millidarcys	
1	21	1399	PRETEST						13.790	2000	16.879	2448		
1	22	1396.7	"						13.776	1998	16.845	2443		
1	23	1393.1	"						13.756	1995	16.810	2438		
1	24	1390.5	"						13.742	1993	16.783	2435		
1	25	1387.8	"						13.735	1992	16.741	2428		
1	26	1406.4	27.3			0.0068	8600		13.845	2008 *	16.947	2458) HP GAUGE (SEAT 26 ONLY)
1	26	1406.4	4.5			0.0099	3750		13.845	2008 *	16.947	2458		
														MISRUN OF RFT#2 DUE TO CABLE FAULT
3	27	1396.6	27.3	350		0.086		950	13.763	1996	16.843	2443		
3	27	1396.6	4.5	720		0.135		110	13.763	1996	16.843	2443		
4	28	1403.5	PRETEST								16.886	2449		SEAL FAILURE
4	29	1400.7	"						13.783	1999	16.872	2447		
4	30	1397.5	"								16.803	2437		SEAL FAILURE
4	31	1397.7	"						13.763	1996	16.852	2444		
4	32	1392.2	"								16.776	2433		SEAL FAILURE
4	33	1388.5	"								16.748	2429		SEAL FAILURE
4	34	1387.7	27.3	11,300		1.81		3100	13.721	1990	16.706	2423		
4	34	1387.7	4.5						13.721	1990	16.706	2423		PRESERVED SAMPLE

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K. B.	CHAMBER (Lit)	RECOVERY					SCHLUMBERGER GAUGE FORMATION PRESSURE		SCHLUMBERGER GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPag	Psig	MPag	Psig	millidarcys	
5	35	1399	27.3	6300		0.95		11200	13.775	1998	16.830	2441		
5	35	1399	4.5						13.776	1998	16.830	2441		PRESERVED SAMPLE

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K.B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia	millidarcys	
6	36	1552	PRETEST						15.273	2215	18.893	2740		
6	37	2504	"								30.166	4375		SEAL FAILURE
6	38	2411	"								29.201	4235		SEAL FAILURE
6	39	1797	"						17.658	2561	21.858	3170		
6	40	1973	"								23.926	3470		SEAL FAILURE
6	41	1972.5	"								23.926	3470		SEAL FAILURE
6	42	2011	"								24.374	3535		SEAL FAILURE
6	43	2365.5	"								28.822	4180		SEAL FAILURE
6	44	2367.5	"								28.684	4160		SEAL FAILURE
6	45	1797	"								21.789	3160		SEAL FAILURE
7	46	1973	"						19.375	2810	23.892	3465		
7	47	2166.5	"						21.230	3079	26.201	3800		
7	48	2216.5	"						21.713	3150	26.822	3890		
7	49	2298	"						22.519	3266	27.753	4025		
7	50	2506	"								30.408	4410		SEAL FAILURE
7	51	2503	"						24.574	3565	30.304	4395		
7	52	2489	"						24.402	3539	30.063	4360		
7	53	2482	"						24.333	3529	29.959	4345		
7	54	2470	"						24.221	3513	29.649	4300		

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K.E.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia	millidarcys	
7	55	2461.5	PRETEST						24.140	3501	29.511	4280		
7	56	2453	"						24.050	3488	29.477	4275		
7	57	2442	"						23.947	3473	29.442	4270		
7	58	2435.5	"						23.878	3463	29.470	4274		
7	59	2426	"						23.781	3450	29.290	4248		
7	60	2415.5	"								29.097	4220		SEAL FAILURE
7	61	2415	"								29.070	4216		SEAL FAILURE
7	62	2411	"						23.634	3428	29.001	4206		
7	63	2403.5	"						23.568	3418	28.897	4191		
7	64	2405	"						23.574	3419	29.022	4209		
7	65	2397.5	"						23.512	3410	28.980	4203		
7	66	2394.5	"						23.512	3410	28.980	4203		
7	67	2378.5	"						23.359	3388	28.684	4160		
7	68	2369	"						23.216	3367	28.580	4145		
7	69	2365.5	"						23.188	3363	28.546	4140		
7	70	2363	"								28.491	4132		SEAL FAILURE
7	71	2362.8	"								28.456	4127		SEAL FAILURE
7	72	2359.5	"						23.188	3363	28.380	4116		
7	73	2352.5	"						23.057	3344	28.442	4125		
7	74	2336	"						22.092	3320	28.236	4095		

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K.B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia	millidarcys	
7	75	2359.5	27.3						23.194	3364	28.496	4133		TIGHT WHEN SAMPLING
7	75	2359.5	4.5						23.194	3364	28.496	4133		TIGHT WHEN SAMPLING
7	76	2359	27.3						23.188	3363	28.496	4130		TIGHT WHEN SAMPLING
7	76	2359	4.5						23.188	3363	28.496	4130		TIGHT WHEN SAMPLING
7	77	2403.4	27.3		100	1.01		5500	23.574	3419	29.027	4210		TIGHT WHEN SAMPLING
7	77	2403.4	4.5						23.574	3419	29.027	4210		PRESERVED SAMPLE
8	78	2365.5	27.3		50	0.84		9750	23.194	3364	28.475	4130		2365.5 tight on samplin
8	78	2366.5	4.5						23.202	3365	28.475	4130		Moved to 2366.5 PRESERVED SAMPLE
8	78a	2366.5	27.3											
8	78a	2366.5	4.5											RESET TOOL TO PREVENT STICKING
9	78b	2489	PRETEST						24.409	3540	30.297	4394		
9	79	2803	"						27.622	4006	34.021	4934		
9	80	2796.2	"						27.553	3996	33.855	4910		
9	81	2792	"						27.505	3989	33.848	4909		
9	82	2779	"						27.449	3981	33.607	4874		
9	83	2769	"						27.312	3961	33.490	4857		
9	84	2749	"						27.138	3936	33.200	4815		
9	85	2743.8	"						27.001	3916	33.193	4814		
9	86	2732	"						26.912	3903	33.055	4794		
9	87	2726	"								32.966	4781		SEAL FAILURE
9	88	2725.8	"								33.000	4786		SEAL FAILURE
9	89	2720.5	"								33.000	4786		SEAL FAILURE

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K.B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia	millidarcys	
9	90	2721.6	PRETEST											
9	91	2718	"						26.883	3899	32.952	4779		SEAL FAILURE
9	92	2712.4	"						26.705	3873	32.869	4767		
9	93	2693.8	"								32.890	4770		
9	94a	2691	"								32.552	4721		TIGHT
9	94b	2691	"								32.614	4730		SEAL FAILURE
9	95	2689	"								32.117	4658		SEAL FAILURE
9	96	2690.7	"								32.455	4707		TIGHT
9	97	2690.5	"								32.483	4711		SEAL FAILURE
9	98	2686	"								32.621	4731		SEAL FAILURE
9	99	2670	"						26.574	3854	32.483	4711		
9	100	2669.5	"								32.350	4692		SEAL FAILURE
9	101	2664	"								32.269	4680		TIGHT
9	102	2661.8	"								32.111	4657		SEAL FAILURE
9	103	2666.4	"						26.174	3796	32.290	4683		
9	104	2665.6	"								32.269	4680		
9	105	2658	"						26.229	3804	32.200	4670		
9	106	2659.4	"						26.167	3795	32.249	4677		
9	107	2665.6	"						26.167	3795	32.166	4665		
9	108	2614	"						26.236	3805	32.373	4695		
9	109	2595	"						25.671	3723	31.628	4587		
									25.471	3694	31.476	4565		

SUMMARY OF FORMATION TEST PROGRAMME

TEST	SEAT	DEPTH (METRES) K. B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY millidarcys	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia		
9	110	2579	PRETEST								31.242	4531		SEAL FAILURE
9	111	2578.5	"						25.297	3669	31.242	4531		
9	112	2568.7	"						25.202	3655	31.138	4516		
9	113	2555	"						25.078	3637	30.945	4488		
9	114	2547	"						25.064	3635	30.897	4481		
9	115	2540.5	"								30.876	4478		SEAL FAILURE
10	115a	2503	"						24.567	3563	30.316	4397		
10	116	2489	"								30.256	4388		SEAL FAILURE
10	117	2490.5	"						24.423	3542	30.180	4377		
10	118	2498.5	"						24.512	3555	30.194	4379		
10	119	2509.5	"						24.622	3571	30.373	4405		
10	120	2513	"								30.387	4407		SEAL FAILURE
10	121	2512.5	"						24.643	3574	30.373	4405		
10	122	2501.5	"						24.560	3562	30.325	4398		
10	123	2504.4	"						24.595	3567	30.270	4390		
10	124	2507.5	"						24.600	3568	30.442	4415		
10	125	2536.5	"						24.898	3611	30.649	4445		
10	126	2540.5	"						24.933	3616	30.766	4462		
10	127	2547	"						24.995	3625	30.842	4473		
10	128	2659.4	27.3			0.058		21300	26.153	3793	32.164	4665		
10	128	2659.4	4.5			0.012		3500	26.153	3782	32.1664	4665		
11	129	2779	27.3			0.062		21,100	27.450	3976	33.536	4864		

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K. B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia	millidarcvs	
11	129	2779	4.5			0.014		3650	27.415	3971	33.536	4864		NO RECOVERY-TOO TIGHT TO SAMPLE
12	130	2498.5	27.3						24.478	3557	30.454	4417		
12	131	2498.7	27.3			0.035		21900	24.505	3554	30.336	4400		SEAL FAILURE SEAL FAILURE
12	131	2498.7	4.5			0.003		9000	24.491	3552	30.336	4400		
13	132	2712.4	PRETEST						26.696	3872	32.848	4764		SEAL FAILURE SEAL FAILURE
13	133	2927	"								35.469	5144		
13	134	2927.2	"								35.441	5140		SEAL FAILURE TIGHT
13	135	2926	"						28.911	4193	35.441	5140		
13	136	2922	"								35.379	5131		SEAL FAILURE SEAL FAILURE
13	137	2922.3	"								35.372	5130		
13	138	2921	"								35.351	5127		SEAL FAILURE SEAL FAILURE
13	139	2921.2	"								35.358	5128		
13	140	2923	"								35.358	5128		SEAL FAILURE SEAL FAILURE
13	141	2917.2	"								35.275	5116		
13	142	2920.2	"						28.822	4182	35.303	5120		SEAL FAILURE SEAL FAILURE
13	143	2907.7	"								35.138	5096		
13	144	2908	"								35.131	5095		SEAL FAILURE SEAL FAILURE
13	145	2907.2	"								35.110	5092		

SUMMARY OF FORMATION TEST PROGRAMME

TARWHINE-1

TEST	SEAT	DEPTH (METRES) K. B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY millidarcys	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia		
13	146	2892	PRETEST								34.951	5069		SEAL FAILURE
13	147	2891	"								34.944	5068		SEAL FAILURE
13	148	2890	"								34.917	5064		SEAL FAILURE
13	149	2886.2	"								34.869	5057		SEAL FAILURE
13	150	2876.5	"								34.745	5039		SEAL FAILURE
13	151	2878.5	"								34.765	5042		SEAL FAILURE
13	152	2718	"						26.884	3899	32.793	4756		
13	153	2870.7	"								34.758	5041		SEAL FAILURE
13	154	2871.3	"								34.745	5039		SEAL FAILURE
13	155	2855	"								34.531	5008		SEAL FAILURE
13	156	2860.5	"								34.579	5015		SEAL FAILURE
13	157	2860	"						28.262	4099	34.579	5015		
13	158	2854	"						28.158	4084	34.496	5003		
13	159	2843.5	"								34.379	4986		SEAL FAILURE
13	160	2843	"						28.015	4063	34.352	4982		
13	161	2834	"								34.255	4968		SEAL FAILURE
13	162	2836.8	"								34.276	4971		SEAL FAILURE
13	163	2726	"								33.090	4799		TIGHT
13	164	2727.5	"								33.083	4798		TIGHT
14	165	2721.5	"						26.848	3894	33.041	4792		
14	166	2694	"						26.517	3846	32.614	4730		

SUMMARY OF FORMATION TEST PROGRAMME

FARWHINE-1

TEST	SEAT	DEPTH (METRES) K. B.	CHAMBER (Lit)	RECOVERY					HP GAUGE FORMATION PRESSURE		HP GAUGE HYDROSTATIC PRESSURE		HORIZONTAL PERMEABILITY	REMARKS
				OIL ml	COND. ml	GAS m ³	FORMATION WATER ml	FILTRATE ml	MPaa	Psia	MPaa	Psia	millidarcys	
14	167	2690.8	PRETEST						26.524	3847	32.552	4721		
14	168	2670	"								32.276	4681		TIGHT
14	169	2664	"						26.193	3799	32.207	4671		
14	170	2667	"								32.242	4676		TIGHT
14	171	2662	"								32.186	4668		TIGHT
FIT	1	2779	54.6			.07		30,050 (mud)						
FIT	1	2779	0.6			.028		600 (mud)						
FIT	2	2661.5	54.6			.042		36,000						
FIT	2	2661.5	0.6					600						

8. TARWHINE#1 TEMPERATURE RECORD

LOGGING RUN	THERMOMETER DEPTH (m) KB	MAX. RECORDED TEMPERATURE (C°)	CIRCULATION TIME (t _k) (hours)	TIME AFTER CIRCULATION STOPPED (t)	HORNER* TEMPERATURE (C°)	GEOHERMAL GRADIENT (C°/km)
<u>SUITE#2</u> DLL/MSFL/GR LDT/CNL/GR	1582 1582	62.2 65.0	5hrs	4hrs : 57min 8hrs : 10min	70.95	40.1
<u>SUITE#4</u> DLL/MSFL/GR LDT/CNL/GR BHC/GR HDT	2521 2521 2521 2521	81.1 83.8 85.5 87.7	2hrs	7hrs : 15min 13hrs : 30min 18hrs : 30min 24hrs : 45min	90.5	32.7
<u>SUITE#5</u> DLL/MSFL/GR LDT/CNL/GR BHC/GR HDT	2815 2815 2815 2815	85.7 87.2 91.1 93.8	1hr 30min	12hrs : 15min 17hrs : 10min 22hrs : 45min 26hrs : 45min	108.0	35.6

(continued next page)

8. TARWHINE#1 TEMPERATURE RECORD

LOGGING RUN	THERMOMETER DEPTH (m)	MAX. RECORDED TEMPERATURE (C°)	CIRCULATION TIME (t_k) (hours)	TIME AFTER CIRCULATION STOPPED (t)	HORNER* TEMPERATURE (C°)	GEOHERMAL GRADIENT (C°/km)
SUITE#6 DLL/MSFL/GR LDT/CNL/GR BHC/GR HDT	2955 2955 2955 2955	85.5 87.2 89.4 91.4	2hrs	5hrs : 30min 9hrs : 20min 13hrs: 35min 17hrs: 40min	98.4	29.5

FIGURES

LOCALITY MAP

SCALE - 1:250,000

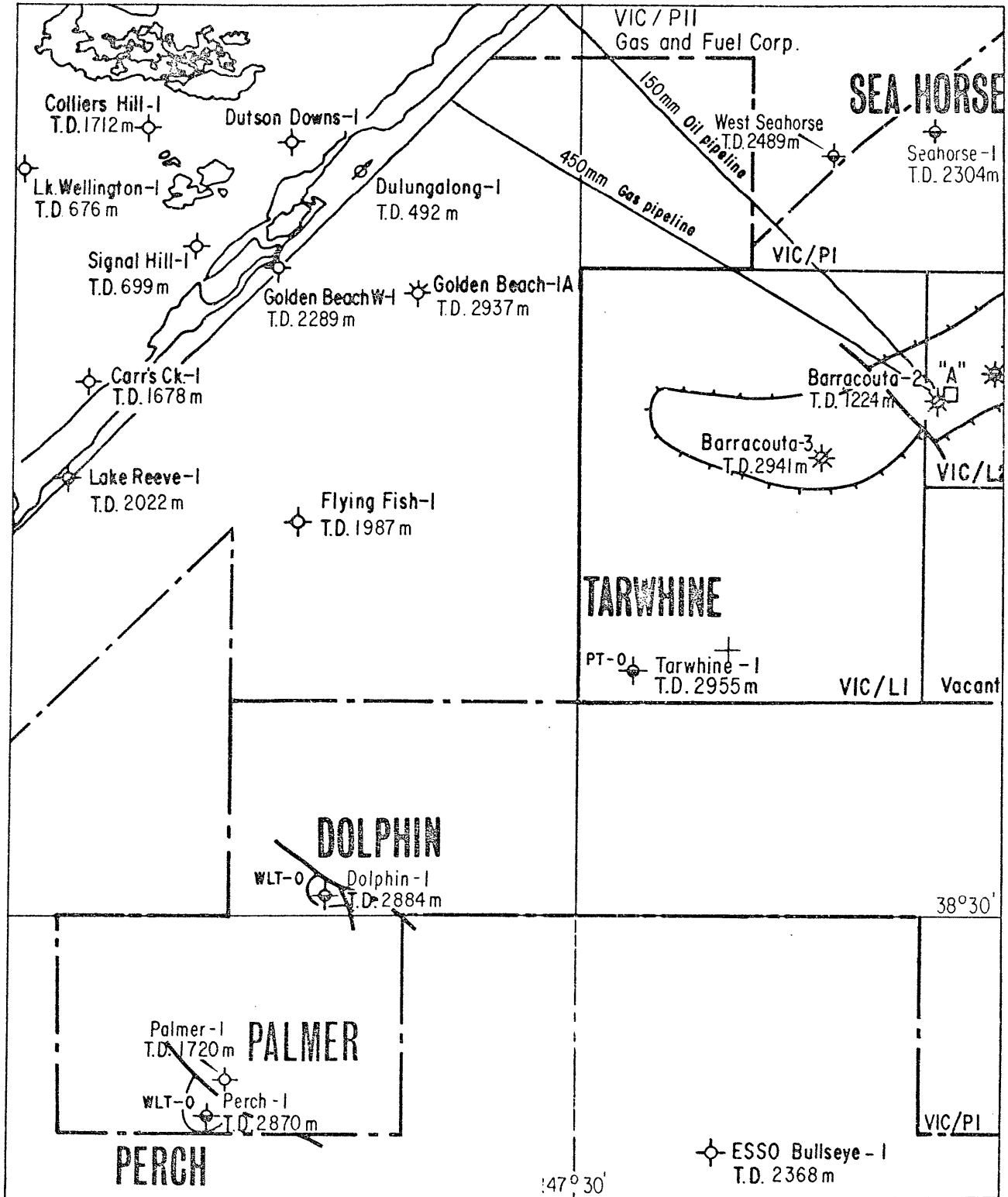


Figure 1

WELL PROGRESS CURVE

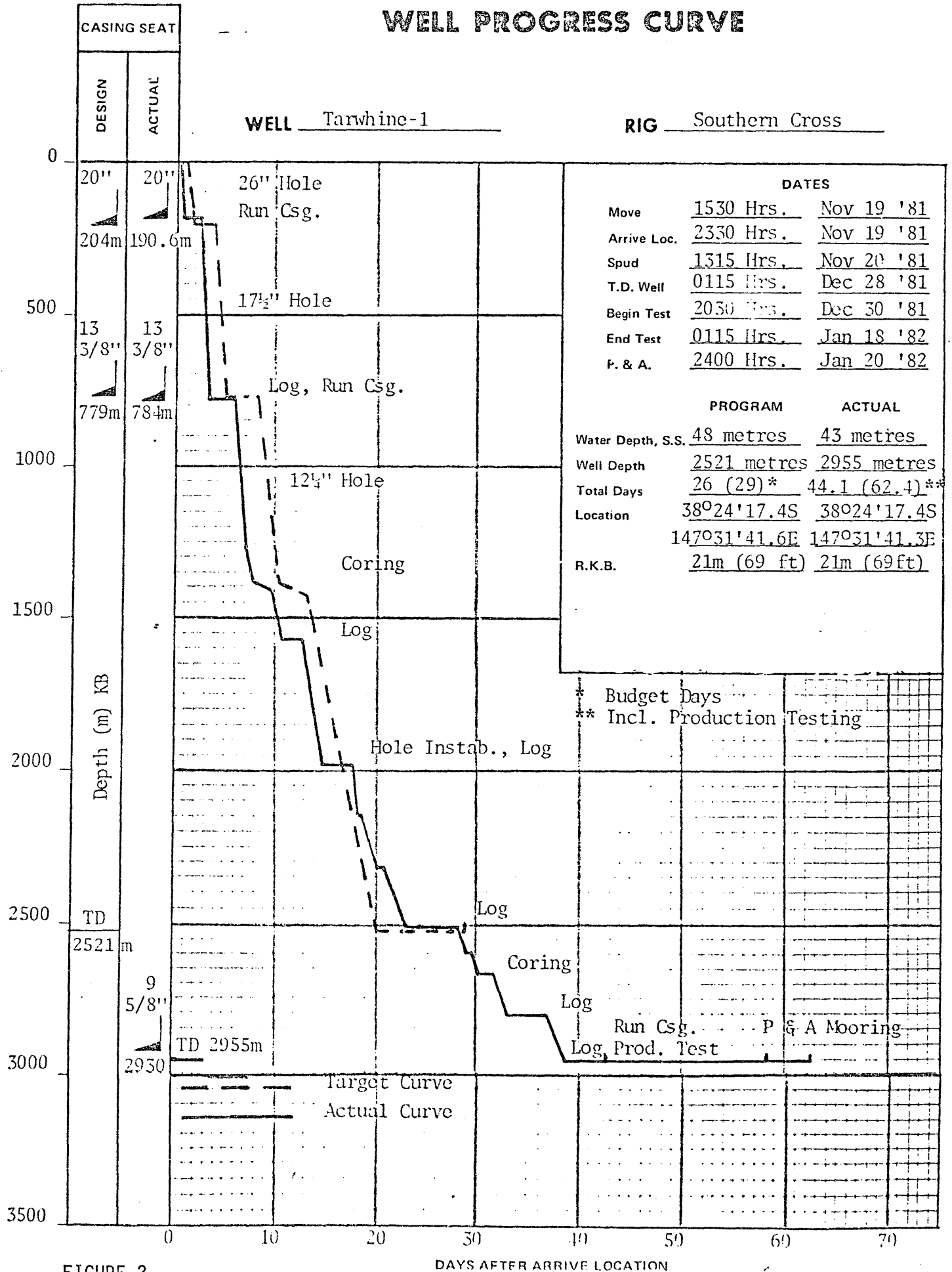


FIGURE 2

ESSO AUSTRALIA LTD.
TARWHINE-1
ABANDONMENT SCHEMATIC

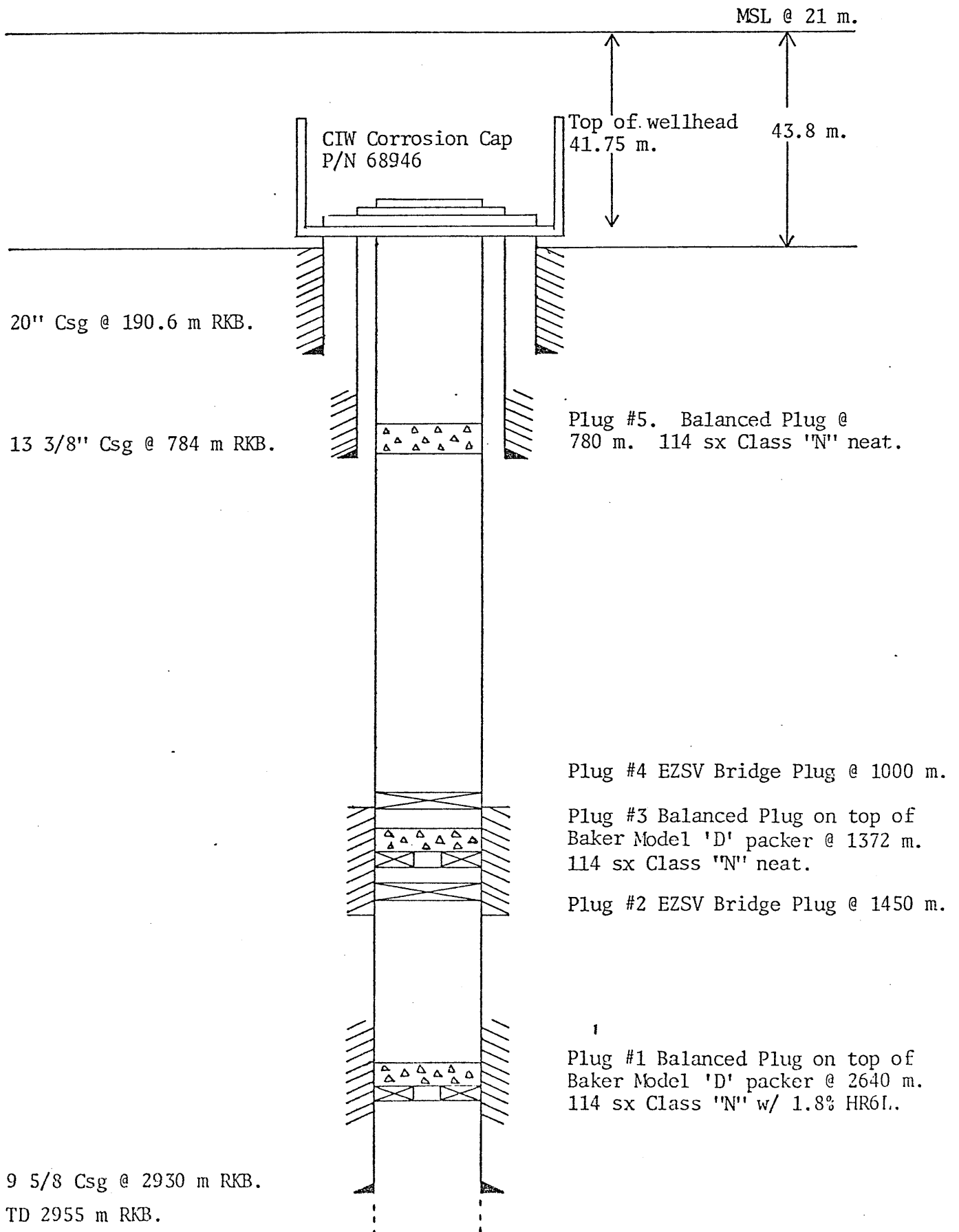


FIGURE 3

TARWHINE - 1

STRATIGRAPHIC TABLE

MM YEARS	EPOCH	SERIES	FORMATION HORIZON	PALYNOLOGICAL	PLANKTONIC	DRILL DEPTH * (METRES)	SUBSEA DEPTH * (METRES)	THICKNESS (METRES)	
				ZONATION SPORE - POLLEN ASSEMBLAGE ZONES A.D. PARTRIDGE/H.E. STACEY	FORAMINIFERAL ZONATIONS D. TAYLOR				
0			SEAFLOOR			64	43		
	PLEIST	E L	GIPPSLAND LIMESTONE		A 1			1016	
		E L			A 2				
	PLIO	E M			A 3				
5		E M			A 4	1080	1059		
	MIOCENE	LATE	[Hatched Area]		B 1	[Hatched Area]	MISSING OR CONDENSED SEQUENCE	[Hatched Area]	
					B 2				
10				C					
		MIDDLE			D 1				
					D 2				
15			E 1		1080	1059			
				E 2					
					F				
20	OLIGOCENE	EARLY	LAKES ENTRANCE FORMATION		G			265	
					H 1				
25		LATE			<i>P. tuberculatus</i>	H 2			
					I 1				
30					I 2				
	EARLY			J 1					
35				J 2					
	EOCENE	LATE	[Hatched Area]	Upper	<i>N. asperus</i>	1345	1324	41	
40				Middle	<i>N. asperus</i>	1386	1365		
		MIDDLE			Lower	<i>N. asperus</i>			1569+
45						<i>P. asperopolus</i>			
				EARLY		Upper	<i>M. diversus</i>		
50		Middle	<i>M. diversus</i>						
			Lower	<i>M. diversus</i>					
55	PALEOCENE	LATE	[Hatched Area]	Upper	<i>L. balmei</i>			1569+	
				EARLY		Lower	<i>L. balmei</i>		
60									
65	UPPER CRETACEOUS	LATE			<i>T. longus</i>				
			T.D.	<i>T. lilljei</i>		2955	2934		

* Depths are True Vertical Depths

FIGURE 4

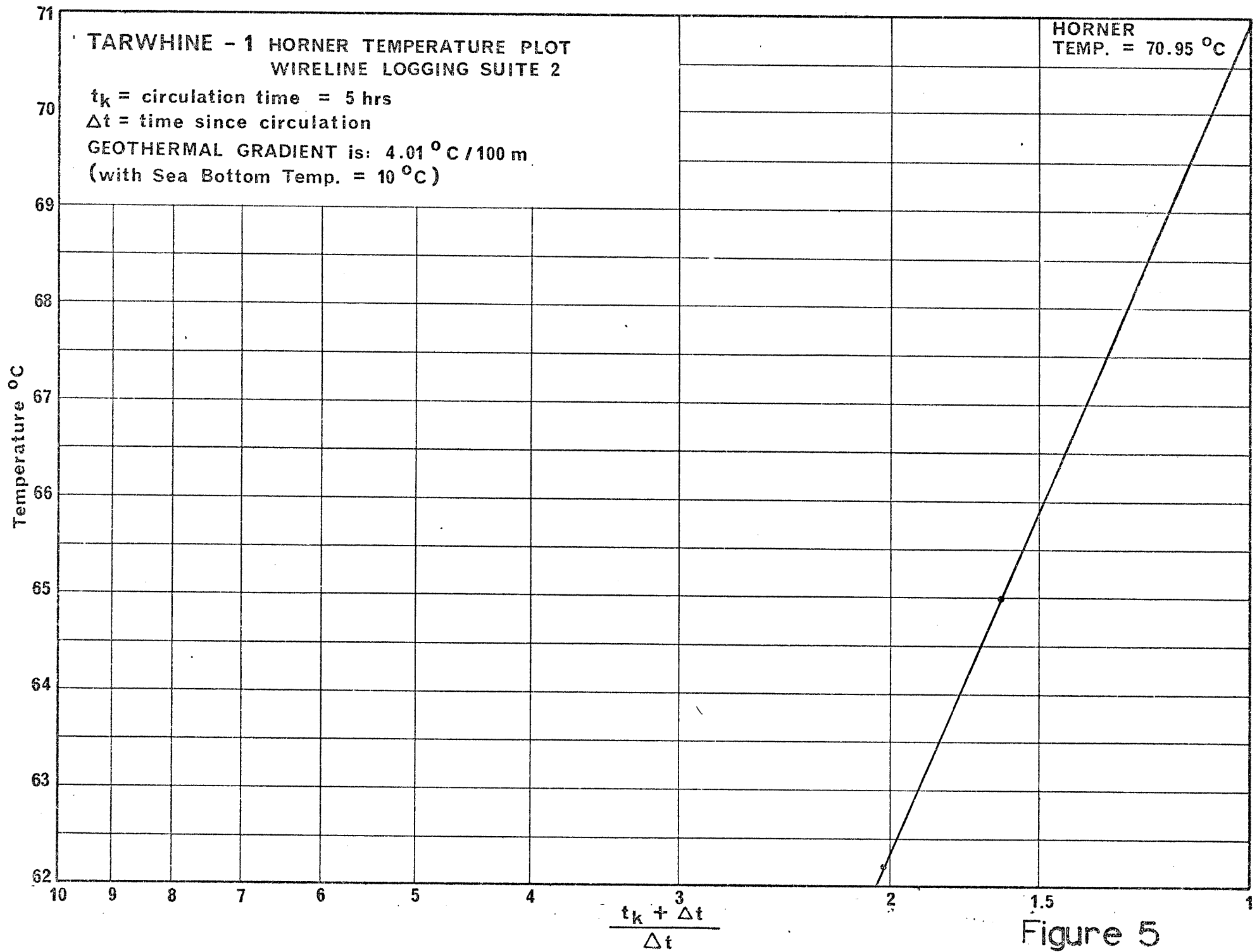


Figure 5

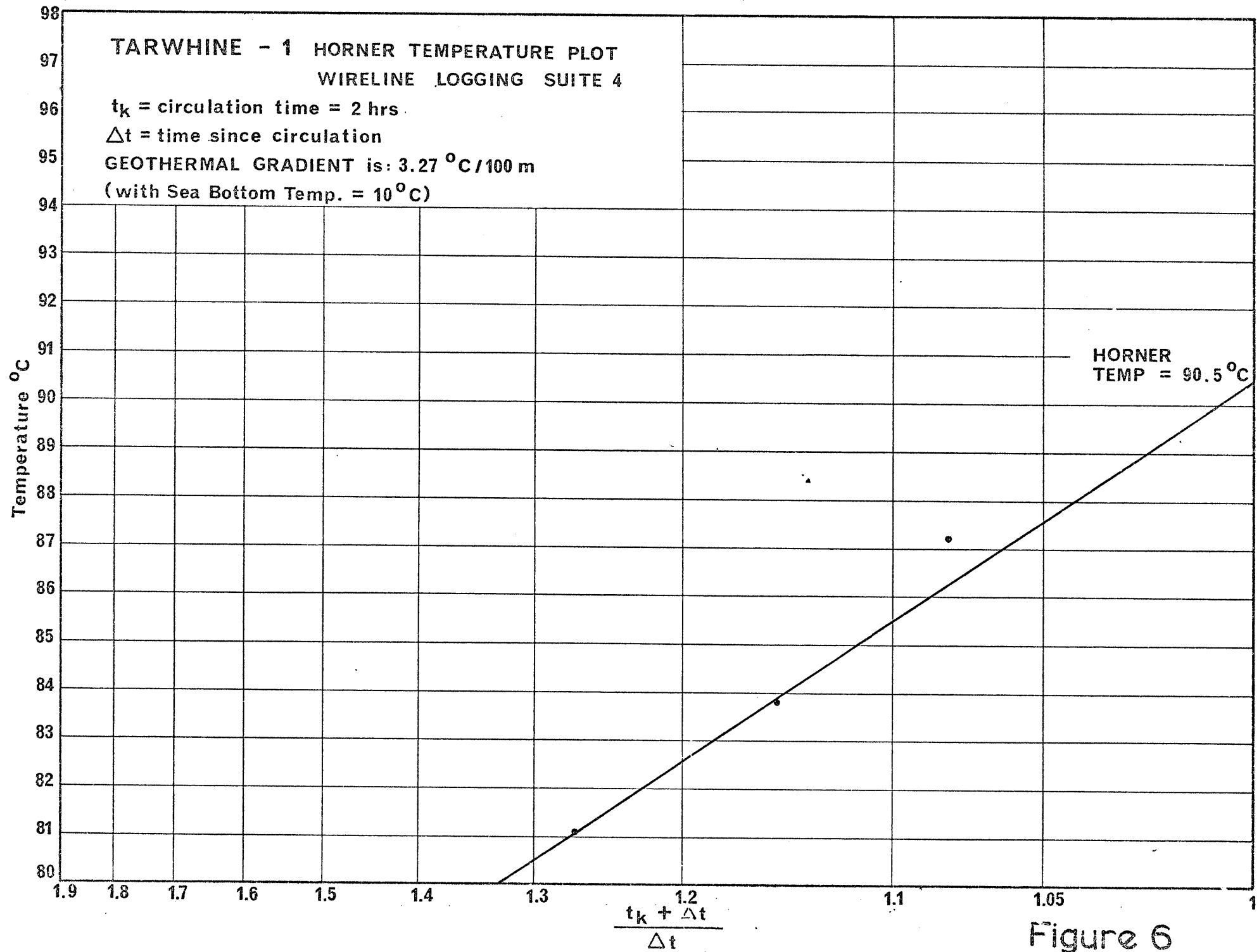


Figure 6

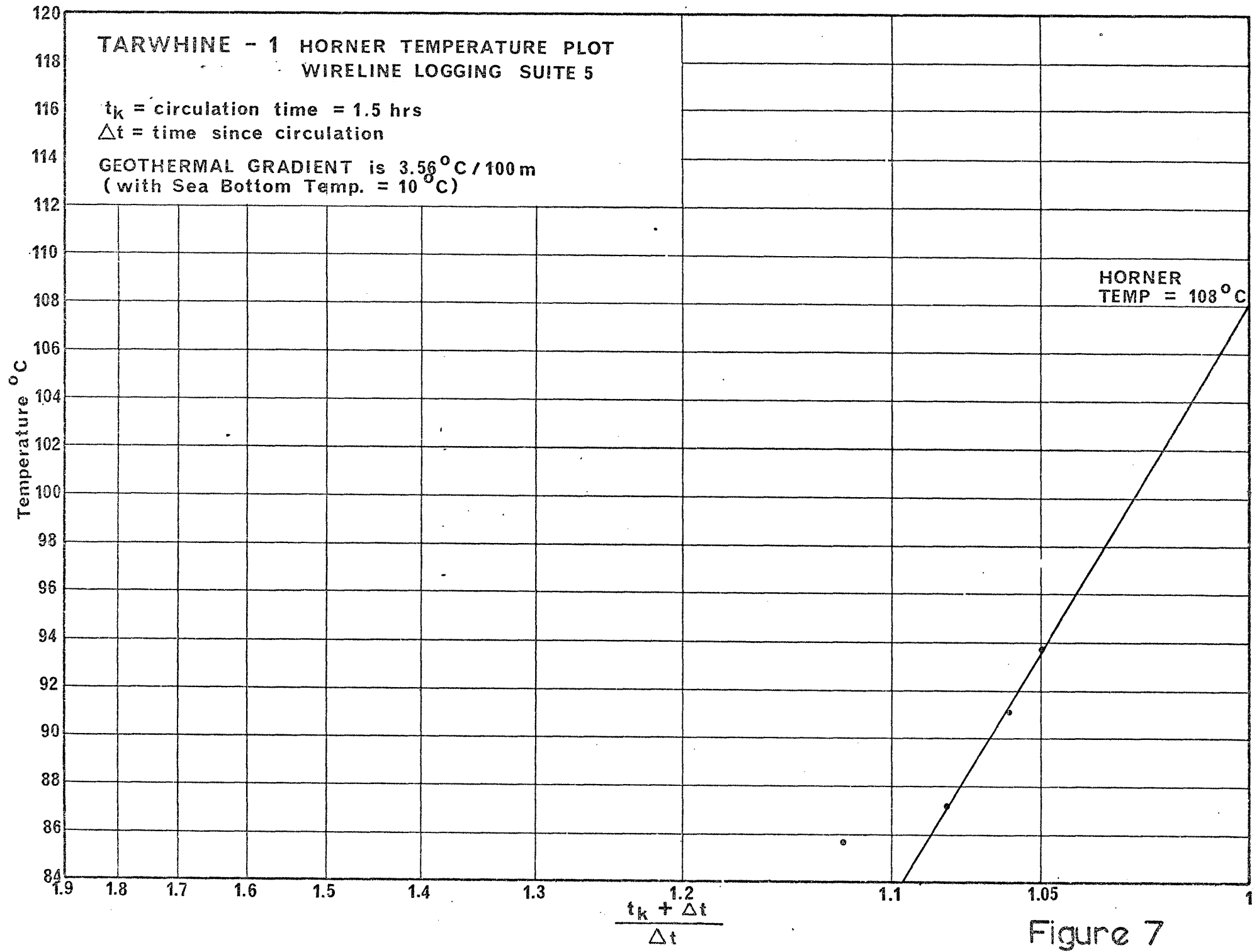


Figure 7

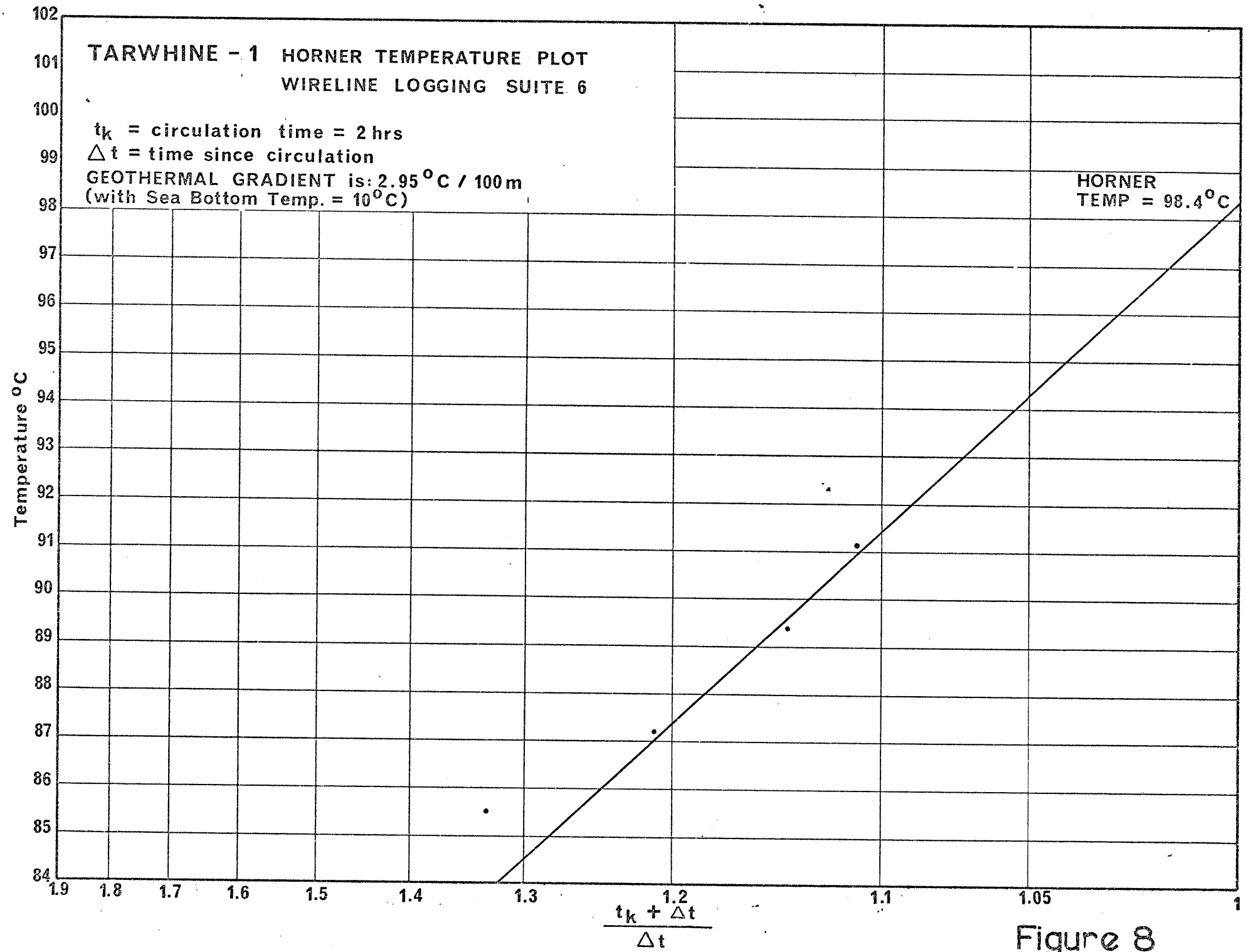


Figure 8

APPENDIX 1

APPENDIX-1

LITHOLOGICAL DESCRIPTIONS

LITHOLOGICAL DESCRIPTIONS

TARWHINE-1

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1280 - 1285	100	<u>CALCISILTITE</u> : white to light grey to medium grey, soft to medium soft; blocky cuttings; very calcareous; grades to very fine grained to fine grained calcarenite in places; occasional carbon flecking and/or partings; occasional foram tests; argillaceous; occasional glauconitic replacement of foram tests; occasional brown to tan cuttings; occasional quartz grain, sub-angular to sub-rounded possibly cavings.
1285 - 1290	100	<u>CALCISILTITE</u> : a:a
1290 - 1295	100	<u>CALCISILTITE</u> : a:a
1295 - 1300	100	<u>CALCISILTITE</u> : a:a
1300 - 1310	100	<u>CALCISILTITE</u> : a:a possible increase in white to light grey very argillaceous fraction remaining calcareous. Trace very fine grained pyrite.
1310 - 1315	100	<u>CALCISILTITE</u> : a:a trace calcarenite.
1315 - 1320	100	<u>CALCISILTITE</u> : a:a
1320 - 1325	100	<u>CALCISILTITE</u> : a:a
1325 - 1330	100	<u>CALCISILTITE</u> : a:a
1330 - 1335	100	<u>CALCISILTITE</u> : a:a increase in clay matrix, trace pyrite.
1335 - 1340	100	<u>CALCISILTITE</u> : a:a
1340 - 1345	100	<u>CALCISILTITE</u> : a:a increase in light brown, very soft siltstone.
1345 - 1350	100	<u>CALCISILTITE</u> : a:a increase in glauconite, light green to dark green discrete grains.
1350 - 1355	100	<u>CALCISILTITE</u> : a:a
1355 - 1360	100	<u>CALCISILTITE</u> : a:a
1360 - 1365	100	<u>CALCISILTITE</u> : a:a
1365 - 1370	100	<u>CALCISILTITE</u> : cutting dominantly medium to dark brown.
1370 - 1375		Top of Gurnard - large dark green grains of glauconite.
1380 - 1385		First appearance of coarse quartz grains very coarse pyrite grains.
1387 - 1388		"Top Coarse Clastics" significant amount of coarse quartz grains.
1390		50% coarse quartz grains.
1392 (B.U.)		60 - 70% Coarse quartz grains, sub-angular to sub-rounded, moderately sorted, clear to frosty grain, maximum size 3 mm. Occasional grain stained brown.
See Core Descriptions 1 & 2		

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1418 - 1420	50	<u>COARSE QUARTZ GRAINS</u> : loose, sub-angular to sub-rounded, moderately well sorted grains, predominantly milky, some clear occasionally pyrite encrusted.
	20	<u>COAL</u> : black, shiny, angular, hard.
	30	<u>SILTSTONE</u> : several types, light grey, light brown to dark grey, dark brown, soft to firm, sub-angular to sub-rounded, some very carbonaceous, some containing granules of dark green glauconite. Trace of pyrite, large lumps, some with cubic crystal form. Trace of discrete grains of glauconite. Trace of white mica.
1420 - 1425	50	<u>COARSE QUARTZ GRAINS</u> :
	20/30	<u>SILTSTONE/COAL</u> :
1425 - 1430	60	<u>COARSE QUARTZ GRAINS</u> :
	20/20	<u>SILTSTONE/COAL</u> :
1430 - 1435	70	<u>COARSE QUARTZ GRAINS</u> :
	10/10	<u>SILTSTONE/COAL</u> :
1435 - 1440	85	<u>COARSE QUARTZ GRAINS</u> :
	15	<u>SILTSTONE</u> : trace Coal.
1440 - 1445	90	<u>COARSE QUARTZ GRAINS</u> :
	10	<u>SILTSTONE</u> :
1445 - 1450	90	<u>COARSE QUARTZ GRAINS</u> :
	10	<u>SILTSTONE</u> :
1450 - 1455	100	<u>COARSE QUARTZ GRAINS</u> : trace siltstone, trace coal.
1455 - 1460	100	<u>COARSE QUARTZ GRAINS</u> : some with a brown mineral stain in places.
1460 - 1465	100	<u>COARSE QUARTZ GRAINS</u> : trace pyrite, glauconite, trace siltstone.
1465 - 1470	100	<u>COARSE QUARTZ GRAINS</u> :

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1470 - 1475	100	<u>COARSE QUARTZ GRAINS</u> : trace siltstone, coal, pyrite, glauconite.
1475 - 1480	100	<u>COARSE QUARTZ GRAINS</u> : trace siltstone, coal, pyrite, glauc.
1480 - 1485	70	<u>COARSE QUARTZ GRAINS</u> :
	30	<u>SILTSTONE</u> : brown to white, soft, carbonaceous flecks, glauconite and pyrite occurring commonly, sometimes mixed together in large lumps.
1485 - 1490	70	<u>COARSE QUARTZ GRAINS</u> :
	30	<u>SILTSTONE</u> :
1490 - 1495	40	<u>COARSE QUARTZ GRAINS</u> :
	60	<u>SILTSTONE</u> : predominantly medium to grey, soft, friable, also medium to dark brown with glauconite grains common. Trace pyrite, coarse lumps.
1495 - 1500	90	<u>COARSE QUARTZ GRAINS</u> : grains coarser than above.
	10	<u>SILTSTONE</u> : a:a
1500 - 1505	60	<u>COARSE QUARTZ GRAINS</u> :
	30	<u>COAL</u> :
	10	<u>SILTSTONE</u> :
1505 - 1510	15	<u>COARSE QUARTZ GRAINS</u> :
	85	<u>COAL</u> : plus trace siltstone.
1510 - 1515	60	<u>COARSE QUARTZ GRAINS</u> :
	30	<u>COAL</u> :
	10	<u>SILTSTONE</u> :
1515 - 1520	50	<u>COARSE QUARTZ GRAINS</u> :
	50	<u>COAL</u> :
1520 - 1525	100	<u>COARSE QUARTZ GRAINS</u> :
1525 - 1530	100	<u>COARSE QUARTZ GRAINS</u> : plus trace coal, siltstone.
1530 - 1535	65	<u>COARSE QUARTZ GRAINS</u> :
	35	<u>COAL</u> :
1535 - 1540	90	<u>COARSE QUARTZ GRAINS</u> : sub-angular to sub-rounded, moderately well sorted, clear to milky occasional yellow mineral staining.
	10	<u>SILTSTONE</u> : predominantly dark brown, hard, sub-angular cuttings, non calcareous. Also light to dark grey, soft, calcareous siltstone - cavings.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1540 - 1545	60	<u>COARSE QUARTZ GRAINS:</u>
	40	<u>SILTSTONE:</u>
1545 - 1550	85	<u>COARSE QUARTZ GRAINS:</u>
	15	<u>SILTSTONE:</u>
1550 - 1555	80	<u>COARSE QUARTZ GRAINS:</u>
	20	<u>SILTSTONE:</u>
1555 - 1556	100	<u>COARSE QUARTZ GRAINS:</u> trace siltstone, coal.
1560 - 1565	100	<u>COARSE QUARTZ GRAINS:</u> trace siltstone, coal.
1565 - 1570	95	<u>COARSE QUARTZ GRAINS:</u>
	5	<u>SILTSTONE:</u>
1570 - 1575	100	<u>SANDSTONE:</u> loose coarse grain quartz. Trace siltstone, coal.
1575 - 1580	100	<p><u>SANDSTONE:</u> loose quartz grains, coarse grain to very coarse grain, some mineral staining in some grains, occasional fine grain to medium grain aggregates, grains angular to sub-rounded, coarser grains generally more rounded, desander indicates fine grain to medium grain matrix quartz.</p> <p>Trace siltstone - medium light grey to medium grey calcilutite (calcisiltite), blocky, firm, very calcareous, possibly cavings from formation above. Glauconite common.</p> <p>Trace coal - a:a</p> <p><u>NOTE:</u> Some cuttings aggregates indicate extensive secondary quartz over-growths and resulting very tight packing of quartz grains. Drill rate through these quartz sands is very slow.</p>
1580 - 1585	70	<u>SANDSTONE:</u> a:a
	20	<u>COAL:</u> a:a
	10	<u>SILTSTONE:</u> a:a, glauconite in calcilutite cuttings still very common.
1585 - 1590	65	<u>SANDSTONE:</u> loose grains medium to very coarse grained, angular to sub-angular quartz. Occasional aggregates of fine grain to very fine grain quartz sandstone with rare yellow fluorescence, trace blue white cut - suspect contamination.
	30	<u>COAL:</u> dark grey to black, moderately hard, dirty (argillaceous).
	5	<u>SILTSTONE:</u> light grey brown, blocky, subfissile, soft to moderately firm, sometimes carbonaceous.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1590 - 1595	40	<u>COAL</u> : a:a
	10	<u>SILTSTONE</u> : a:a
	50	<u>SANDSTONE</u> : a:a plus occasionally subrounded. Trace fragments fine grained quartz sandstone with very fine coal laminations. Trace - <u>Lakes Entrance</u> calcisiltite contamination.
1595 - 1600	25	<u>COAL</u> : black, hard, shiny.
	75	<u>SANDSTONE</u> : medium grain to coarse grain, angular to subrounded loose grains. Trace siltstone a:a.
1600 - 1605	95	<u>SANDSTONE</u> : medium grain to coarse grain, angular to subrounded, clear to milky quartz, loose quartz, moderately well sorted, occasionally medium grain to fine grains, occasional mineral fluorescence in fine grained aggregate's matrix.
	5	<u>COAL</u> : a:a
1605 - 1610	90	<u>SANDSTONE</u> : loose quartz grains, fine grain, medium grain to coarse grain a:a.
	5	<u>COAL</u>
	5	<u>SILTSTONE</u> : medium light grey to pale brown, blocky, some with carbonaceous laminae, some with carbonaceous flecking, firm to soft. Trace very fine grain pyrite.
1610 - 1615	60	<u>SANDSTONE</u> : loose quartz a:a, some very fine grain aggregates.
	40	<u>SILTSTONE</u> : medium light grey, blocky to subfissile, very calcareous in places, carbonaceous siltstone is non calcareous. <u>NOTE</u> : abundant mineral fluorescence, bright yellow fluorescence, no cut, no crush cut. Possibly dolomitic mineral fluorescence in very fine grained quartz aggregates.
1615 - 1620	35	<u>SANDSTONE</u> : a:a fine grain aggregates with very calcareous cement, mineral fluorescence.
	30	<u>SILTSTONE</u> : a:a grading to very fine grain to fine grain sandstone.
	35	<u>COAL</u> : a:a
1620 - 1625	10	<u>SANDSTONE</u> : a:a
	5	<u>SILTSTONE</u> : a:a
	85	<u>COAL</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1625 - 1630		Trace Sandstone a:a
	5	<u>SILTSTONE</u> : a:a
	90	<u>COAL</u> : a:a
1630 - 1635	45	<u>SANDSTONE</u> : loose quartz a:a.
	5	<u>SANDSTONE</u> : very fine grain to fine grain aggregates cemented with calcareous matter.
		Trace Claystone white, soft, contains some fine grain quartz grains.
	45	<u>SILTSTONE</u> : a:a
1635 - 1640	5	<u>COAL</u> : a:a
	50	<u>SANDSTONE</u> : a:a
	15	<u>SANDSTONE</u> : fine grain a:a
	30	<u>SILTSTONE</u> : a:a
	5	<u>COAL</u> : a:a
1640 - 1645	90	<u>SANDSTONE</u> : loose quartz coarse grain a:a increase in medium grain content.
	10	<u>SILTSTONE</u> :
		Trace shale, fissile, medium light grey to medium grey. Trace coal.
1645 - 1650	55	<u>SANDSTONE</u> : loose quartz a:a
		<u>SANDSTONE</u> : fine grain quartz aggregates, tan to cream, calcareous cement a:a, carbon flecking.
	5	<u>CLAYSTONE</u> : white to tan, soft a:a.
	40	<u>SILTSTONE</u> : a:a grades to very fine grain argillaceous Sandstone, carbonaceous laminae in some, occasionally subfissile. Trace shale, trace coal.
1650 - 1655	50	<u>SANDSTONE</u> : a:a trace siltstone.
	50	<u>COAL</u> : a:a
1655 - 1660	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal, claystone.
1660 - 1665	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal, claystone.
1665 - 1670	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal.
1670 - 1675	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal.
1675 - 1680	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1680 - 1685	80	<u>SANDSTONE</u> : loose quartz, medium grain to coarse grain, angular to subrounded, predominantly subangular, clear to milky grains, some medium grain to fine grains, poorly sorted, some quartz pieces appear as thin slivers, possibly cut from quartz welded aggregates, bands or beds, some aggregates with calcitic cement. No shows. Some aggregates with clayey matrix, soft.
	15	<u>SILTSTONE</u> : pale brown to medium light grey, blocky to subfissile, calcareous, very fine grain pyrite in some cuttings, occasionally very fine grain carbonaceous matter.
	5	<u>COAL</u> : grades to very carbonaceous siltstone in places, blocky, shiny, slightly argillaceous.
1685 - 1690	30	<u>SANDSTONE</u> : a:a abundant mineral fluorescence.
	10	<u>SILTSTONE</u> : a:a
	60	<u>COAL</u> : a:a
1690 - 1695	40	<u>SANDSTONE</u> : a:a occasionally cuttings showing secondary growth and welding.
	30	<u>SILTSTONE</u> : a:a
	30	<u>COAL</u> : a:a Trace Claystone: white, soft clay with very fine quartz grains. Trace very fine grained pyrite.
1695 - 1700	70	<u>SANDSTONE</u> : clear to milky loose quartz grains, medium grain to very coarse grain, angular to subrounded.
	10	<u>COAL</u> a:a
	20	<u>SILTSTONE</u> : dark greyish red to light olive grey, soft to moderately firm, blocky to subfissile, occasionally with carbonaceous partings. Minor siltstone - calcareous, light grey, firm. Trace pyrite, very fine aggregates.
1700 - 1705	50	<u>SANDSTONE</u> : a:a
	10	<u>COAL</u> : a:a
	35	<u>SILTSTONE</u> : a:a
	5	<u>SILTSTONE</u> : green grey, blocky to subfissile, calcareous, moderately firm. Trace pyrite - aggregates of pyrite.
1705 - 1710	95	<u>SANDSTONE</u> : a:a
	5	<u>SILTSTONE</u> : a:a
1710 - 1715	75	<u>SANDSTONE</u> : a:a clear to milky quartz grains, angular to subrounded, medium grain to very coarse grain, moderate sorting. Occasionally very fine grain aggregates, well cemented (weak effervescence).
	15	<u>SILTSTONE</u> : green grey, blocky to subfissile, moderately firm, calcareous.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
	5	<u>SILTSTONE</u> : dark reddish brown, blocky, moderately firm with carbonaceous flecks and partings, non calcareous.
	5	<u>COAL</u> : a:a trace pyrite. <u>NOTE</u> : 5-10% of rock shows yellow fluorescence, no cut or crush cut, mineral fluorescence in sandstone (calcareous/dolomitic cement?)
1715 - 1720	65	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : green grey a:a
	10	<u>SILTSTONE</u> : dark reddish brown a:a
	5	<u>COAL</u> : Trace pyrite. Trace mica (free flecks)
1720 - 1725	60	<u>SANDSTONE</u> : loose grains a:a
	10	<u>SANDSTONE</u> : very fine grain to fine grain argillaceous, well cemented, firm, micaceous grades to siltstone.
	15	<u>SILTSTONE</u> : dark reddish brown a:a
	15	<u>SILTSTONE</u> : green grey a:a - grades to claystone/marl. Trace coal, pyrite.
1725 - 1730	60	<u>SANDSTONE</u> : a:a loose quartz
	15	<u>SILTSTONE</u> : a:a reddish brown.
	10	<u>SILTSTONE/Marl</u> : a:a
	15	<u>SANDSTONE</u> : fine grain aggregates argillaceous and silty a Trace coal.
1730 - 1735	95	<u>SANDSTONE</u> : loose quartz grains a:a
	5	<u>SILTSTONE</u> : a:a
1735 - 1740	100	<u>SANDSTONE</u> : loose quartz grains, a:a, medium grain to very coarse grain, angular to sub-rounded. Trace siltstone.
1740 - 1745	95	<u>SANDSTONE</u> : a:a
	5	<u>SILTSTONE</u> : a:a
1745 - 1750	95	<u>SANDSTONE</u> : a:a
	5	<u>SILTSTONE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1750 - 1755	30	<u>SANDSTONE</u> : fine grain to very fine grain, dirty white, argillaceous, moderately hard, yellow mineral fluorescence, (no cut/crush cut). Very weak effervescence in warm HCl.
	20	<u>SANDSTONE</u> : loose medium to very coarse grain a:a
	30	<u>SILTSTONE</u> : light grey to light brown, calcareous, occasional glauconite.
	10	<u>SILTSTONE</u> : dark reddish brown, carbonaceous.
	10	<u>COAL</u> : black, hard, shiny. Trace pyrite.
1755 - 1760	30	<u>SANDSTONE</u> : fine grain to very fine grain aggregates a:a
	15	<u>SANDSTONE</u> : loose medium grain to very coarse grain a:a
	30	<u>SILTSTONE</u> : light grey to light brown a:a
	10	<u>SILTSTONE</u> : dark reddish brown a:a.
	15	<u>COAL</u> : trace pyrite often encrusting sandstone aggregates.
1760 - 1765	40	<u>SANDSTONE</u> : loose grains a:a, medium grain to coarse grain, angular to sub-rounded.
	20	<u>SANDSTONE</u> : fine grain, argillaceous a:a
	25	<u>SILTSTONE</u> : medium reddish brown, a:a, carbonaceous.
	15	<u>SILTSTONE</u> : grey green, light grey brown a:a Trace coal.
1765 - 1770	40	<u>SANDSTONE</u> : loose grains a:a
	20	<u>SANDSTONE</u> : fine grain aggregates a:a
	5	<u>SILTSTONE</u> : reddish brown a:a calcareous.
	25	<u>COAL</u> :
1770 - 1775	40	<u>SANDSTONE</u> : loose quartz grains a:a
	10	<u>SANDSTONE</u> : fine grain aggregates a:a
	30	<u>SILTSTONE</u> : calcareous a:a
	20	<u>SILTSTONE</u> : non calcareous a:a Trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1775 - 1780	60	<u>SANDSTONE</u> : loose quartz grains medium grain to very coarse grain, angular to sub-rounded, moderately sorted.
	10	<u>SANDSTONE</u> : very fine grain to fine grain silty quartz sand aggregates - yellow mineral fluorescence.
	30	<u>SILTSTONE</u> : dark brown to light brown grey, green grey, blocky, subfissile, moderately firm, brown silts, carbonaceous, rare silts calcareous (grading to calcareous mudstone). Trace coal.
1780 - 1785	75	<u>SANDSTONE</u> : loose quartz grain a:a
	25	<u>SILTSTONE</u> : a:a with occasional glauconite. Minor pyrite subhedral fragments.
1785 - 1790	80	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : a:a
1790 - 1795	50	<u>SANDSTONE</u> : a:a
	50	<u>SILTSTONE</u> : a:a
1795 - 1800	90	<u>SANDSTONE</u> : a:a
	10	<u>SILTSTONE</u> : a:a
1800 - 1805	10	<u>SANDSTONE</u> : loose quartz, medium grain to coarse grain, angular to sub-rounded, larger coarse grains sub-rounded, poorly sorted.
	15	<u>SANDSTONE</u> : fine grain to very fine grain, well sorted, occurs as aggregates, with dolomitic cement, poor visible porosity, occasional very fine carbonaceous flecking.
	70	<u>SILTSTONE</u> : medium grey to medium dark grey, blocky to subfissile, very calcareous, firm to soft, sometimes carbonaceous, sometimes glauconitic.
1805 - 1810	5	<u>COAL</u> : black, shiny a:a <u>NOTE</u> : some quartz aggregates show intense packing indicative of secondary quartz overgrowth possibly with dolomitic cement as well i.e. slow reaction with HCl.
	30	<u>SANDSTONE</u> : a:a some very fine grain quartz aggregates show possible carbonaceous streaking.
	70	<u>SILTSTONE</u> : Trace claystone, trace pyrite fine grain to medium grain, trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1812 - 1813		<u>NOTE:</u> some very carbonaceous grains of sand aggregate giving cement, associated with minor increase in gas.
1810 - 1815		Trace of Sandstone: a:a. No shows (mineral fluorescence only).
	95	<u>SILTSTONE:</u> a:a grades to very fine grained sandstone in places.
	5	<u>CLAYSTONE:</u> white, soft, blocky to incoherent.
		Trace of coal: a:a
		Trace of pyrite, very fine grained aggregates.
1815 - 1820	70	<u>SILTSTONE:</u> a:a grades to very fine to fine grained sandstone in places.
	30	<u>CLAYSTONE:</u> a:a
		Trace of sandstone loose quartz: a:a. No shows.
		Trace of coal.
1820 - 1825	40	<u>SANDSTONE:</u> loose quartz, medium to mainly coarse grained, sub-angular to sub-rounded, generally well sorted; clear to milky quartz, some pyrite encrustation; abundant mineral fluorescence, fine grained to very fine grained aggregates; calcareous cement.
	60	<u>SILTSTONE:</u> a:a
		Trace of claystone: a:a
		Trace of coal: a:a
1825 - 1830	80	<u>SANDSTONE:</u> coarse to medium grained loose quartz mainly medium grained; a:a.
	20	<u>SILTSTONE:</u> a:a
		Trace of coal: a:a
		Trace of claystone: a:a
		Trace of pyrite: a:a
1830 - 1835	80	<u>SANDSTONE:</u> a:a
	10	<u>SILTSTONE:</u> a:a
		Trace of claystone: a:a
	10	<u>COAL:</u> a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>	
1835 - 1840	55	<u>SANDSTONE</u> : a:a no shows. Trace claystone: a:a	
	30	<u>SILTSTONE</u> : a:a calcareous and non calcareous, carbonaceous and non carbonaceous.	
	15	<u>SHALE</u> : medium light grey to medium dark grey; typical elongated shale pieces, calcareous. Trace coal: a:a Trace calcite.	
	1840 - 1845	10	<u>SANDSTONE</u> : a:a
1840 - 1845	90	<u>SILTSTONE - SHALE</u> : medium light grey to medium dark grey; blocky to fissile; possibly shaley cuttings; occasionally tan cuttings; calcareous; carbonaceous cuttings, non calcareous; occasionally siltstone cuttings with very fine grained quartz included, some non calcareous cuttings. Trace claystone.	
	1845 - 1850	80	<u>SANDSTONE</u> : loose quartz a:a medium to coarse grained, mainly moderately well sorted medium grained.
1845 - 1850	15	<u>SILTSTONE - SHALE</u> : a:a glauconitic in places in non calcareous siltstone. Trace claystone: a:a Trace pyrite: very fine grained aggregates and encrustations.	
	5	<u>COAL</u>	
	1850 - 1855	35	<u>SANDSTONE</u> : a:a
1850 - 1855	60	<u>SILTSTONE - SHALE</u> : a:a	
	5	<u>CLAYSTONE</u> : a:a Trace coal: a:a	
	1855 - 1860	50	<u>SANDSTONE</u> : a:a
1855 - 1860	50	<u>SILTSTONE - SHALE</u> : a:a Trace claystone: a:a Trace coal. Trace pyrite, abundant, very fine grained.	
	1860 - 1865	75	<u>SILTSTONE - SHALE</u> : light grey to light brown, subfissile, moderately firm, calcareous. Trace claystone: soft, white, incompetent, kaolinite?

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1890 - 1895	20	<u>SANDSTONE</u> : a:a plus fine grained aggregates.
	30	<u>SILTSTONE</u> : reddish brown, carbonaceous, micromicaceous, a:a.
	30	<u>SILTSTONE - SHALE</u> : a:a grey, calcareous, subfissile.
	20	<u>CLAYSTONE</u> : white to dirty white, soft and incompetent.
1895 - 1900	50	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE - SHALE</u> : a:a
	15	<u>SILTSTONE</u> : a:a
	15	<u>CLAYSTONE</u> : a:a
		Trace coal: a:a
1900 - 1905	60	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE - SHALE</u> : a:a
	5	<u>CLAYSTONE</u> : a:a
	5	<u>COAL</u> : a:a
1905 - 1910	45	<u>SILTSTONE - SHALE</u> : a:a grey to grey green, subfissile, moderately firm, calcareous.
	40	<u>SILTSTONE</u> : a:a brown to reddish brown, argillaceous, blocky to subfissile, micromicaceous, occasional carbonaceous flecking, non calcareous.
	10	<u>SANDSTONE</u> : loose quartz grains, angular to sub-rounded, medium to very coarse grained.
	5	<u>CLAYSTONE</u> : soft, white, (kaolinitic?)
1910 - 1915	30	<u>SHALE</u> : grey to greyish green, subfissile, calcareous, moderately firm.
	30	<u>SILTSTONE - SHALE</u> : brown, moderately firm, subfissile, argillaceous, micromicaceous, occasional carbonaceous flecking.
	40	<u>SANDSTONE</u> : loose quartz grains, a:a. Trace coal.
1915 - 1920	60	<u>SANDSTONE</u> : a:a medium grained, occasionally coarse grained, loose quartz grains.
	15	<u>SILTSTONE - SHALE</u> : grey to green, a:a.
	15	<u>SILTSTONE - SHALE</u> : brown a:a
	10	<u>COAL</u> : Trace pyrite.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1920 - 1925	90	<u>SANDSTONE</u> : loose quartz, medium to coarse grained, sub-angular to sub-rounded, poorly sorted.
	10	<u>SILTSTONE - SHALE</u> : medium light grey to tan, blocky to subfissile, calcareous, carbonaceous, firm. Trace coal: blocky, shiny, conchoidal fracture. Trace pyrite.
1925 - 1930	30	<u>SANDSTONE</u> : loose quartz a:a
	70	<u>SILTSTONE - SHALE</u> : a:a Trace claystone: a:a Trace pyrite: abundant as matrix, brown quartz grains.
1930 - 1935	15	<u>SANDSTONE</u> : a:a
	85	<u>SILTSTONE - SHALE</u> : a:a Trace claystone, pyrite and coal.
1935 - 1940	90	<u>SANDSTONE</u> : a:a
	10	<u>SILTSTONE</u> : a:a Trace coal, pyrite.
1940 - 1945	70	<u>SANDSTONE</u> : medium to coarse grained a:a.
	30	<u>SILTSTONE - SHALE</u> : a:a tan cuttings common. Calcareous cutting, non calcareous carbonaceous cuttings.
1945 - 1950	60	<u>SANDSTONE</u> : loose quartz a:a
	40	<u>SILTSTONE - SHALE</u> : a:a Trace claystone, coal.
1950 - 1955	50	<u>SANDSTONE</u> : loose quartz a:a
	50	<u>SILTSTONE</u> : a:a Trace coal, claystone, pyrite.
1955 - 1960	10	<u>SANDSTONE</u> : grades from medium to coarse grained, loose quartz to very fine grained aggregates.
	80	<u>SILTSTONE</u> : a:a
	10	<u>CLAYSTONE</u> : a:a soft white to light grey to medium light grey, blocky when coherent. Calcareous. Trace pyrite, increased abundance.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
1960 - 1965	60	<u>SANDSTONE</u> : a:a
	40	<u>SILTSTONE</u> : a:a Trace claystone, coal, pyrite.
1965 - 1970	70	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a Trace claystone, coal, pyrite.
1970 - 1975	75	<u>SANDSTONE</u> : a:a
	25	<u>SILTSTONE</u> : a:a Trace coal.
1975 - 1980	65	<u>SANDSTONE</u> : a:a loose quartz grains, medium grained to very coarse grained, angular to sub-rounded, many grains show sharp, clean crystalline faces, occasionally with pyrite encrustation, suggests secondary crystallisation of quartz from solution.
	35	<u>SILTSTONE</u> : a:a Trace claystone, coal.
1980 - 1986	75	<u>SANDSTONE</u> : a:a rare quartz grains with dolomitic overgrowths noted.
	25	<u>SILTSTONE</u> : a:a rarely glauconitic (contamination?). Trace claystone a:a
1986 - 1990	60	<u>SANDSTONE</u> : clear to white, loose, medium to coarse, sub-angular, equidimensional quartz grains, no shows.
	35	<u>SILTSTONE</u> : light to dark grey to mid brown, calcareous, carbonaceous matter, iron stained siltstone in part, subfissile to blocky, pyrite clusters.
	5	<u>COAL</u> : black, hard, shiny, brittle, subconchoidal fractures.
1990 - 1995	50	<u>SANDSTONE</u> : a:a
	45	<u>SILTSTONE</u> : a:a
	5	<u>COAL</u> : a:a
1995 - 2000	30	<u>SANDSTONE</u> : a:a
	65	<u>SILTSTONE</u> : a:a
	5	<u>COAL</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2000 - 2005	70	<u>SANDSTONE</u> : occasionally white to grey, dominantly clear, firm, medium to coarse quartz grains, angular to rounded, moderate sorting, minor pyrite encrustations, poorly cemented, no shows.
	25	<u>SILTSTONE</u> : a:a
	5	<u>COAL</u> : a:a occasionally with blue to white fluorescence, giving slow creamy to yellow cut fluorescence.
2005 - 2010	80	<u>SANDSTONE</u> : clear to white, firm to friable, medium to coarse grained, angular to sub-rounded, moderately sorted quartz grains, minor silica cement, minor dolomitic cement, minor pyrite encrustations, no shows.
	15	<u>SILTSTONE</u> : light grey to off white, a:a.
	5	<u>COAL</u> : a:a
2010 - 2015	85	<u>SANDSTONE</u> : a:a
	15	<u>SILTSTONE</u> : a:a
2015 - 2020	65	<u>SANDSTONE</u> : a:a
	35	<u>SILTSTONE</u> : becoming darker grey, often reddish brown, platy to massive, argillaceous, pyrite common.
2020 - 2025	60	<u>SANDSTONE</u> : trace mineral fluorescence, no shows.
	40	<u>SILTSTONE</u> : a:a
		Trace coal: a:a
2025 - 2030	70	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a
2030 - 2035	70	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a
2035 - 2040	80	<u>SANDSTONE</u> : grey, translucent, occasionally clear, trace coloured quartz grains, firm, medium to very coarse (conglomerate?) sub-angular to sub-rounded, moderately sorted, minor dolomite, minor silica cement, minor pyrite encrustations, poor visual intergranular porosity, no shows.
	20	<u>SILTSTONE</u> : medium grey to dark grey, carbonaceous shale, minor micro fossils.
2040 - 2045	90	<u>SANDSTONE</u> : a:a becoming well sorted, no shows.
	10	<u>SILTSTONE</u> : a:a
2045 - 2050	90	<u>SANDSTONE</u> : a:a no shows.
	10	<u>SILTSTONE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2050 - 2055	90	<u>SANDSTONE</u> : a:a
	10	<u>SILTSTONE</u> : a:a
2055 - 2060	95	<u>SANDSTONE</u> : quartzose, medium to very coarse grained, angular to sub-rounded, moderately poorly sorted; clean crystal faces - secondary crystallisation? (sutured contacts) many grains exhibit yellow mineral fluorescence (no cuts) and weak effervescence, indicating dolomitisation; very poor visible porosity.
	5	<u>SILTSTONE</u> : a:a Trace coal.
2060 - 2065	95	<u>SANDSTONE</u> : a:a
	5	<u>SILTSTONE</u> : a:a Trace coal.
2065 - 2070	100	<u>SANDSTONE</u> : a:a Trace siltstone: a:a, trace coal.
	100	<u>SANDSTONE</u> : a:a dolomite cement. Trace siltstone, coal.
2075 - 2080	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal.
	100	<u>SANDSTONE</u> : a:a Trace siltstone, coal.
2085 - 2090	100	<u>SANDSTONE</u> : a:a secondary crystallisation and some dolomitisation.
	100	<u>SANDSTONE</u> : a:a Trace siltstone: a:a
2095 - 2100	100	<u>SANDSTONE</u> : a:a Trace siltstone: a:a
	100	<u>SANDSTONE</u> : a:a Trace siltstone: a:a
2105 - 2110	100	<u>SANDSTONE</u> : a:a Trace siltstone: a:a
	80	<u>SANDSTONE</u> : a:a
2110 - 2115	20	<u>SILTSTONE</u> : grey to green to light green to reddish brown, blocky, subfissile, moderately firm to firm, argillaceous, calcareous and carbonaceous.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2115 - 2120	50	<u>SANDSTONE</u> : a:a
	50	<u>SILTSTONE</u> : a:a
2120 - 2125	70	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a
2125 - 2130	75	<u>SANDSTONE</u> : a:a
	25	<u>SILTSTONE</u> : a:a Trace coal, dolomite.
2130 - 2135	75	<u>SANDSTONE</u> : medium grained to very coarse, however fine grained aggregates present, angular to sub-angular, clear to buff colour.
	25	<u>SILTSTONE</u> : grey to green, fissile, calcareous. Trace coal, minor pyrite associated with some quartz grains, no fluorescence.
2135 - 2140	80	<u>SANDSTONE</u> : medium to coarse grained single quartz grains, angular to sub-angular, smaller aggregates also present, clear to milky colour.
	18	<u>SILTSTONE</u> : calcareous, grey to green siltstone, fissile.
	1 - 2%	<u>COAL</u>
2140 - 2145	70	<u>SANDSTONE</u> : medium to very coarse single quartz grains, clear to milky colour, angular to sub-angular, finer grained quartz aggregates are also present.
	28	<u>SILTSTONE</u> : green to grey, fissile siltstone, calcareous.
	2	<u>COAL</u> : splinters of vitrite.
2145 - 2150	65	<u>SANDSTONE</u> : fine to coarse grained single quartz grains, angular to sub-angular, clear to milky colour.
	35	<u>SILTSTONE</u> : 2 types 1. Green to grey 2. Brown, non calcareous siltstone. No. 1, green to grey type is predominant. Trace coal.
2150 - 2155	75	<u>SANDSTONE</u> : medium to very coarse single quartz grains, angular to sub-angular, clear to milky, fine grain quartz aggregates are rare, non calcareous, very hard, grains are fractured.
	25	<u>SILTSTONE</u> : green to grey fissile siltstone as well as a darker brown siltstone, green to grey siltstone is more calcareous. Trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2155 - 2160	70	<u>SANDSTONE</u> : quartzose, clear, white to off-white, firm to hard, medium to very coarse, (pebble conglomerate?), angular to sub-angular, medium sorting, very well cemented with silica cement, minor dolomite, minor pyrite, no intergranular porosity, no shows.
	30	<u>SILTSTONE</u> : a:a trace glauconite, abundant pyrite. Trace coal.
2160 - 2165	30	<u>SANDSTONE</u> : a:a sub-rounded to angular (commonly fragmented by bit).
	20	<u>SILTSTONE</u> : a:a
	50	<u>SHALE</u> : med to dark grey, grading to carbonaceous shale, firm to hard, calcareous cement, micromicaceous.
2165 - 2170	30	<u>SANDSTONE</u> : a:a massive pyrite encrustations on some quartz grains.
	30	<u>SILTSTONE</u> : a:a mainly ferro-staining.
	40	<u>SHALE</u> : a:a
2170 - 2175	30	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a occasional glauconitic fragments.
	40	<u>SHALE</u> : a:a
2175 - 2180	90	<u>SANDSTONE</u> : quartzose, clear, white to light grey, firm to hard, medium to coarse, well sorted, rounded to sub-rounded, minor silica cement, minor pyrite, fair to good visual intergranular porosity, occasional grain has dull yellow fluorescence which gives a slow weak creamy white crush cut fluorescence.
	10	<u>SILTSTONE - SHALE</u> : a:a
2180 - 2185	80	<u>SANDSTONE</u> : quartzose sandstone, clear to milky, hard, size range from very coarse to medium however coarse grains predominate. Quartz aggregates also present with dolomitic cement. Moderately well sorted sub-angular to sub-rounded. Very weak crush cut, dull yellow fluorescence.
	20	<u>SILTSTONE - SHALE</u> : green to grey, fissile shale, the green grey silt is calcareous, darker shale - siltstone is non calcareous. Trace coal.
2185 - 2190	85	<u>SANDSTONE</u> : quartzose sandstone, clear to milky, hard, very coarse to medium grained, medium predominates, well sorted predominantly sub-rounded grains, however sub-angular to angular grains are present. Quartz aggregates extremely rare, extremely weak crush fluorescence.
	15	<u>SILTSTONE - SHALE</u> : green grey siltstone: a:a shale is rare. Trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>ft</u>	<u>DESCRIPTION</u>
2190 - 2195	95	<u>SANDSTONE</u> : quartzose sandstone; clear to white, hard, very coarse to medium grained, medium predominantly; moderately to well sorted, angular to sub-rounded, sub-angular being predominant; occasional fluorescence; grain showing dull yellow, crush cut.
	5	<u>SILTSTONE</u> : green grey, calcareous, micaceous siltstone, fissile, scattered fragments of black carbonaceous siltstone present. Trace coal.
2195 - 2200	95	<u>SANDSTONE</u> : quartzose sandstone, clear to white, hard, very coarse to medium grained, medium grains predominating; angular to sub-rounded; very tight, siliceous cement, occasional fluorescent grain, very weak crush cut.
	5	<u>SILTSTONE</u> : a:a Trace coal.
2200 - 2205	85	<u>SANDSTONE</u> : a:a
	15	<u>SILTSTONE - SHALE</u> : a:a Trace coal.
2205 - 2210	80	<u>SANDSTONE</u> : quartzose, coarse to medium grained, white to clear, hard, angular to sub-rounded, very tight and hard, weak crush fluorescence. One fragment of medium grain sand showed good cut and yellow fluorescence.
	20	<u>SILTSTONE - SHALE</u> : a:a Trace coal.
2210 - 2215	80	<u>SANDSTONE</u> : quartzose, clear to white, hard, medium to coarse grained, medium predominates; well sorted, non calcareous cement, occasional grains with weak crush fluorescence, angular to sub-rounded.
	20	<u>SILTSTONE - SHALE</u> : green grey siltstone, fissile, calcareous. Trace coal.
2215 - 2220	85	<u>SANDSTONE</u> : a:a
	15	<u>SILTSTONE</u> : a:a Trace coal.
2220 - 2225	85	<u>SANDSTONE</u> : quartzose, clear to white, hard, coarse to medium, well sorted, siliceous cement, occasional fluorescent grain showing very weak crush cut.
	15	<u>SILTSTONE</u> : green grey, micaceous in parts, fissile, brown in places. Trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2225 - 2230	80	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : green grey to brown, fissile siltstone, with rare carbonaceous pieces. Trace coal.
2230 - 2235	85	<u>SANDSTONE</u> : quartzose, clear to white, hard, medium to coarse grained, medium predominating, well sorted, angular to sub-rounded, carbonaceous cement, possibly dolomitic. Sample showing 5 - 10 % fluorescence (very weak yellow) very tight sand, very weak crush cut.
	15	<u>SILTSTONE</u> : green grey and carbonaceous siltstone, slight increase in carbonaceous content. Trace coal.
2235 - 2240	85	<u>SANDSTONE</u> : a:a however less fluorescence and no cut.
	15	<u>SILTSTONE</u> : a:a Trace coal.
2240 - 2245	80	<u>SANDSTONE</u> : quartzose, clear to white, hard, predominantly medium grained, coarse grains present. Angular to sub-angular grains, moderately well sorted; dolomitic cement, most grains appeared fractured; occasional grain has dull yellow fluorescence.
	20	<u>SILTSTONE</u> : green grey to brown, fissile, and occasional carbonaceous fragment. Trace coal.
2245 - 2250	80	<u>SANDSTONE</u> : a:a except that no dolomitic cement could be found.
	20	<u>SILTSTONE</u> : a:a Trace coal.
2250 - 2255	30	<u>SANDSTONE</u> : quartzose, white, clear, occasionally off white to grey, hard, medium to very coarse, sub-angular, poorly sorted, silica cement, minor dolomite, minor pyrite encrustations. No shows.
	50	<u>SILTSTONE</u> : quartzose, a:a.
	20	<u>SHALE</u> : grey, hard, subfissile, pyritic.
2255 - 2260	10	<u>SANDSTONE</u> : a:a
	70	<u>SILTSTONE</u> : quartzose, grey to cream to reddish brown, hard, well sorted grains, clay matrix, now calcareous; minor muscovite, minor pyrite, minor heavy minerals.
	20	<u>SHALE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2260 - 2265	35	<u>SANDSTONE</u> : a:a
	45	<u>SILTSTONE</u> : a:a
	20	<u>SHALE</u> : a:a
2265 - 2270	40	<u>SANDSTONE</u> : a:a
	40	<u>SILTSTONE</u> : a:a
	20	<u>SHALE</u> : a:a micro laminations.
2270 - 2275	45	<u>SANDSTONE</u> : a:a minor fluorescence, weak crush cut.
	35	<u>SILTSTONE</u> : a:a
	20	<u>SHALE</u> : a:a green grey to dark grey carbonaceous shale.
2275 - 2280	55	<u>SANDSTONE</u> : quartzose, mainly clear, off white, firm to hard, medium to very coarse, angular (fractured by bit?) to sub-angular, poorly sorted, well cemented, minor pyrite, minor intergranular porosity.
	30	<u>SILTSTONE</u> : quartzose, a:a.
	15	<u>SHALE</u> : a:a
2280 - 2285	40	<u>SANDSTONE</u> : quartzose, a:a
	40	<u>SILTSTONE</u> : quartzose, light grey to mid to dark grey, to reddish brown, firm to hard, very rich in muscovite in part, clay or iron cement, echinoid spine.
	20	<u>SHALE</u> : a:a
2285 - 2290		NO RETURNS
2290 - 2295	55	<u>SANDSTONE</u> : quartzose, clear to white, hard, very coarse to medium grained, coarse grain dominant; moderately sorted, well cemented with dolomite?, possibly glauconite or chamosite present; occasional grain with very weak yellow fluorescence.
	40	<u>SILTSTONE</u> : green grey to dark brown, firm, fissile, muscovite rich.
	5	<u>SHALE</u> : dark, carbonaceous laminations, mica rich.
2295 - 2300	70	<u>SANDSTONE</u> : quartzose, clear to white, hard, very coarse to medium grained, coarse grains dominant, moderately sorted, angular to sub-rounded, weak fluorescence with occasional grains; well cemented, many grains appear fractured.
	25	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a
2300 - 2305	70	<u>SANDSTONE</u> : a:a grains appear fractured.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2300 - 2305 (contd)	25	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a
2305 - 2310	60	<u>SANDSTONE</u> : a:a angular fragments.
	30	<u>SILTSTONE</u> : a:a quartz rich.
	10	<u>SHALE</u> : a:a
2310 - 2315	50	<u>SANDSTONE</u> : quartzose, clear to white, hard to very hard, very coarse to medium grained, coarse grains dominant, most grains sub-angular, well cemented, moderately sorted.
	45	<u>SILTSTONE</u> : white to green grey to brown, some pieces very carbonaceous, firm to soft.
	5	<u>SHALE</u> : rare but carbonaceous.
2315 - 2320	95	<u>COAL</u> : dull, intermediate, possible micaceous, moderately hard.
	5	<u>SANDSTONE - SILTSTONE</u> : a:a
2320 - 2322.5	35	<u>SANDSTONE</u> : a:a
	65	<u>SILTSTONE - SHALE</u> : a:a Trace coal.
2322.5 - 2325	10	<u>SANDSTONE</u> : quartzose, predominantly white, hard to very hard, predominantly medium grained, well sorted, well cemented.
	85	<u>SILTSTONE</u> : green grey to reddish brown, hard to soft, possibly quartz rich, some coal inclusions.
	5	<u>SHALE</u> : rare carbonaceous when present and micaceous. Trace coal.
2325 - 2330	80	<u>SANDSTONE</u> : quartzose, clear to white, hard, coarse to medium grained, well sorted, moderately well cemented, occasional grain with weak yellow fluorescence, sub-rounded grains predominant.
	5	<u>SHALE</u> : a:a
	15	<u>SILTSTONE</u> : a:a
2330 - 2335	60	<u>SANDSTONE</u> : quartzose, clear to white, hard, very coarse to medium grains, coarse predominates; moderately well sorted, well cemented, occasional grain with dull yellow fluorescence.
	35	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a Trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2335 - 2340	40	<u>SANDSTONE</u> : quartzose, white to clear, very hard aggregates where present, most of rest is single fragments; quartz grains very coarse to medium, angular grain aggregates are medium size; well sorted, sub-rounded, well cemented with siliceous cement, aggregates fluorescent, but no crush cut.
	55	<u>SILTSTONE</u> : green grey to dark grey; carbonaceous, some pieces quite firm, (quartz rich), others fissile and easily broken, coaly inclusions.
	5	<u>SHALE</u> : carbonaceous, hard. Trace coal.
2340 - 2345	10	<u>SANDSTONE</u> : a:a but no fluorescence.
	85	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : dark, hard, carbonaceous slivers present.
2345 - 2350	20	<u>SANDSTONE</u> : quartzose, white to clear, hard to very hard aggregates where present, many larger grains with sharp edges, moderately well sorted, well cemented, occasional grain fluorescence, no crush cut.
	70	<u>SILTSTONE</u> : grey to olive, hard to soft, some micaceous pieces.
	10	<u>SHALE</u> : grey to black, carbonaceous, mostly fissile.
2350 - 2355	55	<u>SANDSTONE</u> : a:a
	40	<u>SILTSTONE</u> : green to grey to creamy, creamy siltstone, rich with coaly inclusions, soft and quartz rich, very carbonaceous.
	1	<u>COAL</u>
	4	<u>SHALE</u> : grey, carbonaceous in parts.
2355 - 2360	60	<u>SANDSTONE</u> : clear to white, very hard to hard, medium grained aggregates and medium to coarse to very coarse single grains, angular to sub-angular; well cemented, some fine aggregates containing coal inclusions, occasional fluorescence, no cut.
	30	<u>SILTSTONE</u> : dark grey to grey, mostly carbonaceous, firm to hard.
	5	<u>SHALE</u> : carbonaceous, dark, contains coal slivers.
	5	<u>COAL</u> : rare - however coal with many mineral inclusions, (quartz) is common.
2360 - 2365	10	<u>SANDSTONE</u> : a:a
	85	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>ft</u>	<u>DESCRIPTION</u>
2365 - 2370	15	<u>SANDSTONE</u> : clear to white, hard to very hard, medium grained aggregates to single very coarse to medium quartz grains, larger single grains are angular, smaller grains in aggregates are sub-rounded, well cemented, moderate to well sorted.
	20	<u>SILTSTONE</u> : grey to green, firm, some darker pieces rich in coaly fragments.
	5	<u>SHALE</u> : dark, carbonaceous, fissile.
	60	<u>COAL</u> : black, some easy parting, some conchoidal fracture.
2370 - 2375	10	<u>SANDSTONE</u> : a:a
	80	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a
	5	<u>COAL</u> : some fluorescence, indication of maceral content, exinite rich in parts.
	10	<u>SANDSTONE</u> : quartzose a:a
2375 - 2380	30	<u>SILTSTONE</u> : quartzose, white to light grey to brown, firm to hard, argillaceous, some carbonaceous matter, minor pyrite and muscovite.
	60	<u>CLAYSTONE</u> : light green to grey to mid brown, firm to hard, contains calcareous matter, occasionally sub-fissile. Trace coal.
	5	<u>SANDSTONE</u> : quartzose, medium to very coarse grains, a:a.
2380 - 2385	10	<u>SANDSTONE</u> : quartzose, white to off white, friable to firm, very fine to fine grains, well sorted, sub-rounded, clay matrix, minor dolomite, common heavy minerals, yellow-orange mineral fluorescence, no shows.
	35	<u>SILTSTONE</u> : a:a grading into carbonaceous shale.
	50	<u>CLAYSTONE</u> : calcareous, a:a.
	10	<u>COAL</u> : black, shiny to earthy, brittle, occasionally has conchoidal fracture, otherwise blocky or sub-fissile.
	5	<u>SANDSTONE</u> : medium to very coarse grained, a:a.
2385 - 2390	10	<u>SANDSTONE</u> : very fine to fine grained, a:a.
	15	<u>SILTSTONE</u> : a:a
	65	<u>CLAYSTONE</u> : a:a
	5	<u>COAL</u> : a:a grading into carbonaceous shale.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>ft</u>	<u>DESCRIPTION</u>
2390 - 2395	5	<u>SANDSTONE</u> : medium to very coarse quartz grains, a:a.
	10	<u>SANDSTONE</u> : fine to very fine quartz grains, a:a
	45	<u>SILTSTONE</u> : a:a
	35	<u>CLAYSTONE</u> : a:a
	5	<u>COAL</u> : a:a
2395 - 2400	20	<u>SANDSTONE</u> : quartzose, clear to white, hard, medium to very coarse grained, angular to sub-angular, poorly sorted, well cemented, abundant pyrite aggregates.
	10	<u>SANDSTONE</u> : quartzose, fine to very fine grained, a:a no shows.
	35	<u>SILTSTONE</u> : a:a
	30	<u>CLAYSTONE - SHALE</u> : a:a
	5	<u>COAL</u> : a:a
2400 - 2405	55	<u>SANDSTONE</u> : very coarse to medium grained, a:a.
	5	<u>SANDSTONE</u> : fine to very fine grained.
	25	<u>SILTSTONE</u> : quartzose, a:a.
	15	<u>CLAYSTONE</u> : calcareous, a:a.
		Trace coal.
2405 - 2410	85	<u>SANDSTONE</u> : quartzose, white to clear, very hard aggregates and fractured single grains, no visible porosity, moderately sorted, angular to very angular, secondary silification evident; no shows, medium to very coarse grains, trace mineral fluorescence only.
	10	<u>SILTSTONE</u> : grey, argillaceous, carbonaceous, firm to soft, also grey green, non carbonaceous
	5	<u>SHALE</u> : dark, fissile, carbonaceous.
2410 - 2415	45	<u>SANDSTONE</u> : a:a
	25	<u>SILTSTONE</u> : a:a
	20	<u>SHALE</u> : dark grey, carbonaceous, fissile, some fragments with coaly inclusions. Trace coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2415 - 2420	20	<u>SANDSTONE</u> : clear, white to light grey, quartzose, fine to coarse grains, poorly sorted, sub-angular to sub-rounded, larger grains show secondary quartz overgrowths, very tight (no visible porosity) some with pyritic cement, minor fine grained aggregates with moderate to poor visible porosity; no shows.
	70	<u>SILTSTONE</u> : medium grey to brownish grey, subfissile, firm to hard, mostly carbonaceous, non calcareous, argillaceous, some quartzose.
	10	<u>SHALE</u> : dark grey to brownish grey, fissile, argillaceous some with carbonaceous material.
2420 - 2425	10	<u>SANDSTONE</u> : a:a pyrite common.
	65	<u>SILTSTONE</u> : grading into carbonaceous shale.
	10	<u>CLAYSTONE</u> : a:a
	15	<u>COAL</u>
2425 - 2430	10	<u>SANDSTONE</u> : quartzose, clear to white, very hard, coarse to medium grained, medium grained aggregates well cemented, quartz fragments angular, grain boundaries cemented, mineral fluorescence.
	80	<u>SILTSTONE</u> : light grey to light brown to brown, firm, some quartzose, argillaceous, some moderately to very carbonaceous, light grey siltstone is occasionally calcareous.
	5	<u>SHALE</u> : grey to black, carbonaceous in parts, fissile, soft to firm.
	5	<u>COAL</u> : black, moderately shiny, striated, firm, some fragments with conchoidal fractures.
	80	<u>SANDSTONE</u> : a:a combined with single quartz grains, medium to coarse, clear to white, angular to sub-rounded.
2430 - 2435	15	<u>SILTSTONE</u> : grey, carbonaceous and micaceous, firm to hard.
	5	<u>SHALE</u> : a:a
		Trace coal.
2435 - 2440	80	<u>SANDSTONE</u> : no single grains, grains of quartz as in 2425 - 2430, well cemented, no visible porosity.
	13	<u>SILTSTONE</u> : a:a
	2	<u>SHALE</u> :
	5	<u>COAL</u> : black, conchoidal fracture, shiny, bright.
2440 - 2445	60	<u>SANDSTONE</u> : quartzose, white to clear, very well cemented aggregates, siliceous cement, no visible porosity, almost quartzite, some pyrite with quartz.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>	
2440 - 2445 (contd)	30	<u>SILTSTONE</u> : a:a	
	5	<u>SHALE</u> : a:a	
	5	<u>COAL</u> : a:a	
2445 - 2450	60	<u>SANDSTONE</u> : quartzose, both single grains and very hard aggregates well cemented, white to clear, medium to coarse, moderately well sorted, angular to sub-angular grains, no visible porosity, pyritic.	
	35	<u>SILTSTONE</u> : a:a	
	5	<u>SHALE</u> : a:a	
		Trace coal.	
2540 - 2455	30	<u>SANDSTONE</u> : a:a	
	60	<u>SILTSTONE</u> : a:a	
	5	<u>SHALE</u> : a:a	
	5	<u>COAL</u>	
2455 - 2460	20	<u>SANDSTONE</u> : clear to white, occasionally milky, quartzose, very hard, both loose single grains which appear to have been fractured out of formation, and some hard tight, siliceous cemented aggregates; sub-angular to sub-rounded, fine to coarse grained, poorly sorted, appear to have secondary silicification at grain boundaries, some with pyrite cement, non calcareous; no visible porosity, no fluorescence or cut.	
	60	<u>SILTSTONE</u> : light to medium grey, medium brown, grey brown, subfissile, firm to hard, argillaceous matrix, some quartz, common carbonaceous flecks and partings, light grey siltstone is calcareous, other is non calcareous.	
	10	<u>SHALE</u> : brown grey, firm, fissile, argillaceous.	
	10	<u>COAL</u> : black, hard, shiny, subfissile.	
	2460 - 2465	40	<u>SANDSTONE</u> : a:a
		40	<u>SILTSTONE</u> : a:a
20		<u>SHALE</u> : a:a	
2465 - 2470	40	<u>SANDSTONE</u> : a:a	
	40	<u>SILTSTONE</u> : a:a	
	10	<u>SHALE</u> : a:a	
	10	<u>COAL</u> : a:a	

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2470 - 2475	40	<u>SANDSTONE</u> : a:a
	40	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
	10	<u>COAL</u>
2475 - 2480	40	<u>SANDSTONE</u> : a:a
	50	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
		Trace coal.
2480 - 2485	40	<u>SANDSTONE</u> : a:a quartzose, hard fractured grains, no shows.
	50	<u>SILTSTONE</u> : a:a Note: light grey calcareous siltstone may be cavings.
	10	<u>SHALE</u> : a:a
2485 - 2490	40	<u>SANDSTONE</u> : a:a
	55	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a
2490 - 2495	20	<u>SANDSTONE</u> : quartzose, clear to white, very hard, both single fractured grains and hard aggregates; poorly to moderately sorted, well cemented, silicified, angular, no shows.
	70	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
		Trace coal.
2495 - 2500	50	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
	20	<u>COAL</u> : black, firm, both easy partings and conchoidal fracture, dull.
2500 - 2505	50	<u>SANDSTONE</u> : a:a plus slight increase in softer grains, firm to medium grain aggregates, slightly argillaceous, no shows.
	30	<u>SILTSTONE</u> : a:a
	15	<u>SHALE</u> :
	5	<u>COAL</u>

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2505 - 2510	85	<u>SANDSTONE</u> : quartzose, white to clear, very hard aggregates and fractured single grains, no visible porosity, moderately sorted, angular to very angular, secondary silification evident; no shows, medium to very coarse grained, mineral fluorescence only.
	10	<u>SILTSTONE</u> : grey, argillaceous, coaly and carbonaceous, firm to soft, also green grey non carbonaceous siltstone.
	5	<u>SHALE</u> : dark, fissile, carbonaceous.
2510 - 2515	45	<u>SANDSTONE</u> : a:a
	25	<u>SILTSTONE</u> : a:a
	20	<u>SHALE</u> : dark grey, carbonaceous, fissile, some fragments with coaly inclusions. Trace coal.
2515 - 2521	20	<u>SANDSTONE</u> : clear, white to light grey, quartzose, fine to coarse grained, poorly sorted, sub-angular to sub-rounded, larger grains show secondary quartz overgrowths, very tight, no visible porosity, some with pyrite cement, minor fine grained aggregates with moderate to poor visible porosity; no shows.
	70	<u>SILTSTONE</u> : medium grey, brownish grey, sub-fissile, firm to hard, mostly carbonaceous, non calcareous, argillaceous, some quartzose.
	10	<u>SHALE</u> : dark grey to brown grey, fissile, argillaceous, some with carbonaceous material.
2521 - 2525	80	<u>SILTSTONE</u> : medium grey, medium dark grey, brownish grey, firm to hard, subfissile, argillaceous, trace carbonaceous material, non calcareous. Also light grey, glauconitic, calcareous siltstone, probably cavings.
	10	<u>SANDSTONE</u> : loose quartz grains, fine to coarse, sub-angular to sub-rounded, some aggregates, fine grained siliceous cement, rare yellow fluorescence, does not cut, probably mineral fluorescence.
	10	<u>COAL</u> : black, shiny, blocky. Note: sample appears to contain cavings from throughout hole - first sample after logging and running in hole with bit.
2525 - 2530	60	<u>SILTSTONE</u> : a:a
	30	<u>SANDSTONE</u> : a:a aggregates more common - quartzose aggregates, very fine to fine grained, sub-rounded, moderately sorted, non calcareous, slightly argillaceous. trace micromica, slightly carbonaceous, no visible porosity, no fluorescence or cut.
	10	<u>COAL</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2530 - 2535	20	<u>SANDSTONE</u> : quartzose, fine to medium grained, clean, angular grains, intergrown, silica overgrowths on grains, very hard, poor sorting, some aggregates with slightly argillaceous matrix, also tight, some grains have pyritic overgrowths, very poor visible porosity, very slightly calcareous, (some calcareous cement in space between grains, although intergranular space very low); very poor to no visible porosity, some yellow gold fluorescence, (5% of Sandstone in sample) most does not cut (appears to be mineral fluorescence from minor calcareous cement) but some very slow, very very weak, very pale blue white cut.
	70	<u>SILTSTONE</u> : medium grey, dark grey, hard, argillaceous, subfissile, medium grey is slightly calcareous, dark grey is non calcareous, dark grey has abundant coaly matrix.
	10	<u>SHALE</u> : light grey, hard, fissile, non calcareous.
2535 - 2540	40	<u>SANDSTONE</u> : a:a mainly clear hard quartz aggregates, and grains with silica overgrowths, less than 5% show yellow fluorescence, very very slow, very very weak pale blue cut, a:a.
	50	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
2540 - 2545	60	<u>SANDSTONE</u> : a:a no fluorescence or cut, some with pyritic cement.
	30	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
2545 - 2550	30	<u>SANDSTONE</u> : a:a no fluorescence or cut.
	60	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
2550 - 2555	40	<u>SANDSTONE</u> : a:a no shows.
	40	<u>SILTSTONE</u> : a:a
	20	<u>SHALE</u> : a:a
2555 - 2560	60	<u>SANDSTONE</u> : a:a no fluorescence.
	30	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a carbonaceous.
2560 - 2565	80	<u>SANDSTONE</u> : quartzose, white, light grey, both aggregates and single grains, angular, aggregates very tight, low porosity, siliceous overgrowths; no fluorescence present, poor sorting.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2560 - 2565 (contd)	15	<u>SILTSTONE</u> : grey to light brown, soft to firm, some argillaceous and harder than the rest; some of the light grey material slightly calcareous, subfissile, and where carbonaceous shows partings along the streaks.
	5	<u>SHALE</u> : dark grey, very carbonaceous, streaks of black coal. Trace coal.
2565 - 2570	90	<u>SANDSTONE</u> : a:a very tight.
	10	<u>SILTSTONE</u> : a:a Trace coal and shale.
2570 - 2575	30	<u>SANDSTONE</u> : a:a
	65	<u>SILTSTONE</u> : a:a more carbonaceous, (predominantly carbonaceous).
	5	<u>SHALE</u> : a:a Trace coal.
2575 - 2580	25	<u>SANDSTONE</u> : quartzose, white to clear to light grey, very hard, angular fragments and aggregates, aggregates very tight, no visible porosity, coarse to fine grained, poor sorting, small amount of possible mineral fluorescence, no shows.
	70	<u>SILTSTONE</u> : green grey to light brown, carbonaceous flecks common, firm to hard, harder fragments, argillaceous.
	5	<u>SHALE</u> : dark grey, hard to firm, fissile, carbonaceous. Trace coal.
2580 - 2585	40	<u>SANDSTONE</u> : a:a
	45	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a
	10	<u>COAL</u> : black, subfissile, some fragments show conchoidal fractures.
2585 - 2590	20	<u>SANDSTONE</u> : a:a some associated pyrite.
	70	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a
	5	<u>COAL</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2590 - 2595	40	<u>SANDSTONE</u> : quartzose, white to clear, light grey, very hard, angular grains and aggregates, poor sorting, coarse to fine grained, very tight, no visible porosity, no fluorescence, silica overgrowths, pyrite.
	55	<u>SILTSTONE</u> : green to grey, light brown; light brown very carbonaceous, contains carbonaceous flecks and coal fragments, firm to hard, subfissile.
	5	<u>SHALE</u> : dark grey, carbonaceous, fissile, firm, carbonaceous partings common. Trace coal.
2595 - 2600	10	<u>SANDSTONE</u> : white, clear, quartzose, angular grain aggregates, very hard, very tight, no fluorescence, no shows.
	85	<u>SILTSTONE</u> : grey to light to dark brown, green grey, very carbonaceous with carbonaceous flecks, commonly sandy with occasional coal fragments, blocky to subfissile, firm to hard.
	5	<u>SHALE</u> : dark brown, grey, platy to fissile, carbonaceous parting, firm.
2600 - 2605	10	<u>SANDSTONE</u> : a:a
	85	<u>SILTSTONE</u> : a:a
	5	<u>SHALE</u> : a:a plus trace pyrite - discrete lumps.
2605.5		<u>GRAB SAMPLE</u>
	50	<u>COAL</u> : a:a
	30	<u>SILTSTONE</u> : a:a
	20	<u>SANDSTONE</u> : a:a <u>Note</u> : 20 units of gas
2605 - 2610	80	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a Trace of quartz, sandstone and pyrite.
	10	<u>COAL</u> : a:a
2610.2		<u>GRAB SAMPLE</u> (Gas Peak = 20 units)
	50	<u>COAL</u> : a:a
2614.6	50	<u>SILTSTONE</u> : a:a
	80	<u>SILTSTONE</u> : a:a
	15	<u>SANDSTONE</u> : a:a
	5	<u>COAL</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2610 - 2615	80	<u>SILTSTONE</u> : a:a
	10	<u>SANDSTONE</u> : a:a
	10	<u>COAL</u> : a:a
2615 - 2620	50	<u>SANDSTONE</u> : clear, white, angular aggregates, very well silicified cement, fair sorting, no visible porosity, tight, no shows, (trace glauconite - cavings?)
	30	<u>SILTSTONE</u> : light to dark brown, grey, blocky, very carbonaceous with carbonaceous flecks, sandy in part, coal partings in part, blocky.
	20	<u>COAL</u> : a:a Trace shale.
2620 - 2625	10	<u>SANDSTONE</u> : a:a
	80	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
2627.5		<u>GRAB SAMPLE</u>
	10	<u>SANDSTONE</u> : trace glauconite
	50	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
	30	<u>COAL</u> : a:a
2625 - 2630	100	<u>SILTSTONE</u> : a:a
2630 - 2635	90	<u>SILTSTONE</u> : light to dark brown, light to dark grey, predominantly blocky, occasionally subfissile, very carbonaceous with carbonaceous flecks in part, occasionally sandy and friable, mainly firm. Trace pyrite, and muscovite.
	10	<u>SHALE</u> : grey to brown, subfissile to fissile, predominantly carbonaceous, minor argillaceous, occasionally carbonaceous partings, occasionally micromica. Trace pyrite.
2635 - 2640	30	<u>COAL</u> : a:a
	60	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
2642		<u>GRAB SAMPLE</u> GAS @ 24 UNITS
	30	<u>COAL</u> : a:a
	60	<u>SILTSTONE</u> : grey to dark brown, some very carbonaceous.
	10	<u>SHALE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2640 - 2645	85	<u>SILTSTONE</u> : a:a
	15	<u>COAL</u> : a:a Trace shale, quartz sandstone, and pyrite.
2645 - 2650	100	<u>SILTSTONE</u> : a:a Trace shale, quartz sandstone, coal and pyrite.
2652		<u>GRAB SAMPLE</u>
2650 - 2656	60	<u>COAL</u> : a:a
	40	<u>SILTSTONE</u> : a:a
	60	<u>SANDSTONE</u> : a:a
2658 B.U.	30	<u>SILTSTONE</u> : a:a
	60	<u>SANDSTONE</u> : white, clear, very angular aggregates, very well siliceous cemented, no visible porosity, very tight, fair sorting, trace to 5% dull yellow fluorescence, no crush cut.
	10	<u>SHALE</u> : a:a
2659	30	<u>SANDSTONE</u> : white, clear, very angular aggregates, very well siliceous cemented, no visible porosity, very tight, fair sorting, trace to 5% dull yellow fluorescence, no crush cut.
	60	<u>SILTSTONE</u> : a:a
	10	<u>COAL</u> : a:a
2656 - 2660		<u>GRAB SAMPLE</u>
	60	<u>SANDSTONE</u> : quartzose, angular to sub-angular, clear to milky, often cemented together; very tight, no visible porosity, no shows.
	40	<u>SILTSTONE</u> : grey to dark brown, often very carbonaceous. Trace muscovite, pyrite and coal.
2660 - 2663 B.U.	80	<u>SANDSTONE</u> : quartzose, clear to milky, angular, very coarse to coarse grained, very well siliceous cemented aggregates, occasionally siliceous overgrowths, fair sorting, very hard, no visible porosity, trace of fair to pale yellow hydrocarbon fluorescence, possible minor white mineral fluorescence, no crush cut, trace of pyrite and muscovite.
	20	<u>SILTSTONE</u> : light to medium grey, grey brown, light to medium brown, very carbonaceous, common dark coarse carbonaceous flecks, occasionally sandy grey in part, firm. Trace coal.
2660 - 2663 B.U.	70	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>ft</u>	<u>DESCRIPTION</u>
2663 - 2669		<u>SEE CORE DESCRIPTION NO. 3</u>
2669 - 2670	50	<u>SANDSTONE</u> : clear to opaque, angular, quartz overgrowths in a predominantly siliceous cement, fair, sorting, very hard, tight. Trace of white to yellow fluorescence with white cut; trace pyrite.
	50	<u>SHALE</u> : dark brown to light brown, occasionally grey, blocky, micromicaceous, occasionally carbonaceous clasts, predominantly argillaceous, hard, subfissile in parts. Trace coal, pyrite, muscovite, occasionally tending to argillaceous siltstone.
2670 - 2675	70	<u>SHALE</u> : a:a
	30	<u>COAL</u> : a:a
2675 - 2680	70	<u>SILTSTONE</u> : light grey to brown, very argillaceous to carbonaceous, blocky, sandy in part, firm, frequently carbonaceous, very fine flecks.
	30	<u>SHALE</u> : a:a
2680 - 2685	20	<u>SANDSTONE</u> : white, fine grained, sub-angular to sub-rounded quartz aggregates in a predominantly siliceous cement, poor sorting, hard, tight, trace of pale yellow to white fluorescence, no cut; occasionally kaolinite clay.
	70	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a Trace coal.
2685 - 2690	70	<u>SANDSTONE</u> : white, clear, angular quartz overgrowths, poor sorting, very hard, tight, trace pyrite, fair yellow to white fluorescence with no cut.
	30	<u>SILTSTONE</u> : a:a grading in part to shale.
2690 - 2695	100	<u>SANDSTONE</u> : white, clear, angular to rounded, very coarse quartz aggregates, relatively clear, unconsolidated aggregates, very hard, even dull yellow fluorescence, no cut; tight.
2695 - 2700	75	<u>SILTSTONE</u> : slightly firm to firm, brown to dark grey, often carbonaceous, blocky.
	25	<u>SANDSTONE</u> : a:a even dull yellow fluorescence, no cut, no residue, trace shale; very carbonaceous, pyrite, mica.
2700 - 2705	95	<u>SILTSTONE</u> : a:a
	5	<u>SANDSTONE</u> : dull yellow fluorescence, occasional grain has very weak cut and crush cut. Trace shale, and pyrite in discrete blocks.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2705 - 2710	95	<u>SILTSTONE</u> : a:a but predominantly light grey to white, grading to fine grained sandstone, cuttings sub-angular, firm to soft, carbonaceous flecks.
	5	<u>SANDSTONE</u> : a:a Trace pyrite, shale and coal.
2710 - 2715	80	<u>SANDSTONE</u> : sub-angular to angular quartzose grains, white to clear, with silica cement, moderately to poorly sorted, trace of pale yellow fluorescence, very weak cut.
	20	<u>SILTSTONE</u> : white to dark brown, soft to firm, some very carbonaceous, cuttings sub-angular to sub-rounded, grades to a fine sandstone in places. Trace pyrite, coal and shale.
2715 - 2720	90	<u>SANDSTONE</u> : a:a trace pale to bright yellow fluorescence, only crush cut on some grains.
	10	<u>SILTSTONE</u> : a:a Trace coal (increasing), pyrite and shale.
2720 - 2725	50	<u>SANDSTONE</u> : a:a trace fluorescence, slight crush cut.
	50	<u>SILTSTONE</u> : a:a Trace coal (increasing). pyrite and shale.
2725 - 2730	30	<u>SANDSTONE</u> : a:a
	60	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : dark brown to black, very carbonaceous, sub-angular to sub-rounded, firm and trace of coal, pyrite.
2730 - 2735	60	<u>SANDSTONE</u> : a:a trace of fluorescence, very weak cut.
	40	<u>SILTSTONE</u> : a:a Trace shale, coal and pyrite.
2735 - 2740	40	<u>SANDSTONE</u> : a:a trace of fluorescence, very weak cut.
	50	<u>SILTSTONE</u> : a:a
	10	<u>COAL</u>
2740 - 2745	70	<u>SILTSTONE</u> : light grey to brown, blocky, argillaceous to carbonaceous, occasionally dark carbonaceous flecks, occasionally micromicaceous, soft to firm, grades in part to very fine sandstone.
	30	<u>SANDSTONE</u> : clear, sub-angular to angular quartz aggregates, occurring as quartz overgrowths, occasionally fine sub-rounded quartz grains in a kaolinitic white clay sparse silica cement; poor sorting, friable to hard, tight, no shows.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>ft</u>	<u>DESCRIPTION</u>
2745 - 2750	50	<u>SANDSTONE</u> : a:a
	50	<u>SILTSTONE</u> : a:a
2750 - 2755	70	<u>SILTSTONE</u> : a:a
	30	<u>SANDSTONE</u> : a:a
2755 - 2760	30	<u>SANDSTONE</u> : a:a trace fluorescence, trace pyrite, no shows, tight.
	70	<u>SILTSTONE</u> : a:a becoming very argillaceous and soft.
2760 - 2765	30	<u>SANDSTONE</u> : a:a trace fluorescence.
	40	<u>SILTSTONE</u> : a:a
	30	<u>SHALE</u> : dark to medium brown, blocky to subfissile, carbonaceous, micromicaceous in part, firm to hard.
2765 - 2770	80	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : a:a
2770 - 2775	10	<u>COAL</u>
	80	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a
2775 - 2780	50	<u>SANDSTONE</u> : a:a
	40	<u>SILTSTONE</u> : a:a
	10	<u>COAL</u> : a:a Trace shale.
2780 - 2785	30	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a
	30	<u>SHALE</u> : a:a
	10	<u>COAL</u> : a:a
2785 - 2790	40	<u>SANDSTONE</u> : clear to white, sub-angular to angular, quartzose overgrowths, moderately sorted.
	30	<u>SILTSTONE</u> : grey to dark brown, soft to firm, carbonaceous grades to fine sandstone.
	30	<u>SHALE</u> : dark grey to brown, hard, very carbonaceous, angular. Trace pyrite and coal.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>z</u>	<u>DESCRIPTION</u>
2830 - 2835	90	<u>SANDSTONE</u> : a:a
	10	<u>SILTSTONE</u> : a:a Trace shale, and pyrite. 15% of sample white fluorescence, no cut, no crush cut.
2835 - 2840	90	<u>SANDSTONE</u> : a:a 20% shows white fluorescence, no cut, no crush cut.
	10	<u>SHALE</u> : a:a Trace shale and pyrite.
2840 - 2845	90	<u>SANDSTONE</u> : a:a
	10	<u>SILTSTONE</u> : a:a Trace shale and pyrite.
2845 - 2850	60	<u>SANDSTONE</u> : a:a trace fluorescence, no cut.
	40	<u>SILTSTONE</u> : a:a grades to fine sandstone. Trace shale and pyrite.
2850 - 2855	80	<u>SANDSTONE</u> : trace fluorescence, occasional grain has very weak cut.
	20	<u>SILTSTONE</u> : brown to grey, soft to firm, blocky, sub-rounded to angular. Trace shale and pyrite.
2855 - 2860	70	<u>SANDSTONE</u> : clear to milky, relatively clean, elongate, angular to very angular quartzose aggregates in a very sparse siliceous cement, but very well fused, tight, fair sorting, occasional quartz coarse overgrowths, trace pyrite, no shows.
	30	<u>SILTSTONE</u> : predominantly brown, occasionally grey, occasionally dark coarse black carbonaceous clasts, blocky, relatively soft to firm. Trace coal and shale.
2860 - 2865	80	<u>SANDSTONE</u> : a:a minor dull yellow fluorescence.
	20	<u>SILTSTONE</u> : a:a
2865 - 2870	90	<u>SANDSTONE</u> : a:a
	10	<u>SILTSTONE</u> : a:a
2870 - 2875	80	<u>SANDSTONE</u> : a:a
	20	<u>SILTSTONE</u> : a:a

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2875 - 2880	70	<u>SANDSTONE</u> : Trace fluorescence, becoming more medium grained and rounded, otherwise as before.
	30	<u>SILTSTONE</u> : brown to grey, carbonaceous, trace micromica, firm. Trace shale and pyrite.
2880 - 2885	30	<u>SANDSTONE</u> : a:a
	70	<u>SILTSTONE</u> : a:a
2885 - 2890	100	<u>SILTSTONE</u> : predominantly white to grey, buff, slightly quartzose, argillaceous, blocky, hard, clayey to silty in part, friable. Trace coal and sandstone.
	2890 - 2895	100
2895 - 2900	90	<u>SILTSTONE</u> : a:a
	10	<u>SANDSTONE</u> : a:a
2900 - 2905	90	<u>SILTSTONE</u> : a:a
	10	<u>SANDSTONE</u> : soft to hard, grey to brown, blocky, sub-angular to sub-rounded, carbonaceous. Trace coal.
2905 - 2910	50	<u>SANDSTONE</u> : well cemented, sub-angular to angular quartz grains, very hard.
	40	<u>SILTSTONE</u> : grades to fine sandstone.
	10	<u>SHALE</u> : a:a Trace coal.
2910 - 2915	60	<u>SANDSTONE</u> : a:a
	40	<u>SILTSTONE</u> : a:a
2915 - 2920	70	<u>SANDSTONE</u> : a:a
	30	<u>SILTSTONE</u> : a:a Trace shale, and pyrite.
2920 - 2925	50	<u>SANDSTONE</u> : a:a
	50	<u>SILTSTONE</u> : a:a Trace shale and pyrite.
2925 - 2930	40	<u>SANDSTONE</u> : a:a
	60	<u>SILTSTONE</u> : a:a Trace coal and shale.

LITHOLOGICAL DESCRIPTIONS

<u>DEPTH</u>	<u>%</u>	<u>DESCRIPTION</u>
2930 - 2935	70	<u>SILTSTONE</u> : a:a
	20	<u>SANDSTONE</u> : a:a
	10	<u>SHALE</u> : a:a Trace coal and pyrite.
2935 - 2940	60	<u>SILTSTONE</u> : a:a
	40	<u>SANDSTONE</u> : medium to hard, carbonaceous, dark grey to brown. Trace shale and coal.
2940 - 2945	30	<u>SANDSTONE</u> : trace white fluorescence, very weak cut.
	60	<u>SILTSTONE</u> : a:a
	10	<u>SHALE</u> : a:a Trace coal.
2945 - 2950	80	<u>SANDSTONE</u> : sub-angular to angular, siliceous cement, grains often fused, very hard, white to milky, moderate sorting. 15 - 25% shows white fluorescence (very very weak), no cut.
	20	<u>SILTSTONE</u> : grey to brown, soft to hard, sub-angular to sub-rounded, grades to fine sandstone. Trace shale, coal and pyrite.
2950 - 2955	10	<u>SANDSTONE</u> : a:a plus trace of fluorescence, no cut.
	90	<u>SILTSTONE</u> : a:a Trace coal, shale and pyrite.

APPENDIX 2

APPENDIX-2

CORE DESCRIPTIONS

ESSO AUSTRALIA LTD.
CORE DESCRIPTION

Core No. 1

Well TARWHINE - 1.

Interval Cored 1392-1405 m, Cut 13.00 m, Recovered 10.85 m, (83.5%) Fm. LATROBE

Bit Type C22 Bit Size 8 15/16" in, Desc by S. TWARTZ Date 28-11-81

Depth & Coring Rate (m/hr)	Graphic	Shows	Interval (m)	Descriptive Lithology
92		●	1392.0 to 1392.1	Calcilutite: medium grey to brownish grey; firm; grading to calcarenite; abundant forams, commonly replaced with glauconite; large glauconitic grains common, abundant micromica; very calcareous; typical GURNARD FORMATION
1393		●	1392.1 to 1392.35	Sandstone: Brownish grey to dark grey, medium to very coarse grained; subangular to subrounded; clear quartz; very argillaceous; poorly sorted; strong HC odour.
94		●	1392.35 to 1392.51	Siltst/Ss: Medium dark brown to yellow grey; quartzose, dark silty laminations; micromicaceous; Ss very argillaceous, quartz medium, coarse and fine grained; carbonaceous partings, strong HC odour.
1395		●	1392.51 to 1393.69 to 1394.69 to 1397.80	Ss: cream to buff; dark grey carbonaceous laminae; well sorted; abundant carbonaceous flecking; subangular to subrounded; argillaceous; abundant fine white mica; very friable; below 1393.69 grades to coarse grained sand; very argillaceous; subangular to subrounded; carbonaceous; poorly sorted; pods of very carbonaceous siltstone, micromicaceous; strong HC odour.
96		●		NOTE: Ss: grading coarse to fine grained throughout entire core.
1397		●		NOTE: Degree of argillaceous material varies - coarse grained sands commonly argillaceous.
1398		●	1397.80 to 1398.51	Siltst/Ss: interbedded Siltstones and sandstones carbonaceous laminae common. Sandstone very fine to coarse grained.
1400		●	1398.51 to 1400.40 to 1400.40 to 1400.85	Ss: as above.
01		●		Siltst/Ss: dark grey to black; carbonaceous siltstone beds with very fine grained to silty sands showing ripple laminations; fluorescence in sandy beds.
1402		●	1400.85 to 1402.85	Ss: as above.

NOTE! Grainsize of Ss grades from coarse grained to very fine grained throughout the core.

LOOKING UP CORE: BLUE ON LEFT, RED ON RIGHT.

ESSO AUSTRALIA LTD.
CORE DESCRIPTION

Core No. 2

Well JARVINE 1

Interval Cored 1405-1418 m, Cut 13 m, Recovered 9.85 m, (.76 %) Fm. LATROBE

Bit Type C22 Bit Size 8 15/16" in. Desc by S. TWARTZ Date 29/11/81

Depth & Coring Rate (m/hr)	Graphic	Shows	Interval (m)	Descriptive Lithology
05.20			1405 to 1405.6	Sltst: lt gy to md. dk gy; blocky; hard; contains occasional shaley vugs; interbedded with beds of lighter more granular quartzose material; micromicaceous
1406		●	1405.6 to 1405.8	Ss: coarse grained; very argillaceous; poorly sorted; occurs occasionally as broad beds, some as isolated coarse grained patches of quartz.
1407		●	1405.8 to 1406.4	Sltst: medium dark grey to medium grey; hard; carbonaceous; may form matrix about coarse grained quartz.
1408		●	1406.4 to 1407.5	Ss: coarse grained to fine grained with depth; interbedded very fine grained Sandstone and micromicaceous, sltst at top; very fine grained quartz is matrix to coarse grained subrounded to subangular quartz grains; common carbonaceous partings. HC fluorescence in clear sandy bands.
1409		●	1407.5 to 1408.2	Sltst/Ss: fine grained to very fine grained sand; clean; very fine grained carbonaceous flecking; very fine grained carbonaceous laminae; micaceous, fluorescence not widespread.
1411			1408.2 to 1409.10	Ss: fine grained to very fine grained; argillaceous; micaceous; as above.
1412			1409.1 to 1410.25	Sltst: medium grey to medium light grey, micaceous; grades to fine grained Ss; very finely interbedded with carbonaceous sltst; contains pods of carbonaceous sltst and coal.
1413			1410.25 to 1411.85	Ss: fine grained to very fine grained; argillaceous in patches; carbonaceous material common. NO SHOWS.
54 1414			1411.85 to 1414.85	Ss: coarse grained; loose quartz; subangular to subrounded, poorly sorted; matrix is angular fine grained to very fine grained quartz and slt; fine white abundant; fine carbonaceous flecking common. NO SHOWS.
1415				

ESSO AUSTRALIA LTD.
CORE DESCRIPTION

Core No. 3

Well TARWHINE - 1

Interval Cored 2663.0-2669.0 m, Cut 6.00 m, Recovered 5.85 m, (.975%) Fm. INTRA LATROBE

Bit Type C20 Bit Size 8 15/16" in. Desc by J. ROCHE L. FINLAYSON Date 20/12/81

Depth & Coring Rate (m/hr)	Graphic	Shows	Interval (m)	Descriptive Lithology
2663.30		⊕	2663.30	Ss: v.c. clear-opaque angled qtz interbedded with well eng. vitreous black coal with a slightly white matrix.
2663.49		⊕	2663.49	Ss: wh, clear, gy - lt brn, opaque m-c. SA-A qtz aggregates in a predom. silic matrix, poor sorting, poor to fair intergranular porosity, v. hd, 100% even bright white - pale yellow fluor. with slow white cut, but instantaneous streaming white crushed cut; occ. rdned c. carb. flecks, tr. muscovite.
2663.58		⊕	2663.58	Shale: lt gy, blocky, sl. argill, sl. micromic, hd, interbedded in part with qtz opaque pebble and coarse ang. gn qtz in a predom. white silty matrix, tr carb. shale clasts.
2663.84		⊕	2663.84	Shale: lt-med gy, blocky, argill, pred. brown-red muscovite and black mica c. gns, in a mainly qtzose matrix, v. hard.
2664.10		⊕	2664.10	Ss: wh, clear, gy - opaque, f to pred. m, SA-SR qtz aggs in a mainly fine white silty matrix, common coarse carb. flecks, occ. muscovite, occ argill. in part poor sorting, v. hd, no vis. porosity, N.S. Tight.
2664.38		⊕	2664.38	Ss: pred. opaque, milky-clear, essentially bimodal; m-v.c. SA-SR qtz in a predom. silic to sl. silty matrix with vitreous clear qtz rdned, v. hd qtz pebbles, occ. carb. flecks, poor sorting, poor intergranular φ even 100% wh - pale yellow fluor with slow wh. cut.
2665.92		⊕	2665.92	Qtz Ss: clear, opaque, gy, conglom. qtz Ss, consisting pred. of well ang. to SR, v-hd qtz pebbles in a silic-silty wh matrix with m-v.c. SA-SR qtz gns; common c. ang qtz overgrowths, poor sorting, occ. v.c. - pebble size blocky carb. shale clasts, poor φ, bright wh - yellow fluor with slow white cut.
2666.07		⊕	2666.07	Shale: lt gy, blocky, v. sl. argill, pred. clean, very hard, grading to v. carb. black shale in part.
2666.74		⊕	2666.74	Shale: m-dk gy, blocky, m. mic, v. hd, common large v. dk carb shale clasts with occ. vitreous conchoidal fractured coal clasts.
2667.72		⊕	2667.72	Ss: pred. gy, occ wh clear, mainly m SA-SR, v. hd qtz gns in a wh. silty matrix, very carbonaceous, argill, fair sorting, Tight. N.S.
2668.59		⊕	2668.59	Ss: as for 2664.84
2668.84		⊕	2668.84	Ss: as for 2665.92 but N.S.
2668.92		⊕	2668.92	Ss: as for 2665.92 but N.S.
2669.11		⊕	2669.11	Shale: as for 2666.07
				NB: Pulled bit after large pump pressure fluctuations ± 100 psi whilst coring.

APPENDIX 3

APPENDIX-3

SIDEWALL CORE DESCRIPTIONS

WELL TARWHINE#1
 GEOLOGIST PNG/WM
 SERVICE CO SCHLUMBERGER

ESSO AUSTRALIA LTD.
 SIDEWALL CORE DESCRIPTIONS

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IES RUN NO 4 SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	FND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB	REMARKS - GAS			
				3	4									5	6	7	8	9	10	11				12	13	14
1	2500.5	30	Coal	mainly dull;	thin inter-	-	black	mod																		
				beds of shiny	coal																					
2	2499.4	20	SS	Qtzse, sl	argill	non	lt.gy	fri	vf-	mod	sa-	20	-	40	even	mod	blue	mod,	blue	not	vis	lt oil	-		tr. dk mica, common carb mat	
3	2495.1	20	Cl yst	gding to	shale	non	med	mod	cl y																tr micromica, tr. carb mat.	
4	2486.1	25	Cl yst	some shale		non	dk gy	firm	silt																micaceous & carb in part	
5	2476.1	15	stst	v. argill		non	med	firm	cl y-																qtzs silt gns, sl. micac, slight bedding plane fissility.	
				v. carb			dk gy		silt																	
6	2465.2	15	stst	finely		non	med	firm	cl y	mod	sr	40													qtzs, v. argill, abndt carb mat, mnr micromica	
				interbedded			gy -	hd	vfl																	
				argill mtx			med dk																			
							gy																			
7	2457.2	20	stst	finely																						
				inter -																						
				laminated																						
				qtzs, argill		non	lt gy	hd	silt	mod	sr	30														

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vfl

WELL TARWHINE#1
 GEOLOGIST PNG/WM
 SERVICE CO SCHLUMBERGER

ESSO AUSTRALIA LTD.
 SIDEWALL CORE DESCRIPTIONS

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NO. 1a	DEPTH 1	REC 2	ROCK TYPE 3	MODIFIERS		CAL 5	COLOR 6	INDUR DEG 7	GRAIN SIZE 8	SRTG. 9	FND 10	DISS CLAY 11	STAIN 12	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW 21	PROB PROD 22	REMARKS - GAS 23	
				4										% RK	DISTR 14	INTEN 15	COLOR 16	INTEN 17	COLOR 18	QUAN 19				COLOR 20
7	(Cont)																							
			carb	sl. qtzs, argill		non	dkgy	hd	clgy			30												v. carb, some fine coaly stringers
			stst	argill					silt															
8	2447.2	20	stst	qtzs, mod argill micromica (musc)		non	meddk gy	v. hd	clgy silt			40												chips only abndt carb flecks & coaly stringers
9	2431	25	Shale	gding in hdness to clyst		non	dk gy	firm hd	clgy			90												argill. Thin disct bands of black shiny coal sl micac.
10	2420	15	clyst	v. argill tr. silt		non	med dkgy	firm	clgy			90												Common vf carb mat, micromica
11	2401.2	25	clyst	fairly "clean" clay minerals		non	med gy	mod firm	clgy			100												rare carb flecks rare micromica
12	2396.1	15	Ss.	qtzs argill		non	med lgy	fri	vf- pr m	sa sr		20												poss silica overgrowths on some gns some shattering of gns.

WELL TARWHINE#1
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IES RUN NO 4 SWC RUN NO 1

NO. 1a	DEPTH 1	REC 2	ROCK TYPE 3	MODIFIERS		CAL 5	COLOR 6	INDUR DEG 7	GRAIN SIZE 8	SRTG. 9	RND 10	DISS CLAY 11	STAIN 12	FLUORESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW 21	PROB 22	REMARKS - GAS 23	
				4										% RK	DISTR 14	INTEN 15	COLOR 16	INTEN 17	COLOR 18	QUAN 19				COLOR 20
20	2362	15	Ss	qtz, argill	carb frag	non	wt - 1tgy	firm- hd	m-vf	pr	a-	20												disseminated carb flecks
21	2359.5	20	Ss	qtz, argill		non	med gy	hd- firm	m-vf	pr	a-	20												carb flecks distr throughout
22	2353.6	20	Ss	qtzs argill		non	1tgy	fri	f-m	pr	sa	20												cmt contam. shattered gns tr py, tr carb mat
23	2352.5	20	Ss	qtzs, tr argill		non	1t gy	fri	vf -med	pr	a-	10												shattered gns, mnr coaly gns, carb streaks, tr. py
24	2346	15	sltst	qtz silt gns argill mtx		non	med dkgy	hd	cly- silt			70												tr micromica appears sl mottled abndt carb flecks
25	2327.2	15	sltst	qtzs, gdes -silty f ss		non	brish gy	hd	cly- f	pr	sa-	40												mod carb
26	2315	20	clyst	sl. silty		non	med 1tgy	firm	cly- silt			70												tr carb flecks tr micromica
27	2304	20	clyst	sl silty		non	med dkgy	firm- hd	cly- silt			80												abndt carb mat, some micromica subfiss parallel to bedding

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IES RUN NO 4 SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS	CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB	REMARKS - GAS
				4	5										14	15	16	17	18	19	20			
28	2290.1	25	stst	qtzs, with many thin carb (coaly)	non	non	ltgy	fri	cly-silt			40												s1 argill
29	2273	25	stst	qtzs, argill mtx lamina	non	non	med ltgy	firm	cly-silt			60												abndt carb flecks in siltst, with some carb partings tr micromica
30	2265	20	Ss	qtzs, s1 argill	non	non	ltgy	fri	f-c pr mainly f-m		sa-													shattered gns tr carb mat
31	2255.1	15	shale	rare carb flecks	non	non	ltgy	hd	cly			100												fairly "clean" shale, subfiss parallel to beddin
32	2241.1	20	Ss	qtzs, vf ss s1 argill	non	non	ltgy	med hd	cly- vfss	good	sr	20												occ carb partings along bedding
33	2230.9	15	clyst	gding to shale	non	non	med dkgy	firm	cly			10												homogeneous tr micromica tr carb flecks
34	2221.1	15	Ss	qtzs, s1 argill	non	non	ltgy	fri	vf-m pr		sa-	10												shattered gns, tr carb mat, tr vf py.

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 SIDEWALL CORE DESCRIPTIONS

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IES RUN NO 4 SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB	REMARKS - GAS
				4	5									14	15	16	17	18	19	20			
35	2204.9	10	Shale	carbonaceous	s1		dkgy	firm-hd	clgy			90											tr micromica
36	2196.2	10	Shale	s1 silty	non	med	hd	clgy				70											tr micromica some dispersed v.f. carb flecks
37	2179.9	10	Ss	qtzs, s1 argill	non	1tgy	fri	vf-m	pr	sa-r		10											fractured gns tr. carb mat.
38	2163	25	Shale	micromicac carbonaceous	non	med	hd	clgy				80											s1 silty
39	2149.1	20	Ss	qtzs, fairly clean	non	1tgy	fri	vf-med	pr	sa-sr		5											shattered gns, tr carb mat.
40	2129.5	20	Ss	qtzs, clean	non	1tgy	fri	vf-med	pr	sa-sr		5											shattered gns, tr. carb mat, some car (coaly) partings. abndt fine disseminated carb mat
41	2115.7	15	Clyst	gdng to shale	non	med	dkgy	firm-mod hd	clgy			90											disseminated carb mat
42	2105.5	15	Ss	qtzs	non	1tgy	fri	f-c	pr	a-sr		5											shattered gns tr vf carb mat.
43	2100	20	Ss	qtzs	non	1tgy	fri	f-c	pr	a-sr		5											shattered gns, ra carb shale lens, tr micromica, tr dispersed carb flecks.

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 SIDEWALL CORE DESCRIPTIONS
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NO.	DEPTH	REC	ROCK TYPE	MODIFIERS	CAL	COLOR	INDUR DEG	GRAIN SIZE	SATG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROD	REMARKS - GAS	
													% RK	DISTR	INTEN	COLOR	INTEN	COLOR	QUAN				COLOR
1a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
44	2085.7	15	Ss	qtzs, fairly clean	non	ltgy	fri	f-m	pr	sa-	10												shattered gns, some carb streaks
45	2067.5	20	Ss	qtzs,clean	non	ltgy	fri	f	gd	sa-	5											common fine disseminated carb flecks	
46	2057.1	20	Shale	abndt fine carb mat	non	med	firm	cl			90											tr silt sized qtz gns, some micromica	
47	2043	15	Ss	qtzs, sl argill	non	ltgy	fri	f-cl	pr	sa-	10											shattered gns common carb (coaly) mat	
48	2036	20	stst	qtzs, argill	non	med	firm	cl			70											abndt carb (coaly) mat, tr micromica (muscovite)	
49	2026.6	20	Ss	qtzs, argill gdes to stst	non	med	firm	silt	good	sr	30											abndt coaly flecks & stringer tr micromica (musc)	
50	2015.6	20	Ss	qtz, sl argill	non	med	firm	silt- vf	good	sr	10											several thin carb lamina, tr micromica	

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NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE				CUT FLUOR.		CUT RESIDUE		SHOW	PROB PROD	REMARKS - GAS
				4	5									14	15	16	17	18	19	20	21			
58	1932	45	clyst			non	med	firm	clyst			95												homogeneous claysone
59	1926	25	clyst	v qtz rich		non	ltgy	firm	vc- clyst	v. poor	sa- sr	70												qtz in a clay rich matrix
60	1911	25	Sst	v carb		non	dkgy	firm	m-silt pred	pr	sa- sr	20												carb rich sst tr mica
61	1900	25	Sst	thin streaks of scat. carb. matl.		non	ltgy	fri	vf- c	pr	sa- sr	20												thin black carb streaks & tr of mica
62	1892.5	20	Sst	thin dis-continuous carb streaks		non	ltgy	fri	c- vf pred. fine	pr	sa- sr	20												slight carb sand
63	1889.	20	Sst	qtz rich		non	v. lt grey	fri	vc- f pred	pr	sa- sr	30												clay rich matrix tr of pyrite
64	1882.	20	Sst	argill, carb		non	dkgy	firm	vf-f	mod	sa- sr	20												micaceous, carb mica, provides some parting
65	1860	15	Sst	qtz rich		non	ltgy	firm	fine- silt	mod	sa- sr	10												fine qtz grains scattered through sample, tr. mica

WELL TARWHINE-1
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IES RUN NO 4 SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR	GRAIN	SRTG	FND	DISG	STAIN	FLOURESCENCE					CUT FLUOR.		CUT RESIDUE		SHOW	PROD	REMARKS - GAS					
				4	5									6	7	8	9	10	11	12	13	14				15	16	17	18	19
66	1849	20	Sst	argill		non	ltgy	fri	m-vf	pr	sa-	25																	slightly carb	
67	1836	30	clyst			non	medgy	firm	clyst			95																	homogeneous clays	
68	1818.5	20	Sst	thin carb streaks		non	dkgy	firm	f-slt	mod	sa-	20																	carb partings common	
69	1807	45	clyst			non	ltgy	firm	clyst			95																	tr mica & carb matter	
70	1786	20	Sst	patches of carb matter		non	ltgy	fri	c-vf	pr	sa-	20																	carb fragments present	
71	1778.9			LOST BULLET																										
72	1767	20	Sst	qtz		non	white tgy	fri	c-f	pr	sa-	20																	carb frag scattered through sand.	
73	1754	20	Sst	qtz		non	ltgy	fri	c-f	pr	sa-	20																	carb frag scatter through sample	
74	1735	45	Sst	qtz		non	white tgy	fri	vc-f	pr	sa-	20																	carb frag scatter through sample	
75	1727	20	Sst	qtz rich		non	medgy	firm	slt			50																	pred silt, some fine sand & mica	

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fine sand

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WELL TARWHINE#1
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 SIDEWALL CORE DESCRIPTIONS

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NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.			CUT RESIDUE		SHOW	PROB	REMARKS - GAS		
				4	5									6	7	8	9	10	11	12	13				14	15
84	1621	20	Sst	qtz	non	white	fri	vc-	por	sa-	30														scattered carb flecks	
85	1604			LOST BULLET																						
86	1591	35	Clst		non	medgy	firm					98														tr. mica
87	1570.25	25	Sst	qtz	non	meddk	fri	vc-f	pr	sa-	20															scattered carb flecks
88	1557.5	30	Sst	qtz	non	1tgy	fri	m-vf	pr	sa-	25															scattered carb flecks
89	1542.4	25	Clst		non	1tgy	firm					95														scattered mica & possibly qtz
90	1531	20	Clst	coaly frag	non	1tgy	firm					90														scattered coaly pieces & feldspars
91	1514	25	Sst	qtz	non	white	fri	c-f	pr	sa-																scattered carb flecks
92	1503	20	Sst	qtz, very carb	non	black	firm	m-f	mod	sa-	30															very carb, dk rare feldspars
93	1485	30	Sst	qtz, carb	non	fawn	fri	vc-f	pr	a-	30															scattered carb flecks & bands

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 SIDEWALL CORE DESCRIPTIONS

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IES RUN NO 4 SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS	CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG.	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.			CUT RESIDUE		SHOW	PROB	REMARKS - GAS
													% RK	DISTR	INTEN	COLOR	INTEN	COLOR	QUAN	COLOR			
1a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
94	1471	30	Sst	qtz	non	white	fri	vc-f	pr	sa-	20												scattered carb flecks
95	1462.5	30	Sst	qtz, carb stringers	non	ltgy	fri	c-f	pr	sa-	20												black carb stringer & flecks
96	1440.5	30	Sst	qtz, argil	non	dkgy	fri	c-f	pr	sa-	25												very dark, argill scattered carb flecks
97	1436	25	Sst	qtz, argill	non	medgy	fri	c-f	pr	sa-	25												scattered carb flecks & coal frag
98	1429	25	Sst	qtz, carb fragment	non	ltgy	fri	vc-f	pr	sa-	30												scattered carb frag
99	1426.6	20	Sst	qtz, argill thin black carb streaks	non	ltgy-	fri	c-f	pr	a-	40												carb streaks common
100	1424.5	25	Sst	qtz, v. argill & carb	non	dkgy	fimm	fine	mod	sa-	20												coal frag & streaks up to 2mm
101	1422.1	20	Sst	carb, feld frag	non	v.dk	fimm	slt															very carb, scattere feld frag.

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frag gyl

WELL TARWHINE#1
 GEOLOGIST PNG/WM
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IES RUN NO 4 SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.			CUT RESIDUE		SHOW	PROB PROD	REMARKS - GAS
				4	5									14	15	16	17	18	19	20	21			
111	1404.6	20	Slt	carb	non	dkgy	firm	firm	Slt			30												carb partings
112	1402.9	25	Slt	v. carb	non	v.dk gy	firm	firm	Slt															carb partings qtz & feld common
113	1401	20	Sst	clay rich matrix	non	v.dk gy	firm	vc-f	pr	va-	50			5	patchy weak	blue	weak	ye11	not visible	in white tight		o11		v.c. qtz in clay matrix
114	1397.5	30	Sst	carb stringers 2mm + flecks	non	wt-tbn	fri	vc-f	pr	sa-	10			50	unever mod	blue	mod	ye11	not visible	in white tight		o11		carb flecks
115	1394.5	30	Ss	qtzs, argill tr. carb mat	non	tggy	fri	f-m	mod	sa-	20			20	patchy mod	blue-ye11	mod	ye11	not visible	in white tight		o11		strong HC odour
116	1392	30	stst	qtzs, v. argill, v. carb	v.	dkgy	soft	clay-			60													s1 mottled appearance
117	1388.6	35	stst	qtzs, v. argill, v. carb, gdes to vf silty ss	s1	dkgy	firm	clay- vf	pr		50													occ loose floatin m. qtzs gns.
118	1386	25	Clst	homogeneous	non	dkgy	firm	clay			90													tr. micromica, mod carbonaceous

FORM R 237 3 72

GEOLOGIST

PNG/WM

TARUWINE-1

ESSO AUSTRALIA LTD
SIDEWALL CORE DESCRIPTION

DEC 1985

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DATE 21st December 1981

SERVICE CO SCHLUMBERGER

IES RUN NO 4

SWC RUN NO 1

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB PROD	REMARKS - GAS		
				4	5									14	15	16	17	18	19	20					
136	1337			LOST BULLET																					
137	1310	40	C. Lut	argill		v	1tgy	hd	clly-			40													
138	1280	50	Marl	(argill c. Lut)		v	med1tgy	hd	clly			50													tr vf pyritic patches, rare carb mat.
139	1250	45	Marl	(v. argill c. Lut)		v	med1tgy	hd	clly			70													tr. vf disseminate py., v. rare carb flecks, tr. micromica
140	1220			LOST BULLET																					
141	1190.1	35	Marl	(v. argill c. Lut)		v	med1tgy	hd	clly			70													tr vf py
142	1160	40	Marl	(v. argill c. Lut)		v	med1tgy	hd	clly			60													tr micromica
143	1130.1	40	Marl	(v. argill c. Lut)		v	med1tgy	hd	clly			40													tr vf pyrite
144	1100	40	Marl	(v. argill c. Lut)		v	med1tgy	hd	clly			50													tr vf py, tr. micromica, v. rare carb flecks

FORM R 257 3/73

WELL TARWHINE#1
 GEOLOGIST PNG/WM
 SERVICE CO SCHLUMBERGER

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 SIDEWALL CORE DESCRIPTIONS

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 ATT _____ REC _____
 DATE 21st December 1981

IES RUN NO 4 SWC RUN NO 1

FORM R 257 3 72

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB PROD	REMARKS - GAS	
				4	5									14	15	16	17	18	19	20				
153	815	10	C. Lut	argi11	v		med ltgy	hd	cly			30												chips only tr. carb mat.

WELL TARWHINE#1
 GEOLOGIST L. FINLAYSON
 SERVICE CO SCHLUMBERGER

ESSO AUSTRALIA LTD.
 SIDEWALL CORE DESCRIPTIONS

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 ATT REC
 DATE 31st December 198

IES RUN NO SWC RUN NO 4 & 5

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.			CUT RESIDUE		SHOW	PROD	REMARKS - GAS	
				1a	1									2	3	4	5	6	7	8	9				10
154	2948.5		Sltst	qtz,mica,	carb	-	1tgy	v.hd	s1t	-	-		-												
155	2944.0		Slt	qtz,mica,	carb		blk/wh	fri	s1t-vfg	wsrtd	r														
156	2939.8		Sltst	qtz,mica	carb		dkgy	fri	s1t																
157	2934.5		Sltst	qtz,mica	carb		dkgy	fri	s1t																
158	2929.3		Slt,	qtz,mica,	carb, arg		1tgy-wh	hd	f.g.																
159	2923.9		Sltst	qtz,mica	carb		gy	fri	s1t																
160	2922.0		Ss	qtz			wh-1t	fri	f.g.	wsrtd	sa														
161	2919.3		Sltst	qtz,carb-	arg		med-dk	frim	s1t																
162	2912.5		Ss	qtz,carb		v.s1	1t-dk	fri	msrtd	s.r															
163	2907.7		Sltst	qtz,arg,			dkgy	sft	s1t																

FORM R 257 5 72
 m.mic

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB	REMARKS - GAS
				1	2									14	15	16	17	18	19	20			
174	2873.0		Ss	qtz,carb,	arg		wh-cl	Fri	pebbles	poor	a												
175	2868.4		Ss	qtz,v.carb			wh-gy	hd	f.g.	wsrtd	sa												
176	2863.6		Ss	qtz,carb			wh-gy	fri	f.g.	wsrtd	sa												
177	2858.5		Stst	qtz,arg,		v.sl	1 tgy	fm	slt														
178	2853.9		Ss	qtz,coal,	tr		wh	fri-hd	fn-	poor	sa-												
179	2851		Ss	qtz,tr.	coal		wh	fri	fn-	poor	sa-												
180	2849.0		Stst	qtz,arg			1t-dk	hd	slt														
181	2845.0		Stst	qtz,arg			gy	medhd	slt														
182	2831.7		Ss	qtz,carb			cream	fri	fn-	poor	sa-												
183	2825.6		Stty	qtz,carb			gy	fri-	slt-														
184	2820.0		Stst	qtz,mica,	arg		dkgy	hd	slt														

FORM R 287 372

FORM R 237 3 72

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	Diss CLAY	STAIN	FLOURESCENCE			CUT FLUOR.			CUT RESIDUE		SHOW	PROB PROD	REMARKS - GAS	
				1	2									5	6	7	8	9	10	11	12				13
185	2807.0		SS	qtz, v. carb			wh-gy	hd	fg	mod	sa														
186	2800.0		SS	qtz, carb, arg			dkgy	fri	vfg	mod	sa														
187	2799.0		Stst	qtz, arg			gy	sft																	
188	2794.9		SS	qtz, arg, mica			gy	fri	fg	mod	sa														
189	2789.9		Stst	arg, m. mica			gy	sft																	
190	2787.9		Sh-slt	arg			gy	sft																	
191	2785.5		Sh-slt	arg			gy	sft																	
192	2782.8		slt	arg, qtz			gy	sft																	
193	2778.9		Sh	carb, coaly			gy	sft																	
194	2776.0		Stst	sndy, arg			dkgy	fm																	
195	2771.7		Stst	sndy, arg			dkgy	fm																	
196	2769.0		SS	qtz, carb			wh	fri	cse	poor	sa-														
197	2766.2		sh-	arg			gy	hd																	

Stst

REMARKS - GAS

WELL TARWHINE-1

ESSO AUSTRALIA LTD. SIDEWALL CORE DESCRIPTIONS

GEOLOGIST L. FINLAYSON

ATT REC

SERVICE CO SCHLUMBERGER

IES RUN NO SWC RUN NO 4 & 5 DATE 31st December 1981

NO. 1a	DEPTH 1	REC 2	ROCK TYPE 3	MODIFIERS 4	CAL 5	COLOR 6	INDUR DEG 7	GRAIN SIZE 8	SRTG 9	RND 10	DISS CLAY 11	STAIN 12	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW 21	PROB PROD 22	REMARKS - GAS 23
													% RK	DISTR 14	INTEN 15	COLOR 16	INTEN 17	COLOR 18	QUAN 19			
1982762.5			sltst	m. mica		gy	hd															
			sh																			
1992758.4			Sh	m.mica		gy	hd															
2002754.1			sltst	m.mica		gy	hd															
2012751.6			sltst	m.mica,qtz		gy	fimm															
2022749.0			Ss	qtz,v.carb		wh	fri	med-	poor	a												
								cse														
2032746.4			Ss	qtz		gy	soft	f.g.	poor	sa												
2042741.9			Coal			blk	fimm															
2052738.7			sltst	qtz,mica,arg		gy	hard	slt														
2062736.3			sltst	qtz,mica,carb		dkgy	fimm	slt														
2072727.7			sltst	qtz,arg		gy	fri	slt														
2082725.0			sltst	qtz,v.carb		dkgy	fimm	slt														
2092718.0			sltst	qtz,mica		ltgy	fimm	slt														
210 2715			ss	qtz,carb		wh	fri	cse	pr	a												

FORM R 257 3 72

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG	RND	' DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB	REMARKS - GAS	
				3	4									5	6	7	8	9	10	11				12
211	2712		Ss	qtz, v. carb			wh	fri	cse	poor	a													
212	2711		Ss	qtz, carb			wh-gy	fri	f.g.	mod	sa													
213	2708.6		sltst	qtz, carb, arg			gy	hd	slt															
214	2705.5		sltst	qtz, arg			dkgy	fm	slt															
215	2703.4		Shale	qtz, arg			dkgy	hd	slt															
216	2701		sltst	qtz, arg			dkgy	fm	slt															
217	2699.3		sltst	qtz, arg, v. carb			dkgy	fm	slt															
218	2697.5		sltst	qtz, arg, carb			dkgy	hd	slt															
219	2693.7		Ss	qtz, arg			dkgy	fri	f.g.	wsrtd	sa													
220	2690.9		Ss	qtz, arg, carb			whgy	fri	f.g.	msrtd	sa													
221	2687.6		Ss	qtz, mica			whgy	fri	f.g.	msrtd	sa													
222	2686.0		Ss	qtz, mica, carb			whgy	fri	f.g.	wsrtd	sa													

FORM R 257 3 72

WELL TARWHINE-1

ESSO AUSTRALIA LTD. SIDEWALL CORE DESCRIPTIONS

GEOLOGIST L FINLAYSON

ATT REC

SERVICE CO SCHLUMBERGER

IES RUN NO SWC RUN NO 5

DATE 31st December 1981

NO.	DEPTH	REC	ROCK TYPE	MODIFIERS		CAL	COLOR	INDUR DEG	GRAIN SIZE	SRTG RND	DISS CLAY	STAIN	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW	PROB	REMARKS - GAS
				1	2								3	4	5	6	7	8	9			
237	2632.0		Slt	arg,carb			gy	fm	Slt													
238	2628.9		Sltst	arg,carb			gy	fm														
239	2619		Sltst	arg,carb			gy	fm														
240	2608.3		Sltst	qtz,arg,carb			gy	fm														
241	2596.5		Ss	qtz			whgy	fm		mod sa												
242	2591		Ss	qtz,arg,carb			whgy	fm		mod sa												
243	2508.8		Sltst	arg			gy	fm														
244	2576.2		Sltst	arg			gy	sft														
245	2571.8		Sltst	arg			gy	sft														
246	2568.5		Ss	qtz			wh	fri	f.g.	wsrtd sa												
247	2560		Ss	qtz			wh	fri	f.g.	msrtd sa												
248	2556		Ss	qtz			wh	fri	f.g.	msrtd sa												
249	2551.2		Sltst	qtz,arg			gy	sft														

FORM R 257 3 72

NO. 1 a	DEPTH 1	REC 2	ROCK TYPE 3	MODIFIERS 4		CAL 5	COLOR 6	INDUR DEG 7	GRAIN SIZE 8	SRTG 9	FND 10	DISS CLAY 11	STAIN 12	FLOURESCENCE			CUT FLUOR.		CUT RESIDUE		SHOW 21	PROB PROD 22	REMARKS - GAS 23	
				% RK	DISTR 14									INTEN 15	COLOR 16	INTEN 17	COLOR 18	QUAN 19	COLOR 20					
250	2536		Ss	qtz			wh	fri	f-mg	msrtd	sa													
251	2531.5		Ss	qtz,carb			wh-gy	fri	v.f.g	msrtd	sa													
252	2522.4		Ss	qtz,carb			wh-gy	fri	v.f.g	msrtd	sa													
253	2515.5																							
254	2496.4		stst	carb			gy	fri	silt															
255	2486		stst	carb,qtz			gy	fri	silt															

FORM R 257 372

APPENDIX 4

APPENDIX - 4

MICROPALAEONTOLOGICAL ANALYSIS

APPENDIX-4

MICROPALAEONTOLOGICAL ANALYSIS OF TARWHINE-1
GIPPSLAND BASIN, VICTORIA.

by

M.J. Hannah

Esso Australia Ltd

Palaeontological Report 1982/18

April 16, 1982

PART I

INTERPRETATIVE DATA

Introduction
Biostratigraphy
Summary Table
Geological Comments
Data Sheet

INTRODUCTION:

The foraminiferal content of thirty-six sidewall cores and two cuttings samples from the marine section of Tarwhine-1 has been examined. Although the entire marine section below the 13.3/8" inch casing shoe was sampled, the majority of sidewall cores come from the transitional interval between the non-marine Latrobe Group and the marine Lakes Entrance Formation. Both the planktonic and benthonic foraminiferal assemblages were scrutinized. However because of their importance to biostratigraphy the planktonics have been accorded the greatest attention. Because of this emphasis the benthonic identifications should be regarded as tentative.

The well penetrated datable marine sediments which range in age from Late Eocene (Zone K) to Mid-Late Pliocene (Zone A4). Mid Miocene to Early Pliocene sediments (Zones F to B1) were not recognised possibly due to either a condensed sequence or an hiatus.

Preservation of microfossils throughout the well is poor to moderate. Only during the interval representing zones I to G (straddling the Oligo-Miocene boundary) does preservation improve. At the top of the section, above sidewall core 148 (980 metres), preservation is so poor that species identification and hence biostratigraphic determinations, become impossible.

Diversity is also low in each sample examined. Again the exception to this is during Zones I to G where diversity of both planktonic and benthonic forms become moderate to high.

BIOSTRATIGRAPHY:

PLIOCENE - ZONE A4: 1010.3 to 1039.9 metres

Recognition of zone based on presence of Globorotalia puncticulata without Globorotalia inflata ss. The lack of Globorotalia crassaformis probably indicates that the two samples come from the early part of the zone. (Early-Middle Pliocene). Preservation is poor and diversity of assemblages (especially the keeled planktonic forms) is low. In the six sidewall cores examined above 1010.3 metres and below the casing shoe preservation is so poor that species identification and hence biostratigraphic determination is impossible. The very few specimens that do occur are very badly recrystallized.

Sidewall core 145 at 1070 metres contains only indeterminate foraminifera. However, specimens present show the same preservational style as those found above, linking this sample with the upper part of the section

EARLY MIOCENE ZONE G: 1100 to 1190.1 metres
ZONE H1: 1250 metres

The four sidewall cores assigned to Zone G contain Globigerinoides trilobus without Globigerinoides bisphericus thus restricting them to this zone.

Preservation of the faunas in these sidewall cores is in sharp contrast to those above. Quality of preservation is probably the best found anywhere in the well. The number and diversity of both planktonic and benthonic forms is also higher over this interval.

The latest Early Miocene, Middle and Late Miocene representing zones B1 to F have not been recognised in Tarwhine-1. This could be a result of either a hiatus or a condensed section in the interval 1039.9 - 1100 metres.

Sidewall core 139 at 1250 metres contains both Globigerina woodi woodi and Globigerina woodi connecta fixing the age as Zone H1. Preservation continues to be good and foraminiferal numbers and diversity remains high. Zone H2 (G. woodi woodi without G. woodi connecta) was not recognised possibly because of the wide sample spacing over this interval.

LATE OLIGOCENE - ZONE I - SWC 138 at 1280 metres.

The presence of Globorotalia opima in this sample is sufficient for the zonal assignment.

EARLY OLIGOCENE - ZONE J1: 1310 metres
ZONE J2: 1320 & 1340 metres.

The sidewall core at 1310 metres contains Globigerina angiporoides without Globigerina brevis or Globigerina gemma. The recognition of these latter two species in the two cuttings samples allows them to be assigned to Zone J2 with a reasonable degree of confidence. G. woodi woodi and G. woodi connecta also occur as contaminants in the cuttings. Preservation of faunas in the sidewall core material is moderate whereas it is variable in the cuttings.

LATE EOCENE - ZONE K: 1348 to 1367.1 metres

Most remaining samples come from the greensand between the top of Latrobe Group and basal Lakes Entrance Formation. The four lowest sidewall cores examined (Nos 115, 116, 117 and 118, at 1394, 1392, 1388 and 1386 metres respectively) consist largely of quartz sand and are part of the Latrobe Group.

Foraminifera first appear, after several metres of barren greensand, in sidewall core 123 at 1375.1 metres. They occur in low numbers and diversity only and are very poorly preserved. Only indeterminate specimens are present.

Sidewall core 127 at 1367.1 metres, containing Globigerina linaperta and Globigerinatheka index, is tentatively assigned to Zone K. However, the non-appearance of Globigerina brevis means that this assignment is less than certain. It is possible that the sample is marginally older than K and is actually equivalent to the onshore Browns Creek Section. The immediately overlying sample (SWC 128) contains all three determinate species, Globigerina linaperta, Globigerina brevis and Globigerinatheka index providing a solid K determination for the sample (Confidence rating 0). Globigerina linaperta continues to be found, sporadically, up to and including SWC 134 at 1348 metres confirming a Late Eocene age for this interval.

The disappearance of Globigerina linaperta marks the Eocene/Oligocene boundary in the Gippsland Basin. The greensand lithology continues above this event to SWC 135 at 1345 metres. This sample, however, is devoid of foraminifera.

GEOLOGICAL COMMENTS:

Geological comments are restricted to a brief discussion of the contentious interval between the non-marine Latrobe Group and the marine Lakes Entrance Formation. In Tarwhine-1 these two units are separated by about 41 metres of greensand - the Gurnard Formation.

There are two distinct phases to the greensand. The lower, sampled in sidewall cores at 1383 metres and 1380.9 metres respectively, is composed almost entirely of pelletal glauconite. Some pyrite and large angular quartz grains are also present, however, there is no carbonate in either sample. Some fish remains have been found in the sidewall core at 1383 metres.

The second part of the greensand starts with the incoming of carbonate in the micaceous siltstone at 1397.5 metres. This is coincident with a sharp reduction in the amount of glauconite in the sample.

Foraminifera first appear at 1375.1 metres. The small assemblage recovered consists entirely of simple benthonic forms (Bathysiphon, Nodosaria). Simple benthonics are also the only foraminiferal content of the next sample (SWC 125 at 1370.9 metres). Foraminiferal numbers in this latter sample are very low, and interestingly the glauconite content is high.

The first planktonic species occur in SWC 126 (1369.1 metres) together with a benthonic assemblage of moderate diversity. The lithology of this sample is a pyritic micaceous siltstone with rare glauconite. Throughout Zone K, however, glauconite increases up section. Simultaneously, foraminiferal numbers drop. In the topmost greensand sample SWC 135 at 1345 metres there are no foraminifera. Glauconite, however, makes up a very significant part of the residue.

To summarise, in the greensand as developed in Tarwhine-1 there appears to be an inverse relationship between the percentage of glauconite in a sample and the amount of carbonate present as manifested by foraminiferal numbers.

SUMMARY OF PALAEOLOGICAL ANALYSIS
TARWHINE-1 - GIPPSLAND BASIN
INTERPRETATIVE DATA

NATURE OF SAMPLE	DEPTH (METRES)	MICRO-FOSSIL YIELD	PRESERVATION	DIVERSITY	ZONE	RATING	AGE
SWC 153	815.0	Very Low	Very very poor	Very very low	Indeterminate	-	(No planktonic foraminifera)
SWC 152	860.2	Very Low	Very poor	Very low	Indeterminate		
SWC 151	889.9	Very Low	Very very poor	Very low	Indeterminate		
SWC 150	920.1	Very Low	Very Poor	Very Low	Indeterminate		
SWC 149	950.2	Very Low	Very Poor	Low	Indeterminate		
SWC 148	980.0	Very Low	Very Poor	Low	Indeterminate	-	
SWC 147	1010.3	Low	Poor	Low	A4	1	(Preservation makes species identification almost impossible). Early Pliocene - Mid/Late Pliocene
SWC 146	1039.9	Low	Poor	Moderate	A4	1	Early Pliocene - Mid/Late Pliocene
SWC 145	1070	Low	Poor	Low	Indeterminate		
SWC 144	1100	Moderate	Good	High	G	1	
SWC 143	1130.1	High	Good	High	G	1	Early Miocene
SWC 142	1160	Moderate	Moderate	Moderate	G	1	Early Miocene
SWC 141	1190.1	High	Moderate	High	G	1	Early Miocene
SWC 139	1250	High	Good	High	H1	2	Early Miocene
SWC 138	1280	High	Good	High	I	1	Late Oligocene
SWC 137	1310	High	Moderate	High	J1	2	Early Oligocene
Cuttings	1320	High	Variable	High	J2	3	Early Oligocene
Cuttings	1340	Moderate	Variable	Moderate	J2	3	Early Oligocene
SWC 135	1345	NFF	-	-	-	-	-
SWC 134	1348	Low	Moderate	Low	K	1	Late Eocene
SWC 133	1351.1	Low	Poor	Low	K	1	Late Eocene
SWC 132	1353	Moderate	Moderate	Low	Indeterminate	-	
SWC 131	1356.1	Moderate	Moderate	Moderate	Indeterminate	-	
SWC 130	1359	Low	Poor	Low	K	1	Late Eocene
SWC 129	1361.9	Moderate	Moderate	High	K	1	Late Eocene
SWC 128	1365.1	Moderate	Poor	High (esp. Benth.)	K	0	Late Eocene

TARWHINE-1 Cont..

NATURE OF SAMPLE	DEPTH (METRES)	MICRO-FOSSIL YIELD	PRESERVATION	DIVERSITY	ZONE	RATING	AGE
SWC 127	1367.1	Low	Poor	Moderate	K	2	Late Eocene
SWC 126	1369.1	Very Low	Poor	Low	Indeterminate	-	(Rotalid benthonics and indeterminate planktonics)
SWC 125	1370.9	Very Low	Poor	Very Low	Indeterminate	-	(Few agglutinated benthonics only).
SWC 124	1373	Very Low	Poor	Very Low	Indeterminate	-	(Few indeterminate Rotalid and and agglutinated benthonics)
SWC 123	1375.1	Very Low	Poor	Very Low	Indeterminate	-	(Few agglutinated benthonics only)
SWC 121	1379.1	NFF	-	-	-	-	-
SWC 120	1380.9	NFF	-	-	-	-	-
SWC 119	1383	NFF	-	-	-	-	-
SWC 118	1386	NFF	-	-	-	-	-
SWC 117	1388.6	NFF	-	-	-	-	-
SWC 116	1392	NFF	-	-	-	-	-
SWC 115	1394.5	NFF	-	-	-	-	-

NNF = No foraminiferal fauna.

M I C R O P A L E O N T O L O G I C A L D A T A S H E E T

B A S I N: GIPPSLAND

ELEVATION: KB: 21m GL: -48m

WELL NAME: TARWHINE-1

TOTAL DEPTH: 2500 metres

A G E	FORAM. ZONULES	H I G H E S T D A T A					L O W E S T D A T A				
		Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEIS- TOCENE	A ₁										
	A ₂										
PLIO- CENE	A ₃										
	A ₄	1010.3	2				1039.9	1			
M I O C E N E	B ₁										
	L A T E	B ₂									
		C									
	M I D D L E	D ₁									
		D ₂									
		E ₁									
		E ₂									
	E A R L Y	F									
		G	1100	1				1190.1	1		
		H ₁	1250	2				1250	2		
	O L I G O C E N E	L A T E	H ₂								
			I ₁	1280	1						
I ₂							1280	1			
E A R L Y		J ₁	1310	2				1310	2		
		J ₂	1320	3				1340	3		
E O C - E N E		K	1348	1				1367.1	2	1365.1	0
	Pre-K										

COMMENTS: The non-occurrence of zone H₂ is likely to be a result of a sampling gap. The lack of Zones F to B₁ indicates either a very condensed sequence or a hiatus. Species identification above 1010.3 metres is impossible due to very poor preservation.

CONFIDENCE RATING: 0: SWC or Core - Complete assemblage (very high confidence).
 1: SWC or Core - Almost complete assemblage (high confidence).
 2: SWC or Core - Close to zonule change but able to interpret (low confidence).
 3: Cuttings - Complete assemblage (low confidence).
 4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M. Hannah

DATE: 11.2.82

DATA REVISED BY: M. Hannah

DATE: 8.4.82

PART II

BASIC DATA

Summary of basic Palaeontological Analyses

Range Charts

SUMMARY OF PALAEOLOGICAL ANALYSIS
 TARWHINE-1 - GIPPSLAND BASIN
 BASIC DATA

NATURE OF SAMPLE	DEPTH (METRES)	MICROFOSSIL YIELD	PRESERVATION	DIVERSITY
SWC 153	815.0	Very Low	Very very poor	Very very low
SWC 152	860.2	Very Low	Very poor	Very low
SWC 151	889.9	Very Low	Very very poor	Very low
SWC 150	920.1	Very Low	Very Poor	Very Low
SWC 149	950.2	Very Low	Very Poor	Low
SWC 148	980.0	Very Low	Very Poor	Low
SWC 147	1010.3	Low	Poor	Low
SWC 146	1039.9	Low	Poor	Moderate
SWC 145	1070	Low	Poor	Low
SWC 144	1100	Moderate	Good	High
SWC 143	1130.1	High	Good	High
SWC 142	1160	Moderate	Moderate	Moderate
SWC 141	1190.1	High	Moderate	High
SWC 139	1250	High	Good	High
SWC 138	1280	High	Good	High
SWC 137	1310	High	Moderate	High
Cuttings	1320	High	Variable	High
Cuttings	1340	Moderate	Variable	Moderate
SWC 135	1345	NFF	-	-
SWC 134	1348	Low	Moderate	Low
SWC 133	1351.1	Low	Poor	Low
SWC 132	1353	Moderate	Moderate	Low
SWC 131	1356.1	Moderate	Moderate	Moderate
SWC 130	1359	Low	Poor	Low
SWC 129	1361.9	Moderate	Moderate	High
SWC 128	1365.1	Moderate	Poor	High
SWC 127	1367.1	Low	Poor	Moderate
SWC 126	1369.1	Very Low	Poor	Low
SWC 125	1370.9	Very Low	Poor	Very Low
SWC 124	1373	Very Low	Poor	Very Low
SWC 123	1375.1	Very Low	Poor	Very Low
SWC 121	1379.1	NFF	-	-
SWC 120	1380.9	NFF	-	-
SWC 119	1383	NFF	-	-
SWC 118	1386	NFF	-	-
SWC 117	1388.6	NFF	-	-
SWC 116	1392	NFF	-	-
SWC 115	1394.5	NFF	-	-

NFF = No foraminiferal fauna.

APPENDIX 5

APPENDIX-5

PALYNOLOGICAL ANALYSIS

APPENDIX-5

PALYNOLOGICAL ANALYSIS, TARWHINE-1,
GIPPSLAND BASIN

by

M.K. Macphail

Esso Australia Ltd

Palaeontology Report 1982/20

13 May 1982.

INTRODUCTION:

Seventy six (76) sidewall cores and two core samples were processed and examined for spore-pollen. The recovery of microfossils was good to fair for most samples except in the Lygistepollenites balmei Zone. Preservation was usually poor and relatively few samples contained zone species of spores and pollen. Age determinations are supported by an analysis of the dinoflagellate assemblages by A.D. Partridge.

Palynological zones and lithological facies subdivisions from the base of the Lakes Entrance Formation to the total depth of the well are given below. Table 1 represents a summary of the palynological analyses. The occurrence of each spore and pollen type is tabulated in the accompanying range chart.

SUMMARY

<u>UNIT/FACIES</u>	<u>ZONE</u>	<u>DEPTH (metres)</u>
LAKES ENTRANCE FORMATION	<u>P. tuberculatus</u>	1310
GURNARD FORMATION	Upper <u>N. asperus</u>	1345-1348
	Middle <u>N. asperus</u>	1351-1381
	Middle <u>N. asperus</u>	1392-1405
	Lower <u>N. asperus</u>	1412-1591
	<u>P. asperopolus</u>	1643-1656
LATROBE GROUP COARSE CLASTICS	Upper <u>M. diversus</u>	1666-1727
	Middle to Lower	1818-1892
	<u>M. diversus</u>	
	Upper <u>L. balmei</u>	1911-1932
	Lower <u>L. balmei</u>	2026-2391
	<u>T. longus</u>	2420-2934
	<u>T. lilliei</u>	2940-2949

GEOLOGICAL COMMENTS:

1. The Tarwhine-1 well contains a continuous sequence of zones from the Late Cretaceous T. lilliei Zone to the Early Oligocene P. tuberculatus Zone. Although spore-pollen assemblages were not sufficiently diverse to separate the Middle and Lower M. diversus Zones, it is probable both are represented in the well.

2. The Gurnard Formation, recognised by glauconitic sediments from 1345 to 1386 metres, contains both Middle and Upper N. asperus spore-pollen and dinoflagellate assemblages. The Upper N. asperus Zone is represented in sidewall cores at 1345 and 1348 metres. The lower of the two also contains foraminiferal faunas referable to the Late Eocene Zone K (Hannah 1982). The Gurnard Formation, initially picked on cutting lithology at the time of drilling as occurring between 1370 to 1386 metres, is clearly Middle N. asperus in age.

3. The Middle N. asperus Zone extends down into the coarse clastics below the Gurnard Formation, demonstrating that there is no significant unconformity at this lithological boundary. Dinoflagellates remain common across the boundary to 1412 metres, top of the Lower N. asperus Zone. This is close to the uppermost occurrence of coal at 1407 metres and consistent with a change from a terrestrial/fluvial to an open marine environment during the Middle Eocene.

4. The presence of Upper N. asperus age sediments in the Tarwhine-1 well strengthens the probability (Partridge 1977) that the unsampled interval between 1040 to 1045 metres in

the Barracouta-4 well is also Upper N. asperus in age, i.e., that there is no unconformity between the Middle N. asperus Gurnard Formation and the P. tuberculatus Lakes Entrance Formation at Barracouta-4. A similar sequence of time-rock units at the two well sites is consistent with a Middle Eocene shoreline parallel to the present-day coastline.

5. Although no major periods of non-deposition and/or erosion are evident, mean sedimentation rates show a sustained decrease from greater than 80 metres per million years in the T. longus Zone to less than 30 metres per million years in the Middle N. asperus Zone. This may reflect a shift (northwards) in the depositional centre of the basin away from the Tarwhine area. Anomalously low deposition rates calculated for the Upper N. asperus and P. asperopolus Zones suggest that minor periods of erosion/non-deposition have occurred. Alternatively, portions of the undated interval between 1644 and 1591 metres may also be P. asperopolus in age.
6. There is no evidence in the form of dinoflagellate cysts for any marine transgression at the Tarwhine-1 well site before the top of the Lower N. asperus Zone at 1412 metres.
7. The Thermal Alteration Index for all samples is less than 2.

DISCUSSION OF ZONES.

Zone boundaries have been established using the criteria of Stover and Evans (1973), Stover and Partridge (1973) and subsequent revisions (A.D. Partridge per comm.).

Proteacidites tuberculatus Zone - above 1310 metres.

The zone is recognised on the presence of Cyatheacidites annulatus at 1250 metres and 1310 metres. The other sample at 1280 metres contains Quintinia psilatispora Martin. This is the lowest stratigraphical record of this taxon in the Gippsland Basin to date.

Upper Nothofagidites asperus Zone: 1345 - 1348 metres

This zone is identified by the absence of spore-pollen indicator species of the underlying zone (e.g., Triorites magnificus) and the overlying zone (e.g., Cyatheacidites annulatus). The age-determination is supported by (i) Pthanoperidinium comatum being the dominant dinoflagellate species in both samples, (ii) Proteacidites rectomarginis being the most common large proteaceous pollen and (iii) Nothofagidites flemingii being a common element in the lowermost sample.

Middle Nothofagidites asperus Zone and Vozzkenikova extensa

Dinoflagellate Zone: 1351.1 - 1405 metres.

The top of the zone is based on the highest occurrence of the pollen taxa Triorites magnificus and Proteacidites adenanthoides, and the dinoflagellates V. extensa and Corrudinium incompositum, at 1351.1 metres. The base of the zone is placed at the lowest occurrence of V. extensa, in samples at 1405.44 metres (core) and 1401.8 metres (sidewall core). Spore-pollen diagnostic of the zone appear later in the zone: Anacolosidites sectus at 1392 metres and Triorites magnificus at 1380.9 metres (base of the Gurnard Formation). The late appearance of diagnostic species is attributed to poor concentration and poor preservation of spore-pollen in samples from the hydrocarbon column at the top of the coarse clastics. Although these samples are rich in terrestrially-derived organic matter, oxidation tends to destroy all forms of organic material except for the highly resistant dinoflagellate cysts.

Lower Nothofagidites asperus Zone: 1411.8 - 1591 metres.

The base of the zone is placed at the marked increase in Nothofagidites spp. abundance, from less than 1% at 1643.5 metres to 33% at 1591 metres. Nothofagidites asperus is recorded at the base but other zone species are recorded higher within the zone, e.g., N. falcatus at 1426.6 metres, and Rugulatisporites trophus at 1542.4 metres. The top of the zone is picked by the absence of indicator species of the overlying zone, i.e., Triorites magnificus and V. extensa. The two lowermost samples, at 1542.4 metres and 1591 metres, contain abundant Proteacidites asperopolus pollen. This phenomenon has been previously noted for Lower N. asperus age samples in the Barracouta-4 well (Partridge 1977).

Proteacidites asperopolus Zone: 1643.5 - 1656 metres.

Two sidewall core samples are identified as belonging to this zone. Confidence in the age-determination of the uppermost, at 1643.5 metres, is good due to the first appearance here of Sapotaceoidaepollenites rotundus, the occurrence of Myrtaceidites tenuis, a species which ranges no higher than the P. asperopolus Zone, and the dominance of proteaceous pollen, particularly P. pachypolus, P. reticuloscabratus and P. xestiformis. Although none of these species is restricted to the P. asperopolus Zone, the marked difference in composition between these samples, the overlying Nothofagidites spp. -dominant and underlying Malvacipollis -dominant palynofloras is typical of the zone. The lower of the two samples, 1656 metres, contains M. tenuis. The remainder of this spore-pollen assemblage consists of long-ranging taxa and the sample is assigned a P. asperopolus age on the basis that it is more similar to sample 1643.5 metres than those in the underlying M. diversus Zone.

Upper Malvacipollis diversus Zone: 1666.4 - 1727 metres.

The top of the zone is identified by the first occurrence of abundant M. diversus pollen and also contains the first appearance of Myrtaceidites tenuis. The occurrence of abundant M. diversus, Proteacidites pachypolus and Milfordia homeopunctata pollen confirm an Upper M. diversus age for samples at 1715.5 and 1727 metres. The quartz-rich sediments between 1727 and 1818.5 metres were barren or contained reworked spore-pollen only. e.g., Gambierina rudata.

Middle-Lower Malvacipollis diversus Zone: 1818.5 - 1892.5 metres.

The base of the zone is picked at the first occurrence of M. diversus pollen, at 1892.5 metres. The species is relatively common in this sample and at 1882.1 metres but is absent from samples between 1818.5 and 1882.1 metres. The top of the zone, at 1818.5 metres is based on the absence of indicator species of the Upper M. diversus Zone, e.g., Proteacidites pachypolus. However this sample cannot be definitely assigned to the Middle M. diversus Zone due to the absence of Middle M. diversus indicator species such as Proteacidites ornatus, P. tuberculiformis and P. xestiformis. The variable occurrences of Cupanieidites orthoteichus, Ischyosporites irregularis, Proteacidites lapis, P. obscurus, Tricolporites adelaidensis, T. paenestriatus and Triporopollenites helosus demonstrate the interval is no older than M. diversus age but the low yields and generally poor spore-pollen diversity make it impossible to make a more detailed subdivision.

Upper Lygistepollenites balmei Zone: 1911 - 1932 metres.

The top of the zone is identified by the first appearance of L. balmei (abundant) with Verrucosisporites kopukuensis. The presence of Gambierina edwardsii, Nothofagidites endurus and Phyllocladidites verrucosus demonstrate the sample is no younger

than Upper L. balmei in age. V. kopukuensis at 1926 metres confirms an Upper L. balmei age for this sample. The base of the zone is picked at 1932 metres due to, (i) the absence of indicator species of the Lower L. balmei Zone, e.g., Tetracolporites verrucosus, and (ii) an abundance of Australopollis obscurus. Occurrences of Dryptopollenites semilunatus at 1911 metres and 1932 metres and Periporopollenites demarcatus at 1932 metres and 2496.1 metres represent extensions in the range of these taxa into the Paleocene and late Cretaceous respectively.

Lower Lygistepollenites balmei Zone: 2026.6 - 2391.5 metres.

The zone falls within an interval in which most samples are either barren or contain spore-pollen assemblages of low diversity and limited stratigraphic usefulness. The top of the zone, 2026.6 metres, is identified by the highest occurrence of Tetracolporites verrucosus and the first occurrence of Proteacidites annularis. The base of the zone is picked at 2391.5 metres on the lowermost occurrence of an L. balmei and (abundant) Gambierina rudata assemblage lacking indicator species of the T. longus Zone. Spore-pollen diagnostic of sediments no older than L. balmei were recorded higher in the zone, e.g., Basopollis mutabilis at 2346 metres, Haloragacidites harrisii and Malvacipollis subtilis at 2036 metres.

Tricolpites longus Zone: 2420 - 2934.5 metres.

The zone is characterised by spore-pollen assemblages that are more diverse than in the overlying L. balmei Zone. Gambierina rudata and gymnosperms are the dominant taxa but many samples also contain T. longus and species which first appear in the T. longus zone, e.g., Tetracolporites verrucosus. Tripoporopollenites sectilis and Tricolporites lilliei occur in most samples.

The top of the zone is defined by the occurrence of Granelispora evansii sp. nov. at 2420 metres. The highest occurrence of T. longus is at 2431 metres. Quadruplanus brossus which is diagnostic of the zone occurs lower down, at 2445 metres. The base of the zone is picked on the simultaneous first appearances of T. longus, Proteacidites otwayensis and P. reticuloconcavus at 2934.5 metres. There is currently some uncertainty as to the exact stratigraphic range of these Palaeocene Proteacidites spp. and subsequent work may show the first appearance of Stereisporites (Tripunctisporis) punctatus at 2699.3 metres represents the base of the T. longus Zone.

Tricolporites lilliei Zone: 2939.8 - 2948.5 metres.

The zone is characterised by a marked increase in Nothofagidites endurus relative to other spore-pollen species (Stover & Evans 1973). These authors distinguish the base of the overlying T. longus Zone by the virtual absence of Nothofagidites spp. and a marked increase in Triorites edwardsii (= Gambierina rudata) pollen. On these criteria, the age of the sediment at 2934.5 metres is equivocal since G. rudata is abundant and N. endurus frequent.

The top of the zone is picked at 2939.8 metres, the highest sample in which N. endurus is clearly more abundant than G. rudata. T. lilliei is also present. The basal sample, at 2948.5 metres, contains a mixed late Cretaceous, Paleocene and Eocene spore-pollen assemblage, lacking T. lilliei. The sample has been contaminated by cavings but is obviously no older than the T. lilliei Zone due to the presence of G. rudata and Tripoporopollenites sectilis.

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- STOVER, L.E., & EVANS, P.R., 1973. Upper Cretaceous spore-pollen zonation, offshore Gippsland Basin, Australia. Special Publication Geological Society of Australia 4: 55-72.
- STOVER, L.E., & PARTRIDGE, A.D., 1973. Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Australia. Proceedings of the Royal Society of Victoria, 85: 237-86.

BASIC DATA

Table-1: Palynological Data
Range Chart - Dinoflagellates
Range Chart - Spore Pollen

P A L Y N O L O G Y D A T A S H E E T

B A S I N: GIPPSLAND
WELL NAME: TARWHINE-1

ELEVATION: KB: 21m GL: -48m
TOTAL DEPTH: 2955 metres

A G E	PALYNOLOGICAL ZONES	H I G H E S T D A T A					L O W E S T D A T A					
		Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	
NEOGENE	<i>T. pleistocenicus</i>											
	<i>M. lipsis</i>											
	<i>C. bifurcatus</i>											
	<i>T. bellus</i>											
PALEOGENE	<i>P. tuberculatus</i>	1250.0	0				1310.0	0				
	Upper <i>N. asperus</i>	1345.0	1				1348.0	1				
	Mid <i>N. asperus</i>	1351.1	0				1405.4	2	1392.0	1		
	Lower <i>N. asperus</i>	1411.8	2				1591.0	2	1542.4	1		
	<i>P. asperopolus</i>	1643.5	2				1656.0	2				
	Upper <i>M. diversus</i>	1666.4	1				1727.0	1				
	Mid <i>M. diversus</i>	1818.5	2									
	Lower <i>M. diversus</i>						1892.5	1				
	Upper <i>L. balmei</i>	1911.0	0				1932.0	2	1926.0	0		
	Lower <i>L. balmei</i>	2026.6	1				2391.5	2	2346.0	1		
	LATE CRETACEOUS	<i>T. longus</i>	2420.0	0				2934.5	2	2699.3	1	
		<i>T. lillieii</i>	2939.8	1				2948.5	2	2939.8	1	
<i>N. senectus</i>												
U. <i>T. pachyexinus</i>												
L. <i>T. pachyexinus</i>												
<i>C. triplex</i>												
<i>A. distocarinatus</i>												
EARLY CRET.	<i>C. paradoxus</i>											
	<i>C. striatus</i>											
	<i>F. asymmetricus</i>											
	<i>F. wonthaggiensis</i>											
	<i>C. australiensis</i>											
	PRE-CRETACEOUS											

COMMENTS: It has not been possible to subdivide the Middle and Lower *M. diversus* Zones due to poor diversity and poor preservation of spore-pollen.

- CONFIDENCE RATING:
- 0: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.
 - 1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.
 - 2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.
 - 3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.
 - 4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M.K. Macphail & A.D. Partridge DATE: May 4, 1982.
DATA REVISED BY: _____ DATE: _____

TABLE-1
PALYNOLOGICAL DATA
BASIC DATA

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN
SWC 139	1250	Good	Low
SWC 138	1280	Good	Low
SWC 137	1310	Good	Low
SWC 135	1345	Good	Moderate
SWC 134	1348	Good	High
SWC 133	1351.1	Good	High
SWC 132	1353	Good	High
SWC 130	1359	Good	Moderate
SWC 127	1367.1	Fair	Moderate
SWC 123	1375.1	Good	High
SWC 120	1380.9	Good	Moderate
SWC 116	1392	Good	Moderate
SWC 113	1401	Good	High
Core 2	1405.44	Good	Low
Core 2	1411.8	Good	Moderate
SWC 101	1422.1	Low	Poor
SWC 99	1426.6	Good	Moderate
SWC 92	1503	Good	Moderate
SWC 89	1542.4	Good	Moderate
SWC 86	1591	Good	Moderate
SWC 82	1643.5	Good	Moderate
SWC 81	1656	Low	Low
SWC 107	1666.4	Good	Moderate
SWC 78	1693	Nil	-
SWC 76	1715.5	Fair	Moderate
SWC 75	1727	Good	High
SWC 73	1754	Nil	-
SWC 69	1807	Nil	-
SWC 68	1818.5	Good	Moderate
SWC 67	1836	Good	Moderate
SWC 65	1860	Fair	Low
SWC 64	1882.1	Low	Low
SWC 62	1892.5	Low	Low
SWC 61	1900	Very Low	Very Low
SWC 60	1911	Good	High
SWC 59	1926	Fair	Low
SWC 58	1932	Good	Moderate
SWC 57	1955	Nil	-
SWC 51	2003.1	Very Low	Very Low
SWC 49	2026.6	Good	Moderate
SWC 48	2036	Fair	Moderate
SWC 41	2115.7	Fair	Low
SWC 38	2163	Fair	Low
SWC 36	2196.2	Nil	-
SWC 35	2204.9	Fair	Low
SWC 33	2230.9	Nil	-
SWC 32	2241.1	Very Low	Very Low
SWC 31	2255.1	Nil	-
SWC 29	2273	Nil	-
SWC 28	2290.1	Very Low	Very Low
SWC 27	2304	Low	Low
SWC 26	2315	Fair	Low
SWC 24	2346	Fair	Low
SWC 23	2352.5	Nil	-

TABLE-1
SUMMARY OF PALYNOLOGICAL ANALYSIS, TARWHINE-1, GIPPSLAND BASIN
INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 139	1250	Good	Low	Marl	<u>P. tuberculatus</u>	Oligocene	0	<u>Cyatheacidites annulatus</u>
SWC 138	1280	Good	Low	Marl	<u>P. tuberculatus</u>	Oligocene	0	<u>Quintinia psilatospora</u>
SWC 137	1310	Good	Low	C. lut.	<u>P. tuberculatus</u>	Oligocene	0	<u>Cyatheacidites annulatus</u>
SWC 135	1345	Good	Moderate	Clyst, calc, glauc.	Upper <u>N. asperus</u>	Late Eocene	2	Diverse <u>Nothofagidites</u> assemblage
SWC 134	1348	Good	High	Clyst, calc, glauc.	Upper <u>N. asperus</u>	Late Eocene	1	<u>Proteacidites rectomarginis</u> and <u>Phthanoperidinium</u> common.
SWC 133	1351.1	Good	High	Clyst, calc.	Middle <u>N. asperus</u>	Late Eocene	0	<u>Triorites magnificus</u>
SWC 132	1353	Good	High	Clyst, calc.	Middle <u>N. asperus</u>	Late Eocene	0	<u>Triorites magnificus</u> , <u>Aglaoreidis qualumis</u> , <u>Proteacidites pachypolus</u> , <u>Simplicipollis meridianus</u>
SWC 130	1359	Good	Moderate	Clyst, tr. glauc.	Middle <u>N. asperus</u>	Late Eocene	2	<u>Proteacidites rectomarginis</u> common
SWC 127	1367.1	Fair	Moderate	Clyst, calc. tr. glauc.	Middle <u>N. asperus</u>	Late Eocene	2	<u>Rugulatisporites trophus</u>
SWC 123	1375.1	Good	High	Clyst, calc, glauc.	Middle <u>N. asperus</u>	Late Eocene	0	<u>Triorites magnificus</u>
SWC 120	1380.9	Good	Moderate	Stst, glauc.	Middle <u>N. asperus</u>	Late Eocene	1	<u>Aglaoreidia qualumis</u> , <u>Triporopollenites ambiguus</u> , <u>Proteacidites recavus</u>
SWC 116	1392	Good	Moderate	Sltst, calc, carb.	Middle <u>N. asperus</u>	Late Eocene	1	<u>Anacolosidites sectus</u> , <u>Proteacidites crassus</u>
SWC 113	1401	Good	High	Sst, clay-rich	Middle <u>N. asperus</u>	Late Eocene	1	<u>Drytopollenites semilunatus</u> , <u>Schizocolpus marlinensis</u> , <u>Proteacidites crassus</u>
Core 2	1405.44	Good	Low	---	Middle <u>N. asperus</u>	Middle Eocene	2	<u>Malvacipollis robustus</u> . Sample from oil column.
Core 2	1411.8	Good	Moderate	---	Lower <u>N. asperus</u>	Middle Eocene	2	<u>Malvacipollis robustus</u> , <u>Proteacidites pachypolus</u> , Sample from oil column.
SWC 101	1422.1	Low	Poor	---	---	---	-	---
SWC 99	1426.6	Good	Moderate	Sst, carb. lens	Lower <u>N. asperus</u>	Middle Eocene	2	<u>Nothofagidites falcatus</u>
SWC 92	1503	Good	Moderate	Sst, carb.	Lower <u>N. asperus</u>	Middle Eocene	2	<u>Proteacidites asperopolus</u> , <u>P. pachypolus</u>

TABLE-1 Cont. 2

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY		LITHOLOGY	ZONE	AGE	CONFIDENCE		COMMENTS
			SPORE	POLLEN				RATING		
SWC 89	1542.4	Good	Moderate	Clyst		Lower <u>N. asperus</u>	Middle Eocene	1		<u>Rugulatisporites trophus</u>
SWC 86	1591	Good	Moderate	Clyst		Lower <u>N. asperus</u>	Middle Eocene	0		<u>Rugulatisporites trophus</u> , <u>Proteacidites asperopolus</u> & <u>P. rugulatus</u> common
SWC 82	1643.5	Good	Moderate	Clyst, carb.		<u>P. asperopolus</u>	Middle Eocene	1		<u>Sapotaceoidaepollenites rotundus</u> , <u>Myrtacidites tenuis</u> , abundant <u>Proteacidites</u>
SWC 81	1656	Low	Low	Sst, carb. lens		Indeterminate	---	-		<u>Nothofagidites</u> spp. rare, <u>Myrtacidites tenuis</u>
SWC 107	1666.4	Good	Moderate	Sst, carb. stringers		Upper <u>M. diversus</u>	Early Eocene	1		<u>M. diversus</u> dominant; <u>Proteacidites pachypolus</u>
SWC 78	1693	Nil	-	Clyst		Indeterminate	---	-		---
SWC 76	1715.5	Fair	Moderate	Ss		Upper <u>M. diversus</u>	Early Eocene	2		<u>M. diversus</u> dominant, <u>P. pachypolus</u>
SWC 75	1727	Good	High	Slst		Upper <u>M. diversus</u>	Early Eocene	1		<u>Proteacidites pachypolus</u> , <u>P. tuberculiformis</u>
SWC 73	1754	Nil	-	Sst		Indeterminate	---	-		---
SWC 69	1807	Nil	-	Clyst		Indeterminate	---	-		---
SWC 68	1818.5	Good	Moderate	Sst, carb. lens		Middle-Lower <u>M. diversus</u>	Early Eocene	1		<u>Tricolporites moultonii</u>
SWC 67	1836	Good	Moderate	Clyst		M-L <u>M. diversus</u>	Early Eocene	2		<u>Proteacidites lapis</u>
SWC 65	1860	Fair	Low	Slst		M-L <u>M. diversus</u>	Early Eocene	2		<u>Proteacidites leightonii</u>
SWC 64	1882.1	Low	Low	Sst, carb.		M-L <u>M. diversus</u>	Early Eocene	2		Infrequent <u>M. diversus</u>
SWC 62	1892.5	Low	Low	Sst		M-L <u>M. diversus</u>	Early Eocene	1		<u>M. diversus</u> frequent.
SWC 61	1900	Very Low	Very Low	Sst, carb. lens		Indeterminate	---	-		---
SWC 60	1911	Good	High	Sst, carb.		Upper <u>L. balmei</u>	Late Paleocene	0		<u>L. balmei</u> frequent
SWC 59	1926	Fair	Low	---		Upper <u>L. balmei</u>	Late Paleocene	0		<u>L. balmei</u> frequent <u>Verrucosisporites kopukuensis</u>
SWC 58	1932	Good	Moderate	Clyst		Upper <u>L. balmei</u>	Late Paleocene	2		<u>Australopollis obscurus</u> abundant, <u>L. balmei</u> , <u>Polycolpites langstonii</u>
SWC 57	1955	Nil	-	---		Indeterminate	---	-		---
SWC 51	2003.1	Very Low	Very Low	---		Indeterminate	---	-		<u>Haloragacidites harrisii</u>
SWC 49	2026.6	Good	Moderate	Ss - Slst		Lower <u>L. balmei</u>	Early-Middle Paleocene	1		<u>Tetracolporites verrucosus</u> , <u>Proteacidites annularis</u>

TABLE-1 Cont. 3

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY		LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
			SPORE	POLLEN					
SWC 48	2036	Fair	Moderate		Sltst	Lower <u>L. balmei</u>	Early-Middle Paleocene	1	<u>Tetracolporites verrucosus</u>
SWC 41	2115.7	Fair	Low		Clyst	Lower <u>L. balmei</u>	Early-Middle Paleocene	2	<u>L. balmei</u> , <u>Nothofagidites endurus</u> common
SWC 38	2163	Fair	Low		Shale	Lower <u>L. balmei</u>	Early-Middle Paleocene	2	<u>L. balmei</u> common
SWC 36	2196.2	Nil	-		Shale	Indeterminate	----	-	----
SWC 35	2204.9	Fair	Low		Shale	<u>L. balmei</u>	Paleocene	2	<u>Australopollis obscurus</u> abundant
SWC 33	2230.9	Nil	-		Clyst	Indeterminate	----	-	----
SWC 32	2241.1	Very Low	Very Low		Ss	Indeterminate	----	-	----
SWC 31	2255.1	Nil	-		Shale	Indeterminate	----	-	----
SWC 29	2273	Nil	-		Sltst	Indeterminate	----	-	----
SWC 28	2290.1	Very Low	Very Low		Sltst	Indeterminate	----	-	----
SWC 27	2304	Low	Low		Clyst	Indeterminate	----	-	<u>Latrobosporites cf. ohaiensis</u>
SWC 26	2315	Fair	Low		Clyst	Lower <u>L. balmei</u>	Early-Middle Paleocene	2	<u>Tetracolporites verrucosus</u> frequent
SWC 24	2346	Fair	Low		Sltst	<u>L. balmei</u>	Paleocene	1	<u>Basopollis mutabilis</u>
SWC 23	2352.5	Nil	-		Ss	Indeterminate	----	-	Amorphous substrates
SWC 20	2362	Low	Very Low		Ss, carb. fragments	Indeterminate	----	-	<u>Gambierina edwardsii</u>
SWC 17	2374	Low	Low		Clyst	<u>L. balmei</u>	Paleocene	2	<u>Gambierina rudata</u> frequent, <u>Stereisporites (Tripunctisporis) punctatus</u>
SWC 13	2391.5	Low	Low		Clyst	<u>L. balmei</u>	Paleocene	2	<u>Gambierina rudata</u> (common), <u>L. balmei</u>
SWC 11	2401.2	Nil	-		Clyst	Indeterminate	----	-	Amorphous substrates
SWC 10	2420	Low	Moderate		Clyst	<u>T. longus</u>	Late Cretaceous	0	<u>Granelispora evansii</u>
SWC 9	2431	Good	Moderate		Shale	<u>T. longus</u>	Late Cretaceous	1	<u>T. longus</u> , <u>Tetracolporites verrucosus</u>
SWC 52	2445	Good	High		--	<u>T. longus</u>	Late Cretaceous	0	<u>Quadruplanus brossus</u>
SWC 7	2457.2	Fair	Low		Sltst, carb.	<u>T. longus</u>	Late Cretaceous	0	<u>Quadruplanus brossus</u>
SWC 6	2465.2	Fair	Very Low		Finely bdd argil. mtx	Indeterminate	----	-	<u>Gambierina rudata</u> only.
SWC 3	2496.1	Fair	Low		Clyst	<u>T. longus</u>	Late Cretaceous	2	<u>Tetracolporites verrucosus</u>
SWC 245	2571.8	Fair	Low		Ss, trace coal	<u>T. longus</u>	Late Cretaceous	0	<u>Quadruplanus brossus</u> with abundant <u>Gambierina rudata</u>
SWC 240	2608.3	Fair	Very Low		Sltst	Indeterminate	----	-	<u>Tricolporites lilliei</u>

TABLE-1 Cont. 4

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY		LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
			SPORE	POLLEN					
SWC 232	2646.5	Fair	Moderate		Slst, some coal	<u>T. longus</u>	Late Cretaceous	1	<u>T. longus</u> , <u>Proteacidites reticuloconcavus</u> , <u>Stereisporites (Tripunctisporis) punctatus</u>
SWC 217	2699.3	Fair	Low		Slst, carb.	<u>T. longus</u>	Late Cretaceous	1	Lowest occurrence of <u>Stereisporites (Tripunctisporis) punctatus</u>
SWC 194	2776	Fair	Low		Ss, some coal	<u>T. longus</u>	Late Cretaceous	2	<u>Proteacidites reticuloconcavus</u> , <u>Tricolporites lilliei</u> , common <u>Gambierina rudata</u>
SWC 187	2799	Fair	Moderate		Ss, some coal	<u>T. longus</u>	Late Cretaceous	2	<u>Proteacidites reticuloconcavus</u> , <u>P. analosexinus</u> , <u>P. angulatus</u>
SWC 185	2807	Very Low	Very Low		Ss	Indeterminate	---	-	---
SWC 177	2858.5	Good	Moderate		Ss	<u>T. longus</u>	Late Cretaceous	2	<u>Proteacidites otwayensis</u> , <u>Tetracolporites verrucosus</u>
SWC 175	2868.4	Very Low	Very Low		Ss	Indeterminate	---	-	Mud contamination
SWC 166	2901.5	Fair	Moderate		Sltst	Indeterminate	---	-	<u>Gambierina rudata</u> common, <u>Tricolporites lilliei</u>
SWC 157	2934.5	Good	Moderate		Slst	<u>T. longus</u>	Late Cretaceous	2	<u>Proteacidites otwayensis</u> , <u>P. reticuloconcavus</u> , <u>T. longus</u> , <u>Gambierina rudata</u> common, <u>Nothofagidites endurus</u> frequent
SWC 156	2939.8	Low	Low		Sltst	<u>T. lilliei</u>	Late Cretaceous	1	<u>Nothofagidites endurus</u> , <u>N. senectus</u> more common than <u>Gambierina rudata</u> , <u>T. lilliei</u>
SWC 154	2948.5	Fair	Moderate		Ss	<u>T. lilliei</u>	Late Cretaceous	2	Contaminated sample but no older than <u>T. lilliei</u> due to occurrence of <u>Gambierina rudata</u> , <u>Triporopollenites sectilis</u>

PE900783

This is an enclosure indicator page.
The enclosure PE900783 is enclosed within the
container PE902676 at this location in this
document.

The enclosure PE900783 has the following characteristics:

ITEM_BARCODE = PE900783
CONTAINER_BARCODE = PE902676
NAME = Dinoflagellate Species List
BASIN = GIPPSLAND
PERMIT = VIC/L1
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Dinoflagellate Species List for
Tarwhine-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 12/05/86
W_NO = W760
WELL_NAME = TARWHINE-1
CONTRACTOR =
CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

PE900784

This is an enclosure indicator page.
The enclosure PE900784 is enclosed within the
container PE902676 at this location in this
document.

The enclosure PE900784 has the following characteristics:

ITEM_BARCODE = PE900784
CONTAINER_BARCODE = PE902676
 NAME = Spore-Pollen Species List, 1 of 2
 BASIN = GIPPSLAND
 PERMIT = VIC/L1
 TYPE = WELL
 SUBTYPE = DIAGRAM
 DESCRIPTION = Spore-Pollen Species List, 1 of 2, for
 Tarwhine-1
 REMARKS =
 DATE_CREATED =
 DATE_RECEIVED = 12/05/86
 W_NO = W760
 WELL_NAME = TARWHINE-1
 CONTRACTOR =
 CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

PE900785

This is an enclosure indicator page.
The enclosure PE900785 is enclosed within the
container PE902676 at this location in this
document.

The enclosure PE900785 has the following characteristics:

ITEM_BARCODE = PE900785
CONTAINER_BARCODE = PE902676
NAME = Spore-Pollen Species List, 2 of 2
BASIN = GIPPSLAND
PERMIT = VIC/L1
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Spore-Pollen Species List, 2 of 2, for
Tarwhine-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 12/05/86
W_NO = W760
WELL_NAME = TARWHINE-1
CONTRACTOR =
CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)