WHALE - 1

WELL COMPLETION REPORT

PERMIT Vic/P11

1982

(W761)

Hudbay Oil (Australia) Ltd.

WHALE No.1

WELL COMPLETION REPORT

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Hudbay Oil (Australia) Ltd.

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DRILLING

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GEOLOGY

APPENDICES B

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1.0 WELL HISTORY

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WHALE — 1.

1.0 - WELL HISTORY

1.1 Name and Address of Operator:-

Hudbay Oil (Australia) Ltd.,
256 Adelaide Terrace,
PERTH W.A. 6000

1.2 Participants

Beach Petroleum N.L.,
32nd Floor, 360 Collins Street,
MELBOURNE VIC. 3000

Gas & Fuel Exploration N.L.,
171 Flinders Street,
MELBOURNE VIC. 3000

Hudbay Oil (Australia) Ltd.,
256 Adelaide Terrace,
PERTH W.A. 6000

1.3 Petroleum Title

Vic/P-11, Victoria

1.4 District:

Block Number 1783 (map: Petroleum Tenements, Vic. 16-1-81)

SP 134.9 Line GB81-41 (E-N) and SP 172.6 on Line GB81-37 (N-S)

1.5 Location - Figure 1

Latitude - 38^{o} 01' 17.182"S

Longitude - 148^{o} 33' 34.172"E

AMG Co-ordinates:

E 636884

N 5790644

AMG Zone 55

Whale-1 is located 56 metres at 040^{o} from the proposed location.

1.6 Water Depth - 52 metres

Total Depth - 810 metres - all depths in this report are referred to Rotary Table (R.T.) 9.45 metres above Mean Sea Level unless otherwise indicated.

Rig on Location - November 30, 1981

Spud Date - December 1, 1981

Rig Release Date - December 25, 1981

Drilling Unit - Petromar "North Sea" (Drillship)

1.7 Well Status at Rig Release

Plugged and Abandoned.

1.8 Drilling Summary

The "Petromar North Sea" sailed from the Baleen No 1 location (Gippsland Basin) to the proposed Whale No 1 location at 0600 hours on 30th November 1981. The rig arrived at the location at 0945 hours on 30th November, 1981.

All anchors were run and the rig was positioned over the location. The Temporary Guide Base was run and positioned on bottom in 52 metres water (seabed 62m RT). A 36" drilling assembly was prepared and the well was spudded at 1400 hours on 1st December, 1981. A 36" hole was drilled to 74m and the hole opener pulled and laid down. The 26" hole was drilled to 215m. A 20" casing string plus the 30" pile joint and Permanent Guide Base were run and cemented in place at 201m with Thix-set lead and neat tail in slurry. The 20-3/4" stack was run and landed and the casing and BOP stack pressure tested.

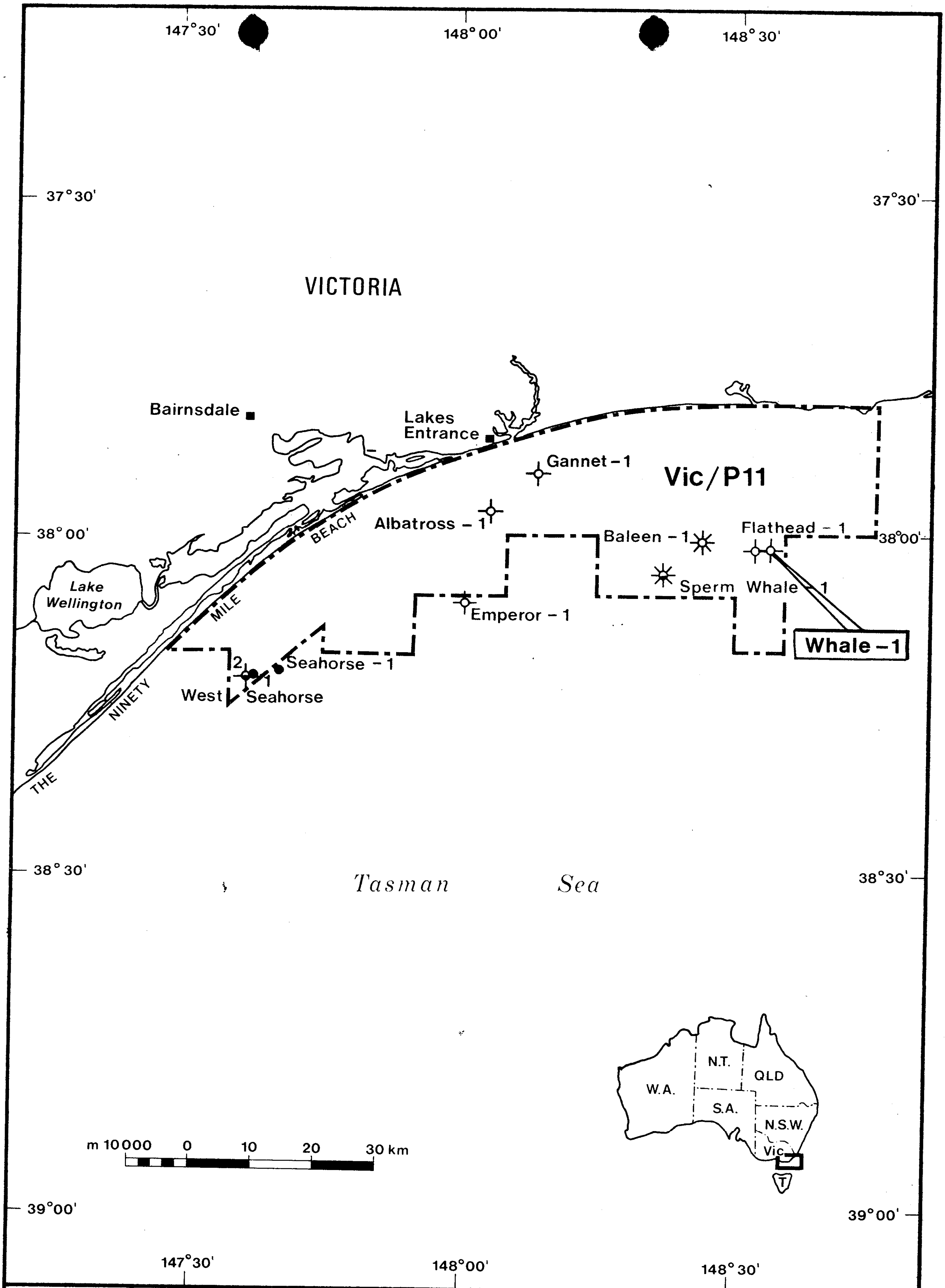
The 20" shoe was drilled out with a 17½" bit and the hole was deepened to 218m. A pressure integrity test was completed indicating formation strength of 1.77 SG. The 17½" bit was pulled and changed out to a 12¼" bit. The 12¼" hole was drilled to 404m and the first set of electric logs were run. A string of 9-5/8" casing swedged up to the 13-5/8" wellhead was run and cemented in place at 395m. The low pressure 20-3/4" BOP stack was pulled and changed out to the 13-5/8" stack. Surface installations were completed and the casing was pressure tested to 2000 psi. A test plug was run and the pipe rams and annular preventers were pressure tested.

An 8½" BHA was made up and the shoe plus 3m of new hole were drilled. A pressure integrity test to a 1.78 SG equivalent was conducted and the hole was deepened to 438m. At this point the mud was changed out to a brine bara-carb system. At the end of displacement, the drill string was hung off due to deteriorating weather conditions and the Lower Marine Riser package was disconnected. After the adverse weather had passed, two guidelines were re-established, the riser was reconnected, and the 8½" hole was deepened to 810m. Electric wireline logs were run and a series of RFT tests were performed. The well was then plugged back to 545m and a 7" liner was run and cemented in place at 515m.

After the liner job, the stack was pulled and the Upper Pipe Rams were changed out to 3½" rams. The stack was rerun and pressure tested. Electric wireline was rigged up and a cement bond log was run over the liner. The pressure test on the liner lap failed necessitating a cement squeeze at the hanger. Cement was successfully squeezed to attain a final squeeze pressure of 2000 psi. The cement was drilled out and the liner pressure tested to 2000 psi.

The interval 460 - 465m was perforated and preparations were begun to run DST #1. The flow test did not yield flow to surface and the string was reversed clean yielding 8 bbls mud and formation water. The tools were pulled and laid down. A bridge plug was set at 457m on electric wireline and pressure tested to 2000 psi. The interval 445 - 454m was perforated and DST #2 was performed. The tool failed to open causing a misrun. The test string was retrieved, serviced, and rerun for DST #2A. This time the packer failed causing another misrun. The packer was pulled, serviced, and rerun for DST #2B. Plugging occurred immediately causing yet another misrun. A cement retainer was run on electric wireline and set at 436m. After pressure testing the retainer to 2000 psi, the test tools were rerun to conduct DST #2C which was successful. The well did not flow to surface, and fluid recovery from the formation was estimated to be less than 1/3 bbl.

All testing equipment was laid down and open ended drill pipe was run to 436m where a cement plug was set. A second cement plug was set at 165m. The stack and riser were pulled, the casing strings were mechanically cut, and all subsea equipment was recovered. The anchors were lifted and the rig departed for the Sperm Whale No 1 location at 0430 hours 25th December, 1981.



Scale:	Hudbay Oil (Australia) Ltd.	Date: April 1982
Drawn by: H.O.A.L.	**LOCATION MAP** **WHALE - 1**	Drawing Nº A4-GP-489

Figure 1

1.9 Geological Summary

The Whale-1 well was drilled to test a large antiformal structure towards the northern margin of the Gippsland Basin. The structure is fault bounded to the north and contains an upthrown block of Lower Cretaceous rocks. Whale-1 lies to the east of the block whilst the Flathead-1 well lies to the west and both wells tested closure around the upthrown block. The resulting hydrocarbon discoveries were designated to be non-commercial accumulations of residual oil. Whale-1 terminated in rocks of Lower Cretaceous age at a depth of 810 metres. This section occurs between 810 and 473 metres and consists of sandstone and siltstone. Minor thin coal laminae and thin carbonate enriched zones occur throughout the section. These thin laminae are best recognized from the electric logs and sidewall cores. Lithological boundaries within the Lower Cretaceous are generally gradational.

The overlying section between 473 and 439 metres has been dated at Upper Eocene to Lower Oligocene. The rocks are dominantly coarse to very fine sandstones and ferruginous siltstones. Coarse glauconitic sandstones, which are occasionally conglomeratic, were intersected between 473 and 467 metres, whilst ferruginous very fine grained glauconitic sandstones occur between 445 and 439 metres. The entire section from 473 to 439 metres contained extremely bright fluorescence and had a strong petroliferous odour. This zone was tested and was found to contain no movable hydrocarbon.

Lower Miocene rocks were intersected between 439 metres and the 20" casing shoe at 201 metres. The section consists of skeletal calcarenites, calcisiltites, calcilutites and minor marls. The lowermost calcarenite contains significant amounts of glauconite, which may have been derived by reworking of the underlying siltstone or is primary within the carbonate at that stage of the depositional cycle. The rocks between the sea floor and the 20" casing shoe are assumed to range from lower Miocene to Recent based on regional geology as no samples were collected prior to setting the 20" casing.

2.0 DRILLING

(Pages 5-16)

2.0 DRILLING

2.1 Drilling Operations

2.1.1 Drilling Data Summary

Drilling Contractor:	Petromarine Drilling Aust. Pty Ltd Office Suite 1-5 1st Floor, Stratham House 49 Melville Parade SOUTH PERTH 6151 WA
Drawworks:	National 1625 powered by two 752 GE Traction motors
Blow Out Preventor Equipment:	Two stack system 20-3/4" x 2000 psi - Hydril MSP Cameron double gate Type U 13-5/8" x 5000 psi - Hydril GL Cameron triple gate Type U
Elevation:	RT to MSL - 9.45m Water Depth - 52.45m Datum - rotary table (61.90m above seabed)
Pumps:	Two National 12-P-160 Triplex driven by two GE 752 motors

2.1.2 General Well Data

Location:

Latitude 38° 01' 17.182" S
Longitude 148° 33' 34.172" E

0600 hours November 30th 1981 - Rig released from Baleen No 1

0945 hours November 30th 1981 - Arrived at location

1400 hours December 1st 1981 - Spudded

0500 hours December 12th 1981 - TD reached

0430 hours December 25th 1981 - Rig released

Days to total depth - 12 days

Hole and Casing Details:

Hole Size	Depth	Shoe Depth	Casing
36"	74m	66m	30" Grade 'B' 310 lb/ft
26"	215m	201m	20" X52 94 lb/ft Cameron 'CC' connectors
12¼"	404m	395m	9-5/8" K55 40 lb/ft BTC
8½"	810m	515m	7" N80 29 lb/ft BTC Liner

2.2 Daily Operation Record

2.2.1 Daily Drilling Operation Summary

See attached Figure 2

2.2.2 Bottom Hole Assembly Record

36" Hole:	26" bit, 36" HO, Bit sub, 12 x 8" DC, XO, HWDP
26" Hole:	26" bit, Bit sub, 12 x 8" DC's, XO, HWDP
12¼" Hole:	12¼" bit, Bit sub, 15 x 8" DC's, XO, 12 x 5" HWDP
8½" Hole:	Interval 404m - 549m 8½" bit, Bit sub, 18 x 6½" DC's, XO, 1 x 5" HWDP, Jars, 11 x 5" HWDP Interval 549m - 810m 8½" bit, Junk sub, Bit sub, 2 x 6½" DC's, Stabilizers 1 x 6½" DC, Stabilizer, 15 x 6½" DC's XO, 1 x 5" HWDP, Jars, 11 x 5" HWDP

2.2.3 Bit Record

See attached Figure 3

2.2.4 Time Breakdown Survey

See attached Figure 4

2.2.5 Well History Chart

See attached Figure 5

2.3 Casing Record

2.3.1 Casing Details

See Casing and Tubing Tally, Figure 6

2.3.2 Cementation Details

See Casing Running Reports, Figures 7,8 and 9

DAILY DRILLING OPERATIONS SUMMARY

WELL WHALE NO 1

DATE	DEPTH	OPERATION
1/12/81	0	Arrived on Whale #1 Location at 0945 hours 30/11/81. Ran and tensioned up anchors. (Ships heading 229°. Final location 56m off at 40° from intended location.)
2/12/81	(Water Depth) 52.0m 215m	Set TGB on seabed. Made up 36" BHA and RIH. Spudded and drilled 36" OH to 74m. POOH and laid down 36" HO. RIH with 26" BHA. Drilled ahead. Dropped survey at 85m. Drilled ahead to 215m (TD 26" OH) circulating with S/W and high viscosity mud pills.
3/12/81	215m	Displaced hole with high viscosity mud. Dropped survey. POOH to S.B. (Survey misrun) RIH. Displaced hole with high viscosity mud. Dropped survey. POOH (Survey misrun). Moved PGB to Moonpool. Rigged up and ran 20" casing. (Shoe at 201.03m.) Cemented 20" casing. POOH with running tool. Ran 20-3/4" BOP stack. Tested casing to 500 psi.
4/12/81	404m	Tested 20-3/4" BOP stack. (Rams to 1500 psi, annular to 1000 psi.) Nippled up flowline and divertor. Made up 17½" BHA and RIH. Drilled out of 20" shoe and drilled ahead to 218m. Circulated hole to mud. Conducted leak off test. (MWE 1.77 S.G.) Dropped survey and POOH. Made up bit #4, 12¼" and RIH to 218m. Drilled ahead to 256m. Dropped survey and retrieved same at the shoe. Drilled ahead to 404m. (T.D. 12¼" OH.) Circulated bottoms up and conditioned mud. Dropped survey. Made wiper trip to 20" shoe.
5/12/81	404m	Retrieved survey. RIH. Circulated bottoms up. POOH. Ran log #1 DIT/BHCS/GR. Ran log #2 FDC/GR. Ran CST. Made up 13-5/8" well head etc. and laid down same. RIH to 404m. No fill. Circulated bottoms up and conditioned mud. POOH. Rigged up and ran 9-5/8" casing (shoe at 374.85m). Cemented same without launching top plug, due to leaking cement head.
6/12/81	404m	Pulled 20-3/4" BOP stack. Jumped divers to clear away contaminated cement from well head. Ran 13-5/8" BOP stack. Jumped divers to clear #1 guide line. Re-positioned Rig and landed 13-5/8" BOP stack. Tested casing to 2000 psi. Tested BOP's (2500 psi rams, 1500 psi U.Ann, 1000 psi L.Ann). Ran wear bushing. Laid down 8" DC's. Made up 12¼" BHA and RIH with Bit #5.
7/12/81	438m	Hit cement stringers at 347m (float collar at 370m). Drilled out and drilled ahead to 407m. Circulated bottoms up. Conducted a leak off test (MWE 1.78 S.G). Drilled ahead to 438m. Circulated bottoms up at a drilling break. Pulled back inside 9-5/8" shoe and circulated while preparing bara-carb brine mud.
8/12/81	438m	RIH to 438m. Displaced hole with bara-carb brine mud. Pulled back inside 9-5/8" shoe and cleaned active tanks in preparation for bara-carb brine mud. POOH to hang off point. Made up hang off tool and RIH and hung off on LPR. Closed blind rams and disconnected LMRP. WOW.
9/12/81	438m	WOW. No 3 guide line parted.
10/12/81	438m	WOW. Positioned Rig over well head. Attempted to land LMRP. No 4 guide line parted. Jumped Divers.
11/12/81	595	Attached #3 and #4 guide lines. Latched LMRP. Retrieved hang off tool. RIH to 438m. No fill. Circulated out 1.26 S.G. mud to 1.45 S.G. mud. Drilled ahead to 464m. Circulated up drilling break. Drilled ahead to 549m. Dropped survey and POOH. Made up bit #6 and 8½" string stabilizers. RIH. Washed to bottom and worked junk sub. Drilled ahead to 595m.
12/12/81	810m T.D.	Drilled ahead to 810m T.D. Circulated bottoms up.
13/12/81	810m	Made wiper trip to shoe. No fill. Circulated and conditoned mud and hole. Dropped survey and POOH. Rigged up to log. Ran Log #1 DLL/ GR. Ran Log #2 MSFL/ BHCS/ GR/ CAL. Sonic malfunctioned. Reran Log #2. Ran Log #3 FDC/ CNL/ GR/ CAL. Ran Log #4 velocity survey. Ran RFT #1 and recovered sample.
14/12/81	810m	Ran RFT #2. Misrun. Serviced tool. Reran RFT #2 and collected sample. Ran RFT #3. No recovery. Ran RFT #4. No recovery. Rigged down from logging. RIH with RR #4. No fill. Circulated and conditioned mud. POOH. Rigged up to log. Ran RFT #5. No recovery.
15/12/81	545m P.B.	Ran RFT #6. No recovery. Reran RFT #6. No Recovery. Ran HDT. Ran CST #1. Ran CST #2. RIH with OEDP. Circulated and conditioned mud. POOH to 605m. Spotted a cement plug from 605m to 545m. POOH.

Figure 2

Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

DAILY DRILLING OPERATIONS SUMMARY

WELL WHALE NO 1

DATE	DEPTH	OPERATION
16/12/81	515m 7" Liner Shoe	Ran and cemented 7" liner with shoe at 515m and overlap at 288m. POOH with running tool. Retrieved WB. Pulled 13-3/8" BOP stack. Changed upper pipe rams to 3½". Repaired blue pod.
17/12/81	515m	Continued repairing blue pod. Tested 13-5/8" BOP stack. Repaired blue pod. Ran 13-5/8" BOP stack. Jumped divers to free #3 guide wire. Landed 13-5/8" BOP stack.
18/12/81	515m	Tested 13-5/8" BOP's. Ran 13-5/8" WB. RIH with bit #6 and 7" casing scraper. Washed cement from 468m to 479m. Repaired leak on slip joint packer. Circulated and conditioned mud to 1.36 S.G. Spotted KCL Polymer pill from 479m to 387m. POOH and laid down bit and scraper. Picked up 4-3/4" DC's. Ran CBL/ VDL over 7" liner. Attempted to test casing. No test. Conducted injection test. RIH with OEDP to 293m and spotted 50 sacks cement across liner overlap.
19/12/81	515m	Squeezed liner overlap. POOH. Made up 8½" bit and RIH. Drilled out cement to top of liner. POOH. Pressure tested casing to 2000 psi. Made up 6" bit and 7" casing scraper. RIH to 288m and drilled out cement in liner overlap. Circulated and conditioned mud. Tested casing to 2000 psi. POOH. Perforated from 460m - 465m. Made up test tools and RIH for DST #1.
20/12/81	457m	Conducted DST #1 with packer set at 446.8m BRT. Reversed out contents of tubing string, and POOH with test string. Set 7" B.P. at 457m. Tested B.P to 2000 psi, made up 6" bit and 7" casing scraper. RIH and spotted KCL pill from 456m to 374m. POOH. Perforated from 445m - 454m. RIH for DST #2.
21/12/81	457m P.B.	Rigged up and tested surface equipment. Set packer at 433.94m. Conducted DST #2. No blow on surface. POOH with test string. RIH with OEDP to 457m. Circulated and conditioned mud. Spotted KCL polymer pill across perforations. POOH. RIH for DST #2A (on DST #2 downhole tools had plugged). Ran 153m diesel cushion.
22/12/81	457m P.B.	Packer would not set due to damaged 'J' slot. Reversed out diesel. POOH. Serviced packer and RIH for DST #2B. Ran 153m diesel cushion. Set packer at 433.94m. Conducted DST #2B. Weak blow on surface. POOH. RIH with OEDP to 456m. Circulated and conditioned mud.(Tools plugged downhole. Damaged packer while POOH.)
23/12/81	457m P.B.	Spotted 10 bbls KCL pill across the perforations. POOH. Set a wireline retainer at 436.26m. Tested same to 2000 psi. RIH for DST #2C. Conducted Test through retainer. Reversed out contents of test string. POOH laying down test string.
24/12/81	Plugged back	RIH with OEDP. Spotted a cement plug from 435m to 405m POOH. Spotted a cement plug from 165m to 100m. POOH. Pulled 13-5/8" BOP stack. Made up and tested 9-5/8" casing cutter assembly. RIH and cut 9-5/8" casing at 78m.
25/12/81	Abandoned	POOH. RIH with grapple, but could not catch casing. RIH with running tool and retrieved 13-5/8" WH. RIH with 20" casing cutter and cut 20" at 72m. RIH with 20" running tool and retrieved 20" WH and PGB. RIH with 'J' tool and retrieved TGB. Pulled anchors. Departed location 0430 hours 25/12/81.

Figure 2

WELL NAME: WHALE NO 1 | LOCATION: GIPPSLAND BASIN | RT-SB/GL 61.9 m.

RIG: PETROMAR NORTH SEA | CONTRACTOR: PETROMARINE DRILLING AUST. PTY LTD | HOAL DRLG SPVSR. H SHIRE/B MC ELHINNEY

SPUD DATE: 1 DECEMBER 1981 | COND. CSG: 201 m | SURF. CSG: 395 m | INTER. CSG: 515 m | SEC. INTER. CSG: m

DATE AT TD: 12 DECEMBER 1981 | PUMP NO 1: NATIONAL 12-P-160 | PUMP NO 2: NATIONAL 12-P-160 | PUMP POWER: 1600 HP

MUD TYPE: SW/GEL, BRINE POLY. | TOOL JTS: Size - 4½" | Type - IF | O.D. 6-3/8"

DRILL COLLARS: No. - 15, 18 | O.D. - 8" and 6½" | I.D. - 2-7/8", 2-13/16 | Length -

BIT NO.	SIZE	MAKE	TYPE	JETS	SERIAL NO.	DEPTH IN (M)	DEPTH OUT (M)	HRS	M/HR	WT (TONNES)	RPM	PUMP PR. (kPA)	PUMP VOL. (L/MIN)	T	B	G	FORMATION/ REMARKS
1RR	36"	SEC			7850	61	74	5.5	2.4	2.3/6.8	75			2	1	I	Firm Seabed
	26"	HTC	OSC3AJ	OPEN	RB267							1380	1173				
2RR	26"	HTC	OSC3AJ	3x18	LJ320	74	215	14	10.1	2.3/6.8	75	56900	2346	1	2	I	
3RR	17½"	HTC	OSC3AJ	3x24	KX789	215	218	0.5	6	4.5/9.1	100	6890	2346	2	2	I	
4	12¼"	HTC	X3A	1x18 2x14	875UA	218	404	8.5	22	4.5/13.6	100	9480	2346	2	2	I	
5	8½"	HTC	J4	1x12 2x10	JN579	404	549	14	10.3	9.1/11.4	80/85	10690	1173	3	4	I	
6	8½"	HTC	J33	1x12 2x10	396BS	549	810	27.5	9.5	11.4	55/160	10690	1075	3	2	I	
7	6"	STC	FV	3x18	BP9447	7" SCRAPER RUN AND WASHING 11m OF CEMENT								1	1	I	
RR6	8½"	HTC	J33	1x12 2x10	396BS	CLEAN OUT CEMENT								3	2	I	
RR7	6"	STC	FV	3x10	BP9447	" " "								2	2	I	

Drawn by A.Clark | Scale N.T.S.

Hudbay Oil (Australia) Ltd

BIT RECORD
WHALE-1

Date March 1982 | Drawing Nº A4-DR-542

Figure 3

WELL: WHALE NO 1

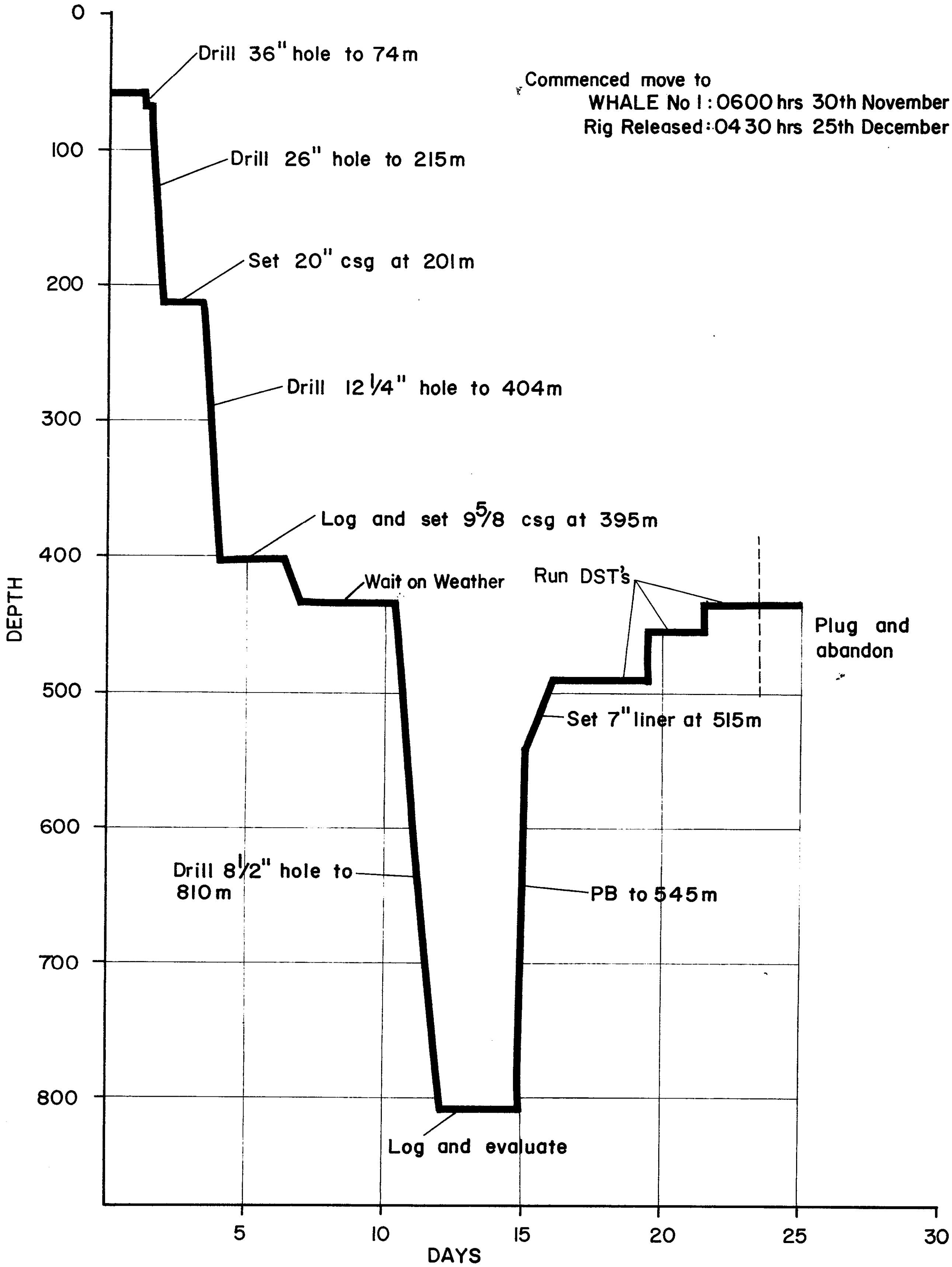
TIME ANALYSIS (Hours)	Moving/ Anchoring	36"/26" Hole	17½" Hole	12¼" Hole	8½" Hole	6" Hole	Comp/Test	Total	%
DRILLING:									
Moving to/from Location	4							4	0.7
Anchor Handling	20½						11½	32	5.3
Drilling		19½		8½	41½			69½	11.6
Round Trips		3½		5	11			19½	3.3
Reaming, Cond. Hole, Cond. Trips		2½		6	25½			34	5.7
Running, Pulling and Cementing Casing		10		15	18½			43½	7.3
Running, Pulling Subsea Equipment		11½		13½				25	4.2
Testing Wellhead and BOP's		2		4	1½			7½	1.3
Plugging Back, Abandonment, Completion					8½		3.2	40½	6.8
Curing Lost Circulation									
Fishing and Washouts									
Well Control									
Surveys		2½		1½	1½			4½	0.8
Downtime: Weather					67			67	11.2
Mechanical Surface									
Mechanical Subsea									
Others									
EVALUATION:									
Circulating Samples					½			½	0.1
Hole Cond, Trips for Coring, Logging, Testing				1	8½			9½	1.6
Coring									
Electric Logging				8	24½			32½	5.4
Wireline Flow Testing					27			27	4.5
Drill Stem and Production Testing							180½	180½	30.2
Downtime: Logging									
Flow Testing									
Others									
OTHERS **Repositioning rig, Diving**				½	1			1½	0.3
Total Time	24½	51½		63	235½		224	598½	
% Downtime	–	–		–	28		–		

Hudbay Oil (Australia) Ltd.

WELL TIME BREAKDOWN ANALYSIS WHALE - 1

Author: A.I.
Drawn: A.Clark
Date: March 1982
Scale: N.T.S.
Drawing Nº A4-DR-468

Figure 4



Author: K.Putnam	Hudbay Oil (Australia) Ltd.	Scale: N.T.S.
Drawn: A.Clark	WHALE - 1	Drawing Nº A4-DR-495
Date: April 1982	WELL HISTORY CHART	

Figure 5

HUDBAY OIL (AUSTRALIA) LIMITED

Casing and Tubing Tally

(METRIC)

Well Name and No. WHALE NO 1 Date 15 DECEMBER 1981 Casing Size 7"

Weight 29 lb Grade N 80 Connection BTC Joints Run 18

Joint No.	Length of joint (m)	Total in Hole (m)	Joint No.	Length of Joint (m)	Total in Hole (m)	Joint No.	Length of Joint	Total in Hole
PB	TD·	545.00						
7" Csg Shoe		515.00	Carried Forward			Carried Forward		
	Shoe 0·75	514.25	41	•		81	•	
01	11·06	503.19	42	•		82	•	
02	11.65	491.54	43	•		83	•	
	0·30	L.C. 491.24	44	•		84	•	
03	11·92	479.32	45	•		85	•	
04	12.04	467.28	46	•		86	•	
05	12·00	455.28	47	•		87	•	
06	11·90	443.38	48	•		88	•	
07	11.85	431.53	49	•		89	•	
08	11·60	419.93	50	•		90	•	
	4·04	(Pup) 415.89 –	Top of Pup Jt.			Sub tot	•	
09	11·90	403.99	51	•		91	•	
10	11·92	392.07	52	•		92	•	
11	11·75	380.32	53	•		93	•	
12	11·76	368.56	54	•		94	•	
13	11·65	356.91	55	•		95	•	
14	12·08	344.83	56	•		96	•	
15	11·85	332.98	57	•		97	•	
16	11·89	321.09	58	•		98	•	
17	11·98	309.11	59	•		99	•	
18	11·85	297.26	60	•		100	•	
	9·13	288.13 –	Top Liner Hanger Assy Comp.			Sub tot	•	
21	2·57	(R.T.) 285.56	61	•				
22	110·16	(HWDP) 175.40	62	•				
23	179·64	(5" DP) -4.24	Stick up above RT					
24	•		64	•				
25	•		65	•				
26	•		66	•				
27	•		67	•				
28	•		68	•				
29	•		69	•				
30	•		70	•				
Sub tot	•		Sub tot	•				
31	Plugged back to 545.00		71	•				
32	Mud type Baracarb-Brine		72	•				
33	30m Open Hole		73	•				
34	TIW Float Shoe		74	•				
35	2 Jt casing.		75	•				
36	TIW latch down collar		76	•				
37	Complete liner hanger and Packer.							
38	Running tool		78	•				
39	31 Jt. Drill Pipe		79	•				
40	Wellhead 4.24m stick up		80	•				
Sub tot	·		Sub tot	•				

TALLY SUMMARY

Group No. Ending	Length (Forward)
10	•
20	Mud SG 1.45 Vis 50
30	Yield 27 •
40	WL 9.7 •
50	Disp. by Howco
60	39 bbls mud •
70	•
80	Bumped plug with 1000 psi
90	Float shoe held OK
100	600 psi pumping pressure.
TOTAL	

Tally By

Checked By

REMARKS Dropped ball and set hanger. Pumped 5 bbls pre-flush ahead of cement. Mixed and pumped 156 sacks class 'B' cement with 20 bbl mixing water plus 0.05 pct Halad 22A + 0.75 pct CRF + 3 pct KCL + 1 pct $CaCl_2$. Dropped dart and displaced with 39 bbls mud. Bumped plug with 1000 psi. Float shoe holding OK. Set Packer with 22000 lb wt. Pulled up 1 single and reversed out cement contaminated mud plus 5 bbl pre-flush. (Note average slurry wt: 14 - 15.5 ppg.)

Figure 6

Operator's Representative

HUDBAY OIL (AUSTRALIA) LIMITED

Casing, Running Report

Well Name and No. WHALE NO 1 Date 3 December 1981 Casing Size 20"

HOLE	Size	36"	26"			
	Depth (m)	74m	215m			
CASING	Size	30"	20"			
	Depth (m)	66.37m	201.04m			

MUD: Type Spud Mud s.g. 1.06 Vis. 100 + YP WL

Power Tong Torque Maximum C.I.W. 'CC' Conn. . Minimum ft/lbs.

Fill up Points All joints

Calc. Displ. (m3) 151 bbls Pump Strokes Howco Unit

250 psi psi

CASING INFORMATION

TD		215m
OFF BOTTOM	13.96m	
Shoe (make and type) Landed at		201.06m
Length Shoe JT.	13.21	187.83
10 Joints. Grade X-52m wt. 94 lb/ft ID. 19.124 ins.	119.54	
Landing Collar (make and type) N/A		
Hanger or Suspension joint (make and type) C.I.W. 20"/30" W.H. (20 3/4 x	10.13	68.29
Top Hanger or Suspension joint 13 5/8)		58.16
Landing String R/T	0.31	57.85
Pup	3.01	54.84
2 Stds H.W.D.P.	55.60	-.76
Pup	6.90	-6.86
metres above R.T. at Zero Tide		-6.86
Less tide of Approx 1m	1.00	-5.86
metres up from R.T.		

DETAILED CASING AND CEMENTING REPORT

Landed casing with shoe @ 201.04m Top of 20" @ 58.16m.
Circulated Volume of casing and D.P.
Rigged up to cmt, circulated 5 bbl S/W, tested lines to 2000 psi.
Mixed and pumped cmt as follows:

Fill: Mixed 650 SKs class 'B' cement.)
565 Sks class 'G' cement.)
+570lbs Thix Set 'A' (0.5%)) Mixing time
+280lbs Thix Set 'B' (0.25%)) 2½ hrs.
with 203 bbl S/W. Slurry Wt. 1.74 S.G.)

Tail: Mixed 300 Sks. class 'G' cmt with 36 bbl) Mixing time
S/W @ Slurry Wt avg. 1.89 S.G.) 15 mins

Displaced with 151 bbls of S/W. 35 mins

As observed by subsea T.V. had returns throughout job.
No bleed back once pressure released.

COMMENT Problems were experienced obtaining suction from slurry tank to H.P. pumps due to viscous nature of Thix Set slurry. Hence slow mixing speed on fill slurry.

Figure 7

Operators Representative B McElhinney

HUDBAY OIL (AUSTRALIA) LIMITED

Casing, Running Report

Well Name and No. WHALE NO 1 | Date 5 December 1981 | Casing Size 9-5/8"

HOLE	Size	36"	26"	12¼		
	Depth (m)	74m	215m	404m		
CASING	Size	30"	20"	9 5/8"		
	Depth (m)	66.37m	201.04	395		

MUD: Type SW/Gel s.g. 1.06 Vis. 39 YP 7 WL 14.5

Power Tong Torque Maximum 7010 ft/lbs. Minimum 4210 ft/lbs.

Fill up Points Every 5 jts. Torque Used 5000 ft-lbs

Calc. Displ. (m3) 78 bbl Pump Strokes Used Howco

250 psi 500 psi

CASING INFORMATION

TD		404m
OFF BOTTOM	9.15	
Shoe (make and type) Weatherford Float — Landed at		394.85
Length Shoe	0.45	394.40
2 Joints. Grade K55 wt 40 lb/ft ID 8.833 ins.	23.74	370.66
Landing Collar (make and type) W.L. Float	0.34	370.32
Ran 26 jts 9 5/8", K55 40 lb/ft casing	307.63	62.69
XO 9 5/8" Pin BTC Down x 13 5/8" Box BTC Up	0.37	62.32
Hanger or Suspension joint (make and type) C.I.W. 13 5/8" W.H. (20 3/4" x 13 5/8")		
Top Hanger or Suspension joint	4.5	57.82
Landing String	0.80	57.02
2 Stds H.W. D.P. + 1 Jt H.W. D.P. + 1x13 5/8" RT	9.27	47.75
	55.60	
metres above R.T. at Zero Tide		
Less tide of 1m		-7.85
metres up from R.T.		-6.85

DETAILED CASING AND CEMENTING REPORT

Ran a total of 28 joints of 9 5/8" casing.
Placed centralizers on 1st 4 connections.
Baker-loked 1st 3 connections and X/O below 13 5/8" landing joint.
Broke circulation at 20" shoe.
Torque to bottom out △ on first three doped connections was 5000 ft lbs.
Upon landing and circulation prior to cementing the cement head leaked with 350 psi. Heave at the time was 4-6m causing the chiksans to loosen the bottom connection on the cement head itself. Several efforts were made to tighten it and each time it backed off. It was decided not to launch the dart for fear of not being able to launch the top plug with 3000 psi.

CEMENT JOB Pumped 20 bbl S/W ahead
Tested lines to 3000 psi OK
Mixed and pumped 200 Sks 'G' cement and 2.5% gel (Pre-Hyd) + 0.75% CFR-2 @ 12.8 ppg (1.53 SG) using 77 bbl of mix water)

Tail 200 SKs 'G' cement neat + 24 bbl Mix water @1.89 SG (15.8 ppg)

Pumped 5 bbl S/W
Displaced with further 73 bbl mud. Good returns throughout.
Did not launch top plug, see above.

Figure 8

Operators Representative B McElhinney

HUDBAY OIL (AUSTRALIA) LIMITED

Casing, Running Report

Well Name and No. WHALE NO 1 Date 15 December 1981 Casing Size 7" Liner

HOLE	Size	36"	26"	12¼	8½"	
	Depth (m)	74m	215m	404	810	
CASING	Size	30"	20"	9-5/8	7"	
	Depth (m)	66.37m	201.04	395m	515m	

MUD: Type Baracarb-Brine s.g. 1.46 Vis. 49 YP 24 WL 11.6

Power Tong Torque Maximum ______ ft/lbs. Minimum ______ ft/lbs.

Fill up Points Every 4th Jt. & self filling shoe

Calc. Displ. (m^3) DP & Liner 39 BBLS Pump Strokes Displaced by Howco

600 psi Pump with 1000 psi

CASING INFORMATION

TD 810m plug back to 545m		545.00
OFF BOTTOM 30m		515.00
Shoe (make and type) T.I. W. float shoe Landed at		515.00
Length Shoe	.75	514.25
2 Joints. Grade N.80 wt. 29 lb/ft ID. 6.184 ins.	22.71	491.54
Landing Collar (make and type) T.I.W. latch down collar	.30	491.24
Ran 16 jts. N.80 29#7" liner B.T.C & 1 pup Jt. "Top" @ 415.89	193.98	297.26
T.I.W. hydro set) T.I.W. extension) 9.13 T.I.W. pkr.)	9.13	288.13
Hanger or Suspension joint (make and type)		
Top Hanger or Suspension joint		
Landing String		
Running tool above liner	2.57	285.86
12 Jt. H.W. dip	110.16	175.40
19 Jt. 5" 19.5# dip	179.64	- 4.24 above r.t.
metres above R.T. at Zero Tide		
Less tide of No correction		
metres up from R.T.		4.24

DETAILED CASING AND CEMENTING REPORT

Run in hole with a total of 18 jts. N.80 29# 7" csg. top of liner@ 288.13m, marker pup jt @ 415.89m & shoe @ 515.00m. Drop ball and set slips - unlatched R/T & broke circ. pump 5 bbls. pre flush - mix & pump 156 sx class B cmt mixed w/ 20 bbls mix water, .05% Halad 22A & .75% CRF + 3% KCL + 1% CaCl av. slurry wt. 14 to 15.5 ppg-drop dart & disp. w/39 bbls mud, bumped plug w/ 1000 P.S.I. CK float holding OK-set pkr w/ 22000# wt. pull up 1 jt. & reversed out cement contaminated mud & pre-flush.

Figure 9

Operators Representative ______

2.4 Mud System

2.4.1 Mud Report Summary

The well was spudded with a 26" bit and 36" hole opener and was drilled from 62m to 75m. Seawater was circulated with returns to the seabed. After spotting 30 bbls of Gel Spud Mud, the bit and hole opener were pulled and laid down. Drilled ahead with a 26" bit, pumping seawater and spotting 20 - 30 bbls Gel Spud Mud prior to each connection. At 215m the hole was displaced with 550 bbls of Gel Spud Mud and a wiper trip made. A further 330 bbls of mud was pumped before pulling out and setting 20" casing at 201m. Mud cost for this section of hole was $4,985.98.

17½"/12¼" Hole Section

17½" hole was drilled from 170m to 218m in 0.5 hours. A pressure integrity test was performed and drilling proceeded with a 12¼" bit to 404m in 8.5 hours, at a mud cost of $6,535.75. The 9-5/8" casing was set at 395m. No major problems were encountered.

The 20" BOP and marine riser were run and latched. The BOP's were tested and a 17½" bit was run in, tagging cement at 170m. Seawater was used while drilling out the cement and casing shoe. Drilling continued to 218m where the hole was displaced with Q-Mix/Prehydrated Gel Mud and a leak off test was performed (indicated formation strength of 1.77 SG). Drilling was then resumed using a 12¼" bit and continued down to 404m with no major problems. Mud was circulated to condition the hole and a wiper trip made to the 20" casing shoe - 1m of fill was found after running back to bottom. After circulating bottoms up and pulling out, electric wireline logs were then run. When logging was completed a conditioning trip was made to bottom. No fill was indicated and the hole was circulated and conditioned prior to running 9-5/8" casing. Cement mix water was remixed after the original cement water was contaminated with active mud. The casing volume circulated before cementing the casing at 395m.

8½" Hole Section

The 8½" hole section was drilled from 395m to 810m in 41.5 hours. Seawater/Gel/Polymer mud was used to 438m where mud was changed to a low solids BRINE-BARACARB mud (to minimize formation damage in the objective zone). Total mud costs in this section was $69,876.01. After running Schlumberger logs, a cement plug was set from 545 - 605m and a 7" liner run and cemented at 515m in preparation for testing the well.

After landing and testing the BOP's an 8½" bit was run in and cement tagged at 347m. Seawater/Gel/Polymer mud was circulated while drilling out the cement and shoe and while drilling ahead to 438m where a drilling break was circulated out. After pulling back to the casing shoe, mud was circulated while mixing the new BRINE-BARACARB mud. After running back to bottom, the hole was displaced to the shakers with BRINE-BARACARB mud, and the bit then pulled back to the casing shoe. Active mud was displaced to the reserve pits and active pits cleaned and filled with BRINE-BARACARB mud.

Bad weather delayed drilling ahead and resulted in 88 bbls of mud being lost when the riser was disconnected. After latching on to the BOP and running in to 438m (no fill), drilling continued to 549m before tripping for a new bit. Drilling continued to TD at 810m while losing 30 bbls of mud to the formation at 605 - 630m. After circulating, making a wiper trip and finally circulating to condition mud and hole, the logs were run.

After turning back in to 810m (no fill), the mud was circulated and conditioned and the bit was pulled for logging.

After logging, open ended drill pipe was run in and the mud was circulated prior to setting a cement plug from 605 - 545m. The 7" liner was run and cemented (hanger at 288m, shoe at 515m), mud displaced from the riser with seawater and the

8½" Hole Section (Continued)

BOP pulled to change rams. The BOP's were landed and pressure tested and after running in with 3½" drill pipe and scraper, mud was conditioned and mud weight raised to 1.35 SG. After spotting a 3 percent KCl/DEXTRID pill (10 bbls), the string was pulled and a CBL log taken. A pressure test proved unsatisfactory and a cement squeeze was performed at 253 - 288m. After drilling out the cement, a pressure test was satisfactory. The mud was circulated and treated for cement contamination and kill mud was weighted to 1.4 SG prior to pulling out for wireline flow testing.

Testing

Two drill stem tests were conducted with packers set at 447m and 433m. Additional materials to maintain optimum mud rheology and mud weight were required during this phase. Testing was completed and the well plugged and abandoned on December 23, 1981.

2.4.2 Mud Engineering

Mud engineering services and mud materials were supplied by Baroid Australia Pty Ltd.

The Engineers at the wellsite were:

Peter Ledden
Alan Searle
Even Hill

2.4.3 Mud Record

See attached Figure 10

HUDBAY OIL (AUSTRALIA) LIMITED

Mud Properties

WELL WHALE NO 1

MUD COMPANY: BAROID

1. Specific gravity
2. Viscosity (sec)
3. A.P.I. Water Loss (ml)
4. $CaCO_3$ ppb
5. A.P.I. Cake (millimetre)
6. Sand (%)
7. Chloride (ppm x 1000)
8. pH
9. Solids (%)
10. Plastic Viscosity (cp @ 50°C)
11. Yield Point (lb/100ft.^{2})
12. Gels (lb/100ft.^{2} 10 sec/10 min)
13. Total Hardness (epm)
14. Pf
15. $CaCl_2$ ppb
16. KCL ppb
17. Other Salts ppb
18. Bentonite Kg/m^3

Date	Depth 0600 hrs (metres)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Dec 1	–	M I	X I N G		S P	U D	M U	D											
2	215	1.06	100+																
3	285	1.06	40	14.8	–	2	TR	4	9	4	8	12	4/8	2	0.1	–	–	–	57
4	404	1.06	40	14.5	–	2	TR	6.3	9.1	4	8	7	3/5	4.7	0.08	–	–	–	57
5	404	1.08	36	16.3	–	2	0.75	7	9.3	5	5	5	1/3	3.7	0.05	–	–	–	57
6	438	1.25	46	6.6	–	1	0.5	5	9.1	9	15	12	2/9	3	0.05	–	–	–	78
7	438	1.44	49	8.5	28	1	–	151	10	18	17	23	5/9	2840	0.15	54	35	8	–
8	438	1.44	49	8.5	28	1	–	151	10	18	17	23	5/9	2840	0.15	54	35	8	–
9	438	1.44	49	8.5	28	1	–	151	10	18	17	23	5/9	2840	0.15	54	35	8	–
10	490	1.44	47	9.7	23¼	1	5	148	9	18	16	27	5/8	2440	0.1	46	37	8.35	–
11	580	1.45	48	12	23¾	2	3	140	8.7	18	19	32	4/7	2210	0.03	42	43	3.5	–
12	780	1.46	56	10.1	32.9	2	1	124	8.5	20	27	30	4/9	2300	0.02	43.7	32.6	0.6	–
13	810	1.46	65	8.9	32.5	2	1.5	133	8.8	20	30	34	4/10	2620	0.03	49.8	31.5	0.3	–
14	810	1.46	54	9.7	27.5	2	1.5	114	8.3	20	28	28	4/7	2250	–	42.7	26.6	0.34	0.5
15	810	1.45	50	9.7	24	2	1.5	114	8.3	20	25	27	4/7	2250	–	38.9	22.8	0.4	2.5
16	810	1.46	49	11.6	24	2	2	102	8.3	20	24	24	4/7	2060	–	38.9	22.8	0.4	2.5
17	810	1.44	47	11.6	–	2	1.5	103	8.6	20	21	21	3/5	2200	0.4	–	–	–	2.3
18	810	1.36	47	9.3	–	2	1.0	55	8.3	16	19	12	3/7	1020	–	–	–	–	1.6
19	810	1.36	48	10.6	–	2	1.0	53	9.2	16	18	14	3/6	1460	–	–	–	–	1.9
20	810	1.34	46	11	–	2	1.0	52	9.4	13	16	14	3/6	1380	0.4	–	–	–	1.6
21	810	1.34	47	11	–	2	1.0	49	9.8	12	17	14	3/7	1380	0.4	–	–	–	1.5
22	810	1.36	44	9.2	–	2	1.5	44	9.1	13	19	9	3/9	840	0.3	–	–	–	1.5
23	810	1.36	46	10.2	–	2	2.0	33	9	12	18	14	3/7	830	0.2	–	–	–	1.4

Figure 10

2.4.4 Materials Consumption and Costs

Materials	Unit	Cost Unit	Quantity	Cost

36"/26" Hole - Interval 61 - 215m

Materials	Unit	Cost Unit	Quantity	Cost
Caustic	23 kg	17.75	10	177.50
Gel	100 lb	15.50	196	3038.00
Lime	25 kg	6.75	20	135.00
	TOTAL			$3350.50
	CARRY OVER FROM LAST WELL			$1635.48
	TOTAL COST FOR 36"/26" HOLE			$4985.98

12½" Hole - Interval 215 - 404m

Materials	Unit	Cost Unit	Quantity	Cost
Gel	100 lb	15.50	260	4030.00
Caustic	23 kg	17.75	16	284.00
Q-Broxin	25 kg	24.15	37	893.55
Coat 888	23 kg	23.20	1	23.20
Barite	100 lb	8.70	150	1305.00
	TOTAL COST FOR 12¼" HOLE			$6535.75

8½" Hole - Interval 404 - 810m

Materials	Unit	Cost Unit	Quantity	Cost
$CaCl_2$	25 kg	12.75	1078	13744.50
Coat 888	23 kg	23.20	1	23.20
Dextrid	23 kg	51.60	86	4437.60
KCL	50 kg	26.75	361	9656.75
Q-Broxin	25 kg	24.15	31	748.65
Na HCO_3	50 kg	35.50	20	710.00
M_g O	20 kg	12.80	45	576.00
XC - Polymer	23 kg	335.00	41	13735.00
HEC	25 kg	149.00	12	1788.00
Baracarb C	40 kg	8.93	330	2946.90

Materials	Unit	Cost Unit	Quantity	Cost

8½" Hole - Interval 404 - 810m (Continued)

Baracarb F	25 kg	5.58	30	167.40
Baradefoam 1	20 l	98.00	5	490.00
$CaCO_3$	40 kg	8.93	137	1223.91
Caustic	23 kg	17.75	4	71.00
Barite	100 lb	8.70	2248	19557.60
		TOTAL COST FOR 8½" HOLE		$69876.01

Consumption and Cost for the Entire Well

Gel	100 lb	15.50	456	7068.00
Caustic	23 kg	17.75	30	532.50
Lime	25 kg	6.75	20	135.00
Q-Broxin	25 kg	24.15	68	1642.00
Coat 888	23 kg	23.20	2	46.40
$CaCl_2$	25 kg	12.25	1078	13744.50
KCL	50 kg	26.75	361	9656.75
Dextrid	23 kg	51.60	86	4437.60
Na HCO_3	50 kg	35.50	20	710.00
Mg O	20 kg	12.80	45	576.00
XC-Polymer	23 kg	335.00	41	13735.00
HEC	25 kg	149.00	12	1788.00
Baracarb C	40 kg	8.93	330	2946.90
Baracarb F	25 kg	5.58	30	167.40
Baradefoam 1	20 l	98.00	5	490.00
$CaCO_3$	40 kg	8.93	137	1223.41
Barite	100 lb	8.70	2398	20862.60
		TOTAL		$79762.26
		CARRY OVER FROM BALEEN NO 1		$ 1635.48
		TOTAL COST FOR THE ENTIRE WELL		$81397.74

2.4.5 Mud Equipment Description

1. Reserve mud storage tanks 4 x 500 bbls.

2. Active mud storage 400 bbls complete with 150 bbl settling tank and 85 bbl pill tank.

3. Brandt Dual Tandem Shaker.

4. Demco Desander, 6 cone x 6 inch rated at 1050 gpm with Mission 6 inch x 8 inch centrifuged pump and 75 HP electric motor.

5. Demco Desilter, 12 cone x 4 inch rated at 1080 gpm with Ingersoll-Rand centrifugal pump and 75 HP electric motor.

6. Pioneer Mud Cleaner, 16 cone x 4 inch rated at 800 gpm with 75 psi head.

7. Degasser - Drilco.

8. Pit Volume Totalizer.

9. Mud Mixer, Lightning mixers 2 ea x 25 HP in active tanks, 4 ea x 25 HP in reserve tanks.

10. Pioneer Sidewinder Mud Mixing Hopper.

11. Mud Mixing Pumps, Ingersoll-Rand MIR 150 with 75 HP electric motors, two on active tank, two on reserve tanks.

12. Mud/Gas separator with vent to Crown block.

13. Swaco super adjustable choke 10,000 psi with control panel.

14. Trip tank - 25 bbls with high-low level switch activated motor for transfer pump to annulus.

2.5 Flow Testing

2.5.1 Flow Testing Summary

Two drill stem tests were run on the well. The first DST was run over the interval 460 - 465m RT. The interval was perforated with a 4 inch casing gun at 4 shots per foot with a 90 degree phasing.

Three downhole gauges were used to record pressures and temperature during the test and a Surface Pressure Read Out (SPRO) unit was used to provide a continuous monitor of downhole conditions during the test.

A 5 minute initial flow period was followed by a 92 minute initial shut in period. The final flow period lasted 148 minutes and was followed by a final shut in of 40 minutes.

During the initial flow period, the bottomhole flowing pressure built steadily from 68 psi to 519 psi. The pressure built up to 641 psi during the initial shut in period. The flowing pressure in the final flow period built from 496 psig to 623 psig in ten minutes. The pressure stabilized at 641 psig after 30 minutes and remained unchanged throughout the remainder of the final flow period and final shut in. The well did not flow to surface, however, the fluid produced from the formation is estimated to be 8 bbls.

Several fluid samples were recovered while reversing out the test string. One sample obtained from the DST tool was water with a chlorides content of 12,000 ppm and appears to be representative of the formation fluid.

The second drill stem test was run over the interval 445 - 454m RT. The interval was perforated with a 4 inch casing gun at 4 shots per foot with a 90 degree phasing.

Three downhole gauges were used to record pressures and temperature during the test and a Surface Pressure Read Out (SPRO) Unit was used to provide a continuous monitor of downhole conditions.

A 180m diesel cushion was run in above the DST tools to reduce the initial drawdown. During the initial 7 minute flow period the pressure built up from 217.3 psi to 219.6 psi. The initial shut in lasted 83 minutes and the pressure built up to 621 psi and was still building. The final flow period lasted 318 minutes and the flowing pressure increased from 220 psi to 252 psi. The DST tools were closed for a final 73 minute shut in and the pressure built steadily from 252 psi to 487 psi. The well did not flow to surface, however the fluid produced from the formation is estimated to be less than 1/3 bbl.

Several samples were collected while reversing out, however, none were representative of the formation fluid due to the small amount of production.

2.5.2 Flow Data

The well testing report as prepared by Flopetrol is attached as Appendix A1 to this report

2.5.3 Pressure Data

The bottomhole pressure data as reported by Dowell Schlumberger is attached as Appendix A2 to this report.

2.5.4 Interpretation and Analysis

DST No 1: Interval 460 - 465m RT

- An estimated 8.4 bbls of formation water were produced in 4.5 minutes at an average rate of 2700 BPD.

- A representative downhole sample of the formation fluid was obtained from the PCT chamber and a preliminary field analysis indicated a chloride content of 12,000 ppm.

- A variable rate Horner analysis indicates a permeability in excess of 1000 md.

- The Horner plot also indicates a barrier located approximately 675 feet from the well.

DST No 2: Interval 445 - 454m RT

- An estimated 0.27 bbls of formation fluid were produced in 318 minutes at an average rate of 1.2 bbl/day.

- A representative sample of formation fluid was not obtained during the test due to the low flow rate.

- A variable rate Horner analysis indicates an extremely low formation permeability of 0.025 md.

- The Horner analysis also indicates no near wellbore formation damage.

2.6 General Data

2.6.1 Positioning Report

See attached Positioning Report, Figure 11 and Appendix A3.

2.6.2 Downhole Surveys

Depth	Drift
85m	0^{o}
243m	$\frac{1}{2}^{o}$
404m	$3/4^{o}$
549m	$\frac{1}{2}^{o}$
810m	1^{o}

2.6.3 Plug Back and Squeeze Cementation Record

The well was plugged back from 605m to 545m to conduct a DST. OEDP was run to 605m and a 66 sack cement plug mixed to 15.8 ppg was pumped and balanced. The DP was pulled up to 545m and reversed clean.

A cement squeeze was necessary at the 7" liner hanger to establish pressure integrity. A 50 sack plug of Class "B" cement with 2 percent $CaCl_2$ mixed to 15.8 ppg was spotted over the interval 293m - 249m. Two stands of DP were pulled and the string was reversed clean. The cement was stage squeezed up to 2200 psi using 3/4 bbl of cement slurry. Excess cement was then drilled out of the 9-5/8" casing and the 7" liner with 8½" and 6" bits respectively. After drilling out, the 9-5/8" casing and the 7" liner were successfully pressure tested to 2000 psi.

2.6.4 Fishing Operation

None required.

2.6.5 Side Tracked Hole

None required.

2.7 Abandonment Report

Whale No 1 was abandoned on December 25th, 1981. Two cement plugs were placed in the casing, the 9-5/8" and 20" casings were mechanically cut 10m below sea floor, and the subsea equipment was retrieved.

Plug No 1: OEDP was run to 435m and an 18 sack cement plug mixed at 15.8 ppg was pumped and balanced. Two stands of DP were pulled and the string was reversed clean.

Plug No 2: OEDP was run to 165m and the well was displaced to sea water. A 77 sack cement plug mixed at 15.8 ppg was pumped and balanced, the DP was raised to 100m, and the string was reversed clean.

See attached schematic "As Abandoned", Figure 12

2.8 Recommendation for Future Drilling Programmes

With the exception of some downtime due to weather and lost time due to DST missruns, Whale No 1 was drilled trouble free. One possible improvement would be to utilize 9" or 11" DC's on the 36" and 26" hole in order to improve ROP and increase effective hole size.

Proposed Location: 38° 01' 18.61" S — **Latitude:**

148° 33' 32.7" E — **Longitude:**

Actual Location: 38° 01' 17.182" S — **Latitude:**

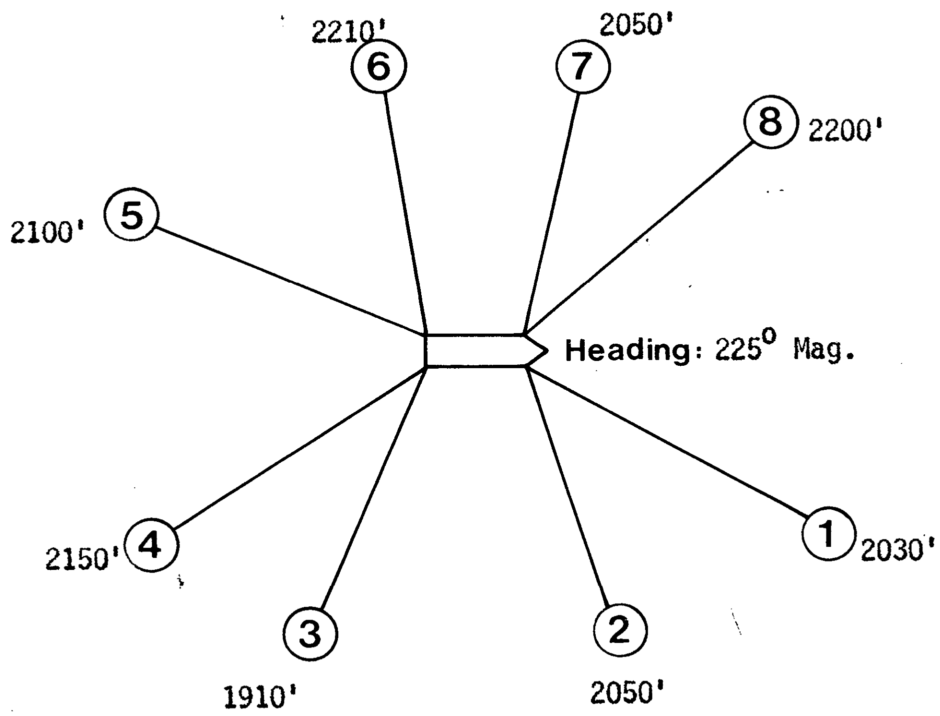
148° 33' 34.172" E — **Longitude:**

Distance and Bearing from Proposed to Actual: 56 metres @ 040°

Survey Method: Trisponder System

Checked By: JMR-4 Satellite Observation

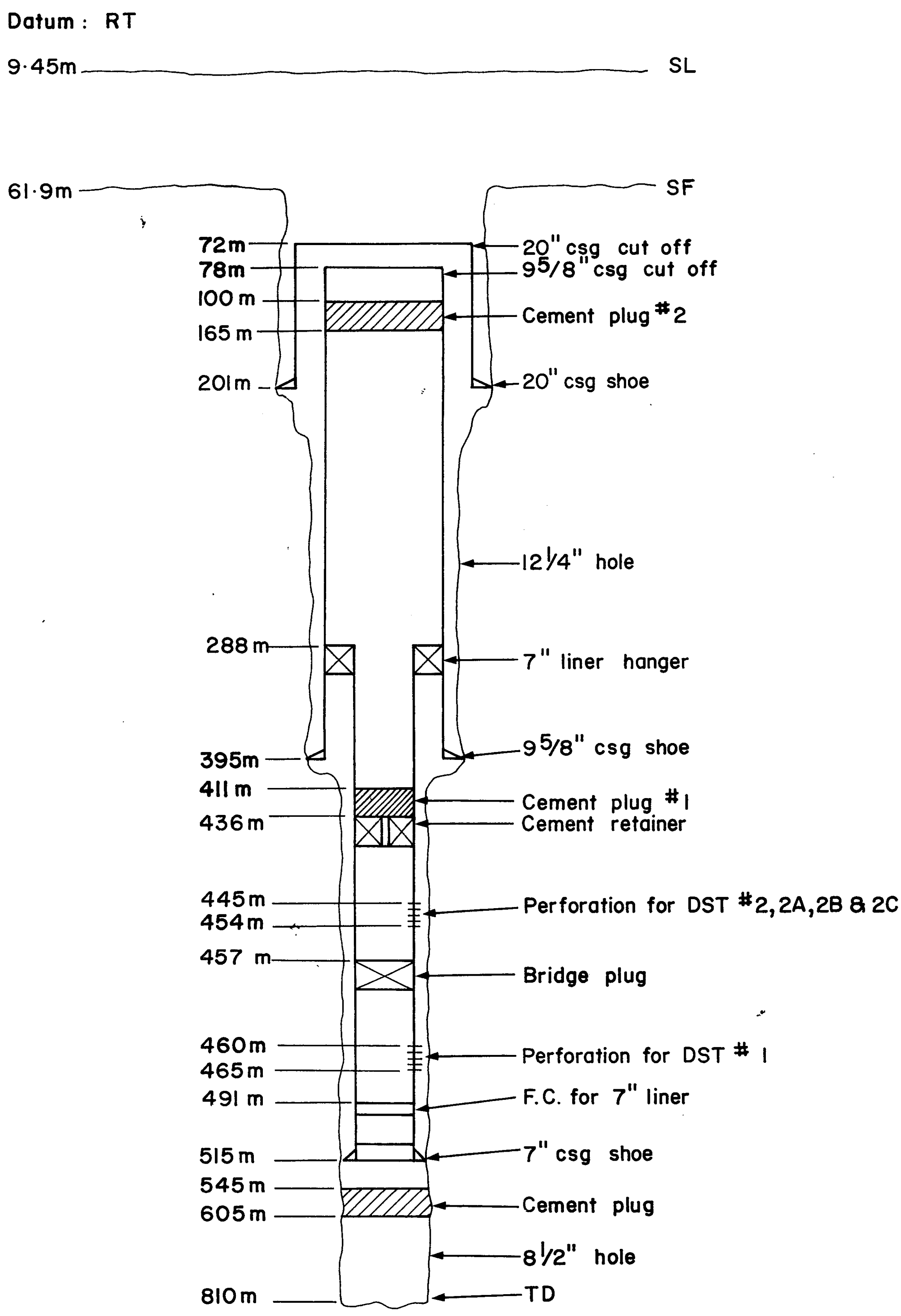
Anchor Pattern:



Remarks Anchors were deployed and recovered without problems, and no problems were experienced with the mooring system during the drilling operation.

Author: A.Eisenbarth	Hudbay Oil (Australia) Ltd.	Date: May, 1982
Drawn by: H.O.A.L.	**POSITIONING** **WHALE - 1**	Drawing Nº **A4-DR-521**

Figure 11



Author: K. Putnam	Hudbay Oil (Australia) Ltd.	Date: April 1982
Drawn by: A. Clark	WHALE - 1 **AS ABANDONED**	Drawing Nº A4-DR-496

Figure 12

APPENDIX A1

W E L L   T E S T I N G   R E P O R T

No. 181281191281

FLOPETROL

DIVISION : FTR / NTD

BASE : PERTH

REPORT N°: 181281191281

Well Testing Report

Client: HUDBAY OIL (AUSTRALIA) LIMITED

Field : GIPPSLAND BASIN Well: WHALE 1

Zone: 460M TO 465M Date: 18TH & 19TH DECEMBER, 1981

D.S.T. NO. 1

N°: DOP 100

FLOPETROL	Client : HUDBAY	Section : INDEX
Base : PERTH	Field : GIPPSLAND BASIN	Page : 01
	Well : WHALE 1.	Report N° : 18128119128

INDEX

- [X] 1 _ TEST PROCEDURE _
- [ ] 2 _ MAIN RESULTS _
- [ ] 3 _ OPERATING AND MEASURING CONDITIONS _
- [X] 4 _ SURFACE EQUIPMENT DATA _
- [X] 5 _ WELL COMPLETION DATA _
- [X] 6 _ SEQUENCE OF EVENTS _
- [X] 7 _ WELL TESTING DATA _

Flopetrol chief operator	Client representative
Name : REMONDIN JEAN LOUIS	Name : BRIMAGE RUSSELL

N° DOP 101

- TEST PROCEDURE -

DETERMINATION OF THE FLUID AND PRESSURES OF THE FORMATION SITUATED BETWEEN THOSE TWO DEPTHS 640 METERS TO 645 METERS.

FLOPETROL	Client : HUDBAY	Section : 4
Base : PERTH	Field : GIPPSLAND BASIN	Page : 03
	Well : WHALE 1	Report N° : 181281191281

SURFACE EQUIPMENT LAYOUT

REMARKS :

REFER TO HUDBAY DRAWING NO. A4_DR_276.

DOP 105

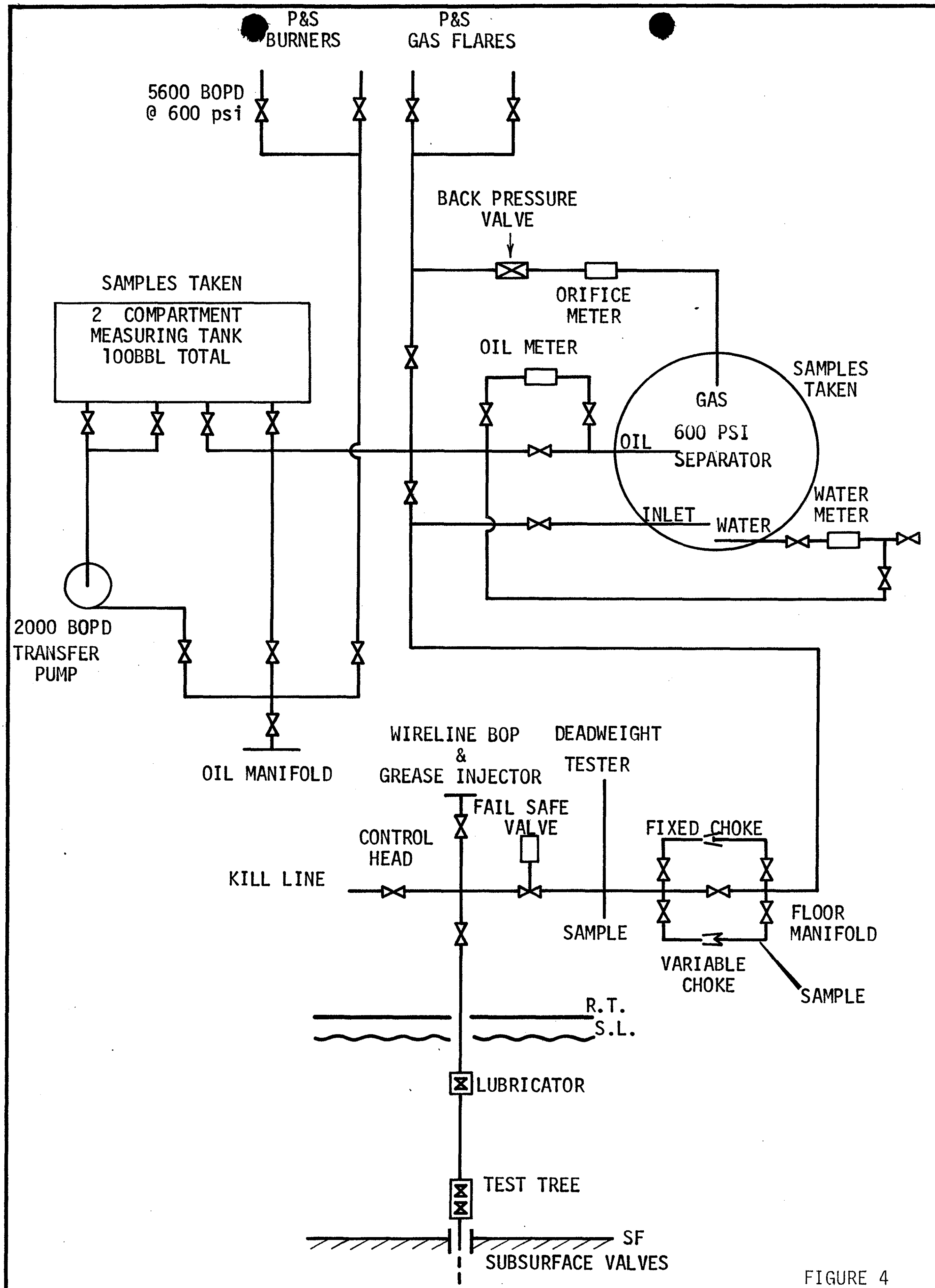
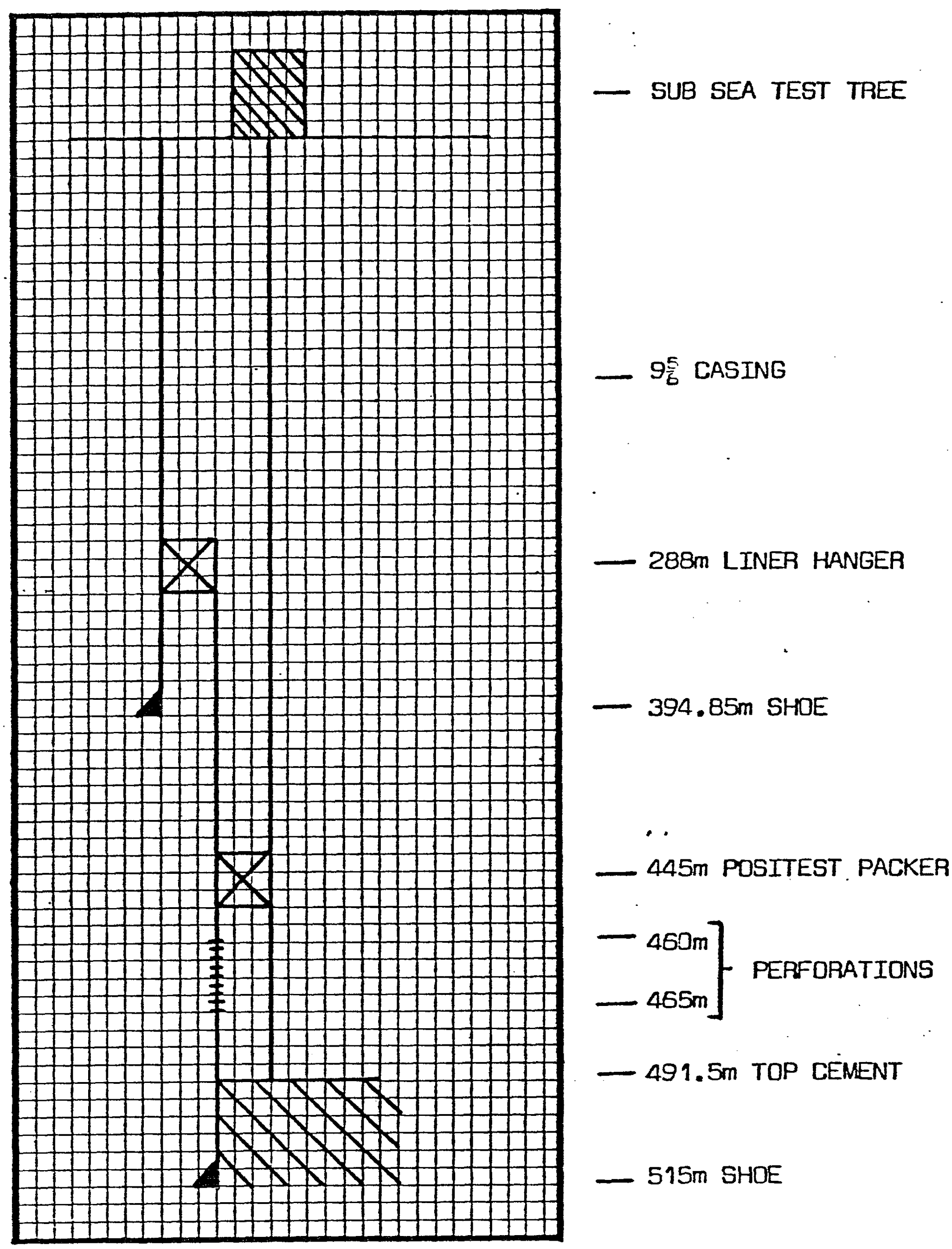


FIGURE 4

Scale:	Hudbay Oil (Australia) Ltd.	Date: August, 1981
Drawn by: J. Hall	**PETROMAR NORTH SEA** **D.S.T. SURFACE EQUIPMENT SCHEMATIC**	Drawing Nº **A4-DR-276**

FLOPETROL	Client : HUDBAY	Section : 5
	GIPPSLAND BASIN	
	Field :	Page : 04
Base :	Well : WHALE 1	Report N° : ~~18128119128~~

– WELL COMPLETION DATA –



REMARKS :

NOT TO SCALE.

N° : DOP 106

FLOPETROL	Client : HUDBAY	Section : 6
Base : PERTH	Field : GIPPSLAND BASIN Well : WHALE 1	Page : 05 Report N°: 1812811912

- SEQUENCE OF EVENTS -

DATE	TIME	OPERATION
18.12.81		MUD WEIGHT = SG = 1, 36
	1925	SCHLUMBERGER RUN IN HOLE TO PERFORATE
		4" GUNS, 4 SHOT/FOOT
		DEPTH 460 M TO 465 M
19.12.81	0315	RIG UP E.Z. TREE
	0320	UNLATCH TEST ON RIG FLOOR
	0400	RIG UP FLOW HEAD
	0615	FINISH RIG UP OF SURFACE EQUIPMENT INCLUDING SCHLUMBERGER
		W-L EQUIPMENT.
	0630	START TO PRESSURE TEST SURFACE EQUIPMENT 600 PSI TO THE
		VALVE ON FLOWLINE (RIG FLOOR LEVEL).
		3,000 PSI TO THE CHOKE MANIFOLD, INCLUDING FLOWHEAD AND
		W-L EQUIPMENT.
	0723	SET PACKER AT 445 M APPLYING 20,000 LBS ON TOP.
	0745	PRESSURIZE ANNULUS TO OPEN PCT = 1200 PSI.
	0745	STRONG BLOW.
	0750	BLEED TO CLOSE PCT.
	0925	PRESSURIZE ANNULUS TO OPEN PCT = 1400 PSI
		CHOKE SIZE = ½" POSITIVE CHOKE.
	0936	WELL OPEN ONLY THROUGH BUBBLE HOSE, STILL NO PRESSURE AT
		SURFACE.
	1145	PUMP THROUGH TUBING TO BREAK PUMP OUT.
	1150	START TO REVERSE OUT.
	1220	FINISHED REVERSING OUT.
		FOUR SAMPLES HAVE BEEN TAKEN. FIRST ONE WAS WATER, THE
		THREE OTHERS WERE - KCL AND THE TWO LAST ONES WERE MUD.
	1230	START DIRECT CIRCULATION

DOP 107

FLOPETROL

Section : 6

Page : 06
Report N° 181281191281

_ SEQUENCE OF EVENTS _(Continuation)

DATE	TIME	OPERATION
19.12.81	1400	END OF DIRECT CIRCULATION.
		PULL OUT OF HOLE - END OF D.S.T. NO. 1
	1500	E.Z. TREE ON RIG FLOOR.
		PCT CHAMBER APPROX. 100 PSI
		200 CC OF WATER (12,000 PPM).
		SAMPLE TRAPPED BETWEEN PCT AND HRT = 3 LITRES OF WATER.
		ALSO RECOVERED AROUND SPRO GAUGE - SANDSTONE - (DIRECT
		FLUORESCENCE AT FLUORSCOPE).

N°. DOP 108

FLOPETROL

DIVISION : FTR / NTD

BASE : PERTH

REPORT N°: 221281231281

Well Testing Report

Client: HUDBAY OIL (AUSTRALIA) LIMITED

Field : GIPPSLAND BASIN Well: WHALE 1

Zone : 445M TO 454 M Date: 22nd AND 23rd DECEMBER, 1981

D.S.T. 2C

N°: DOP 100

INDEX

☐ 1.– TEST PROCEDURE –

☐ 2.– MAIN RESULTS –

☐ 3.– OPERATING AND MEASURING CONDITIONS –

☒ 4.– SURFACE EQUIPMENT DATA –

☒ 5.– WELL COMPLETION DATA –

☒ 6.– SEQUENCE OF EVENTS –

☐ 7.– WELL TESTING DATA –

Flopetrol chief operator
Name : REMONDIN

Client representative
Name : BRIMAGE

FLOPETROL

Base : PERTH

Client : HUDBAY

Field : GIPPSLAND BASIN

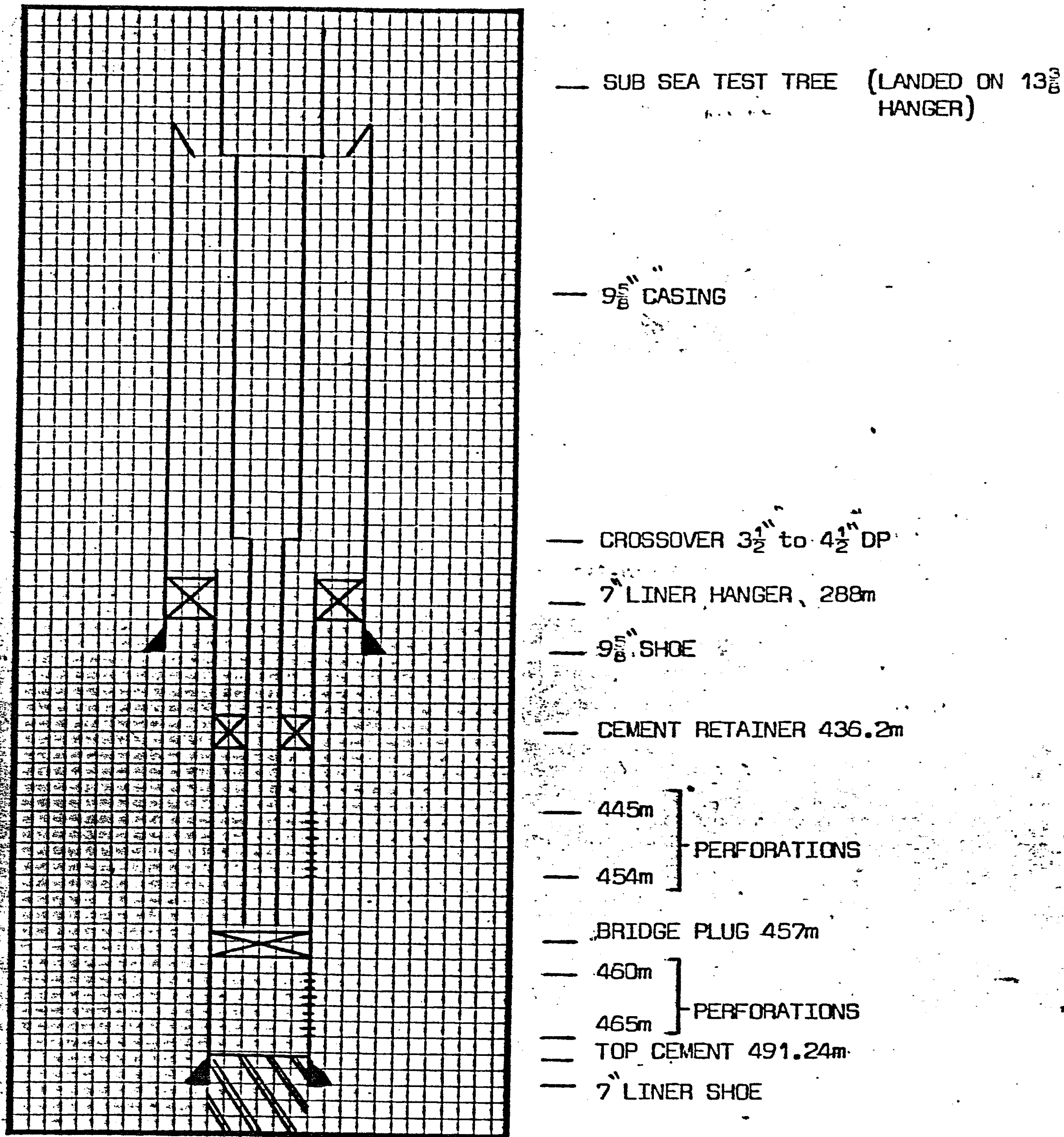
Well : WHALE 1

Section : 5

Page : 02

Report N° 22128123128

- WELL COMPLETION DATA -



REMARKS :

NOT TO SCALE.

N° : DOP 106

FLOPETROL

Base : PERTH

Client : HUDBAY

Field : GIPPSLAND BASIN

Well : WHALE 1

Section : 6

Page : 03

Report N°:22128123128

- SEQUENCE OF EVENTS -

DATE	TIME	OPERATION
22.12.81		SET CEMENT RETAINER AT 436.2 M WITH SCHLUMBERGER.
	1530	START RUNNING E.Z. TREE AFTER LATCH TEST ON RIG FLOOR.
	1630	FINISH RIG UP OF SIRFACE EQUIPMENT.
	1715	START PRESSURE TESTING SURFACE EQUIPMENT 600 PSI TO FLOWLINE.
		3,000 PSI TO CHOKE MANIFOLD, INCLUDING SCHLUMBERGER W-L EQUIP
	1742	OPEN PCT. (PRESSURISING ANNULUS 1300 PSI) NO
		MANIFESTATION AT SURFACE.
	1749	BLEED OFF ANNULUS TO CLOSE PCT FOR INITIAL SHUT IN PRESSURE.
	1912	OPEN PCT (PRESSUREISING ANNULUS 1300 PSI), COUPLE OF
		BUBBLES AT SURFACE.
23.12.81	0032	BLEED OF ANNULUS TO CLOSE PCT.
	0150	UNLATCH SPRO = PULL OUT OF HOLE.
	0227	REVERSE CIRCULATION.
		TAKEN - 8 SAMPLES.
	0323	END OF REVERSE CIRCULATION.
	0335	RIG DOWN SURFACE EQUIPMENT
		END OF D.S.T. 2C.
		MUD WEIGHT 1.36.

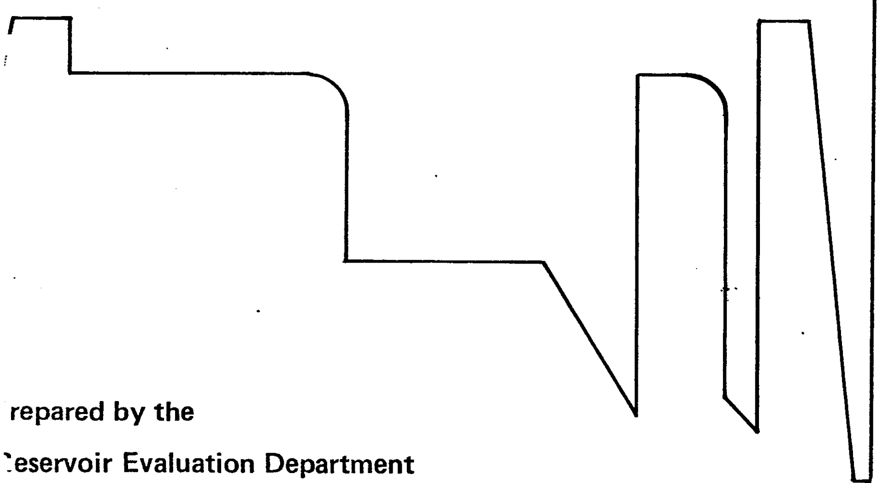
N°: DOP 107

APPENDIX A2 **DOWELL SCHLUMBERGER**

TECHNICAL REPORT No. F 82024

DRILL STEM TEST REPORT

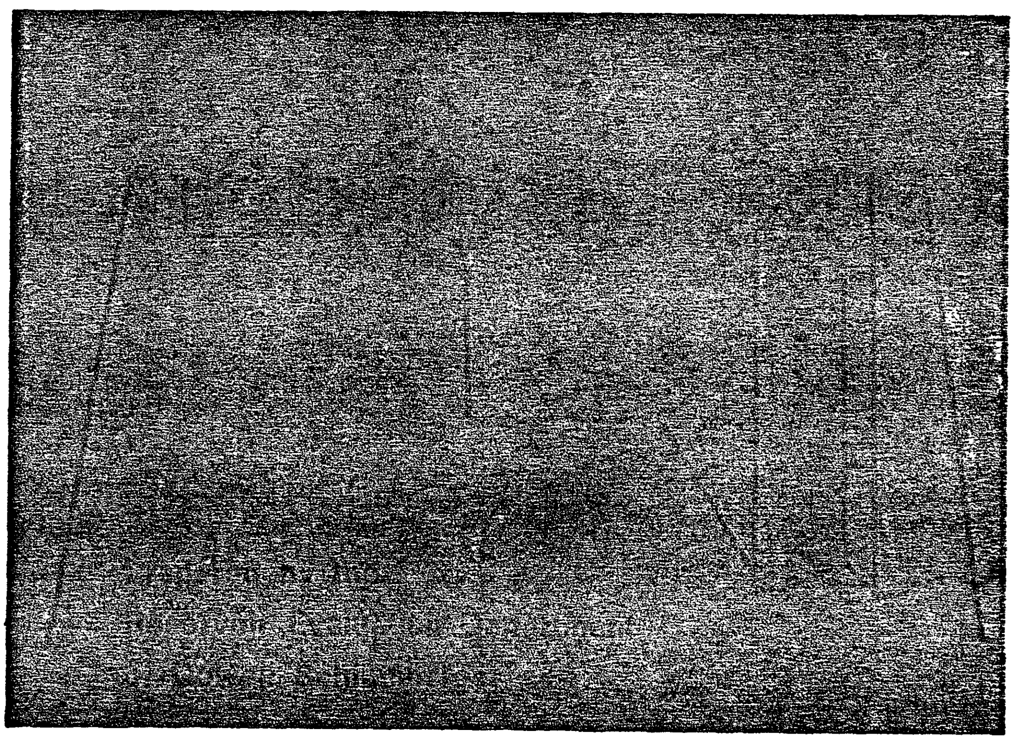
HUDBAY OIL
WELL WHALE 1
FIELD WILDCAT
TEST NO 1
AUSTRALIA



repared by the
eservoir Evaluation Department

REPORT N° F 82024
JOB N°
INVOICE/SIR.
DATE MARCH 31, 1982

SPECIAL DATA ANALYSIS



COMPANY HUDBAY OIL
WELL WHALE 1
FIELD WILDCAT
TEST N° 1
COUNTRY AUSTRALIA

ASSUMPTIONS MADE FOR CALCULATIONS OF LIQUID RECOVERIES

1. Q is averaged at a constant rate.
2. Pf is formation flowing pressure at a constant rate.
3. Formation flow is single phase, and any gas produced at surface is assumed to have separated in the drill pipe.
4. Radial flow is assumed.
5. Where specific reservoir parameters are not available, an Estimated Damage Ratio is calculated by assuming :

   Effective permeability, K, is 1-200md
   Formation porosity, ϕ, is . . . . 10-30 %
   Fluid compressibility, C, is . . . . 10^{-6} to 10^{-4}
   Fluid viscosity, μ, is . . . . 0.05 to 50cp
   Well bore radius, rw, is . . . . 3 7/8" to 4 3/8"

   which gives an average value for the function $\log \frac{K}{\phi \mu C r_w^2}$ of 5.5

6. Other standard radial flow equilibrium assumptions.

EMPIRICAL EQUATIONS

1. $$D.R. = \frac{Po - Pf}{M\left[\log \frac{KT}{\phi \mu C r_w^2} - 2.85\right]}$$ where $M = \frac{P1 - P10}{\text{log cycle}}$

2. $$\text{Transmissibility} = \frac{Kh}{\mu} = \frac{162.6QB}{M}$$

3. DST $J = \frac{Q}{Po - Pf}$ Theoretical $J = \frac{7.08 \times 10^{-3}\, kh}{\mu B \ln(re/rw)}$ Assumed $\ln(re/rw) = 7.60$

4. Radius of investigation, $ri = \sqrt{\frac{KT}{57{,}600\, \phi \mu C}}$ where T = flow time in minutes

5. $$\Delta P\ Skin = Po - Pf - \left[\frac{Po - Pf}{DR}\right] \text{psi}$$

ASSUMPTIONS MADE FOR CALCULATIONS FOR GAS RECOVERIES

1. Qg is steady state flow, and unless stated otherwise is at standard conditions, 14.7 psi and 60° F.
2. Pf is final formation flowing pressure at steady state flow.
3. Formation flow is single phase, and any liquid (condensate) produced at surface is assumed to have condensed in the drill pipe.
4. Radial flow is assumed.
5. Where specific reservoir parameters are not available, an Estimated Damage Ratio is calculated by assuming :

   Effective permeability, K, is 1-200md
   Formation porosity, ϕ, is . . . . 10-30 %
   Fluid compressibility, C, is . . . . 10^{-6} to 10^{-4}
   Fluid viscosity, μ, is . . . . . . 0.05 to 50cp
   Well Bore radius, rw, is . . . . 3 7/8" to 4 3/8"

   which gives an average value for the function $\log \frac{K}{\phi \mu C r_w^2}$ of 5.5

6. If not given, gas specific gravity is assumed to be 0.7 (air 1.0), with a pseudo critical temperature of 385 Rankin and a pseudo critical pressure of 668 psia.
7. Other standard radial flow steady state assumptions.

EMPIRICAL EQUATIONS

1. $$D.R. = \frac{Po^2 - Pf^2}{Mg\left[\log \frac{KT}{\phi \mu C r_w^2} - 2.85\right]}$$ where $Mg = \frac{P_1^2 - P_{10}^2}{\text{log cycle}}$

2. $$\text{Transmissibility} = \frac{Kh}{\mu} = \frac{1637\, Q\, Tr\, Z}{Mg}$$

3. Radius of Investigation, $ri = \sqrt{\frac{KT}{57{,}600\, \phi \mu C}}$ where T = flow time in minutes

4. $$\Delta P\ Skin = Po - Pf - \left[\frac{Po - Pf}{DR} \text{ psi}\right]$$

CONFIRMATION OF REPORT DISTRIBUTION

TO HUDBAY OIL

WELL WHALE 1 FIELD WILDCAT TEST N° 1

COUNTRY AUSTRALIA DATE MARCH 31, 1982

Dowell Schlumberger has been requested to furnish the following companies with Technical Reports. This distribution of Technical Reports will be used for :

☐ All tests on this well,

☐ This one test only,

unless otherwise notified.

_____ TECHNICAL REPORT (S)

_____ TECHNICAL REPORT (S)

_____ TECHNICAL REPORT (S)

_____ TECHNICAL REPORT (S)

_____ TECHNICAL REPORT (S)

_____ TECHNICAL REPORT (S)

Dowell Schlumberger

Cables: "Bigorange"
Telex: Orange RS 23005
Telephone: 2351022
2351287

MARCH 31, 1982

REPORT NO : F 82024

GENTLEMEN,

The enclosed test appears to be a good Mechanical drill stem test during which the tools did function properly. The formation did produce enough reservoir fluid for proper identification. Reservoir pressure drawdown was sufficient and adequate Initial shut-in build-up did occur for reliable quantitative analysis.

An estimated flow rate of 1300 BBls/Day of liquid was noted during the initial flow period of this test. During the final flow period, flow pressure reach formation pressure to the extent that the well was killed and the final shut-in build-up considered unreliable for analysis.

A review of the test datas indicate high permeability and the presence of well bore damage.

FRANCIS SOO
RESERVOIR EVALUATION DEPARTMENT

FS/rs

P. O. Box No. 383, KILLINEY ROAD POST OFFICE, SINGAPORE 9

REPORT Nº F 82024

SPECIAL DATA ANALYSIS

HORNER METHOD

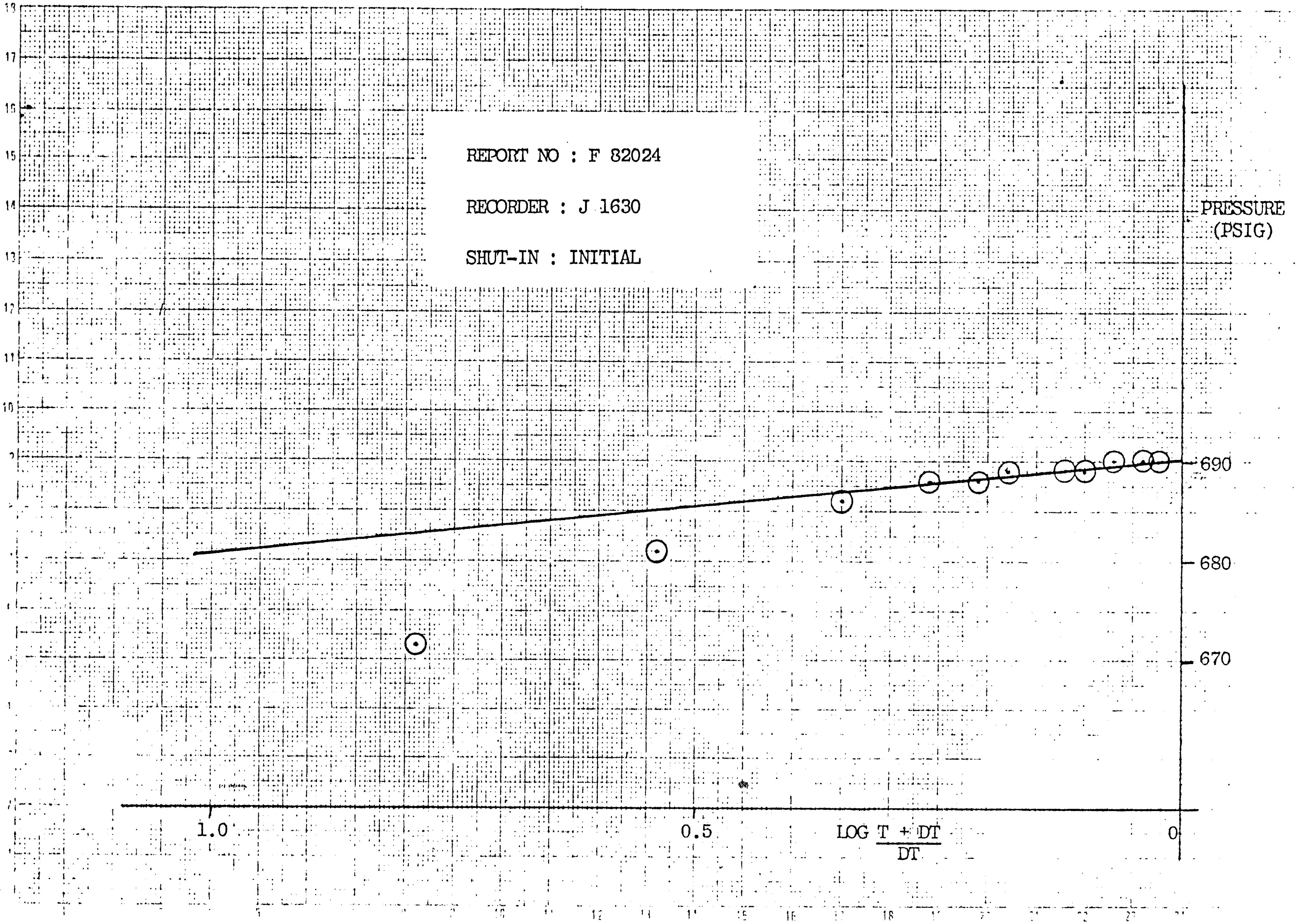
RESERVOIR ENGINEERING DATA – LIQUID TEST

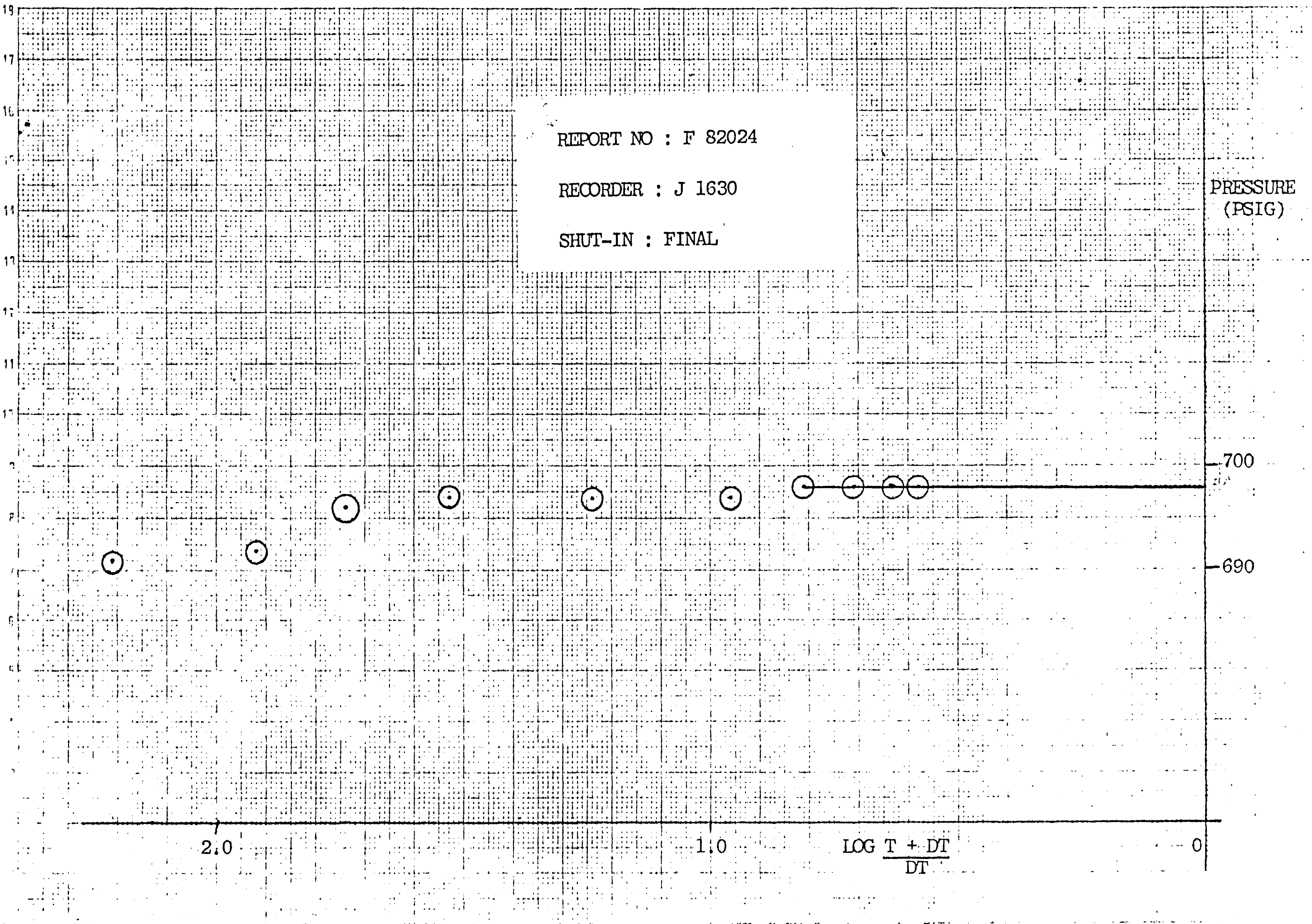
RECORDER Nº J 1630

Maximum Reservoir Pressure	Po	698	psig.	Flow Rate ESTIMATED	Q	1300	Bbl/day
Damage Ratio	DR	1.6		Gas Oil Ratio		–	CF/Bbl
Transmilibility (to LIQUID)	$\frac{Kh}{\mu}$	23487	$\frac{\text{Md-ft}}{\text{Cp}}$	Slope of Shut-In Curve INITIAL	M_1	9	$\frac{\text{psi}}{\text{Log Cycle}}$
Productive Capacity	Kh	23487	Md-ft	Slope of Shut-In-Curve	M_2		$\frac{\text{psi}}{\text{Log Cycle}}$
Permability (to LIQUID	K	1432	Md	Pressure Gradient		0.47	psi/ft
Productivity Index (Actual)	PI	12	$\frac{\text{Bbl/day}}{\text{psi}}$	Radius of Investigation	ri	2251	ft.
Productivity Index (No damage)		–	$\frac{\text{Bbl/day}}{\text{psi.}}$	Δ P Skin		–	psi

These calculations were based on the following data, either supplied from the well, or obtained from the current technical literature.

Net Productive Interval	h	164	ft.	Formation Volume Factor	B	1.0	Bbls/Bbl
Porosity	ø	20	%	Viscosity at reserv. cnd.	μ	1.0	Cps
Oil Gravity at 60 °F		–	°API	Compressibility	C		4×10^{-6}
Gas Gravity		0.7		Total Flow Time	T	163	mins.
Well Bore Radius	rw	3.5	in.	Bubble Point		–	psig.


REPORT NO : F 82024
RECORDER : J 1630
SHUT-IN : INITIAL
PRESSURE
(PSIG)
690
680
670
1.0
0.5
0
LOG T + DT / DT



REPORT NO : F 82024
RECORDER : J 1630
SHUT-IN : FINAL
PRESSURE
(PSIG)
700
690
2.0
1.0
0
LOG T + DT / DT

PE604584

This is an enclosure indicator page.
The enclosure PE604507 is enclosed within the container PE900000 at this location in this document.

The enclosure PE604507 has the following characteristics:

ITEM_BARCODE = PE604584
CONTAINER_BARCODE = PE900000
NAME = Pressure Log
BASIN = GIPPSLAND BASIN
PERMIT = VIC/P11
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Pressure Log (enclosure from WCR) for Whale-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
W_NO = W761
WELL_NAME = WHALE-1
CONTRACTOR =
CLIENT_OP_CO = HUDBAY OIL (AUS) LTD

REPORT N F 82024

Flopetrol Schlumberger

RECORDER Nº : J 1782 CAPACITY :4700 PSI DEPTH : 450.1 M

OPENING : OUTSIDE TEMPERATURES : 101 DEG F

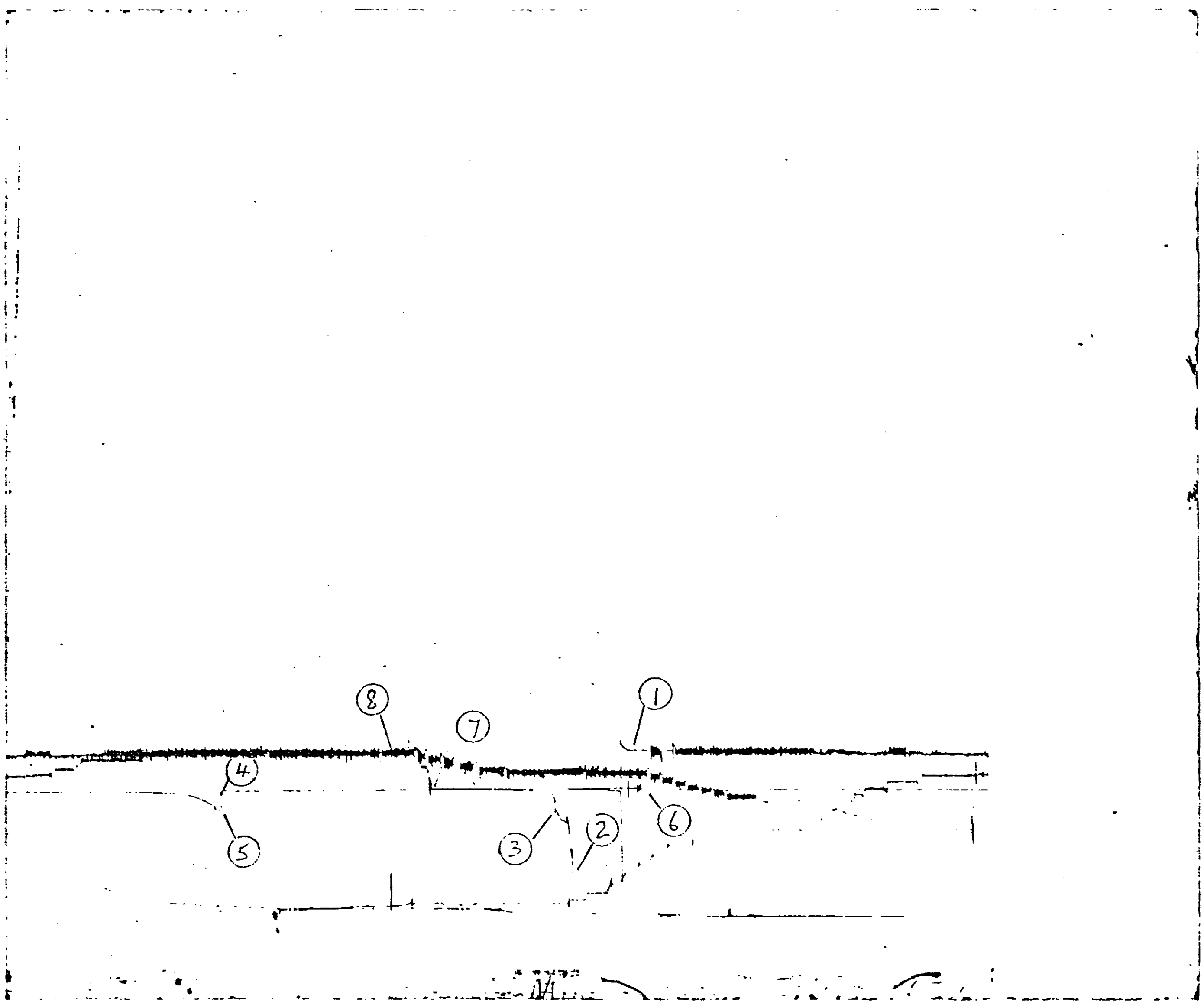
CLOCK Nº : 9-1467 CAP: 48 HRS CLOCK TRAVEL : 0.021163 in/min

CALIBRATION DATA AT M = 936.0018

A = 1.1452

PRESSURE (PSI) = DEFLECTION (INS) X M ± A

PRESSURE DATA FROM THIS CHART IS PRESENTED ON THE NEXT PAGE.



PRESSURE DATA FOR RECORDER : J 1782

DESCRIPTION	LABEL POINT	PRESSURE (PSI)	TIME GIVEN	TIME COMPUTED
INITIAL HYDROSTATIC	1	932		
INITIAL FLOW (1)	2	238		
INITIAL FLOW (2)	3	599	5	4
INITIAL SHUT-IN	4	711	92	92
SECOND FLOW (1)				
SECOND FLOW (2)				
SECOND SHUT-IN				
THIRD FLOW (1)				
THIRD FLOW (2)				
THIRD SHUT-IN				
FINAL FLOW (1)	5	614	0	0
FINAL FLOW (2)	6	711	146	155
FINAL SHUT-IN	7	713	69	60
FINAL HYDROSTATIC	8	921		

REMARK :

REPORT Nº F 82024

RECORDER Nº : J 1629

CAPACITY : 2800 PSI

DEPTH : 441.4 M

OPENING : INSIDE

TEMPERATURES : 78 DEG F

CLOCK Nº :9-0714 CAP: 24 HRS

CLOCK TRAVEL : 0.041542 in/min

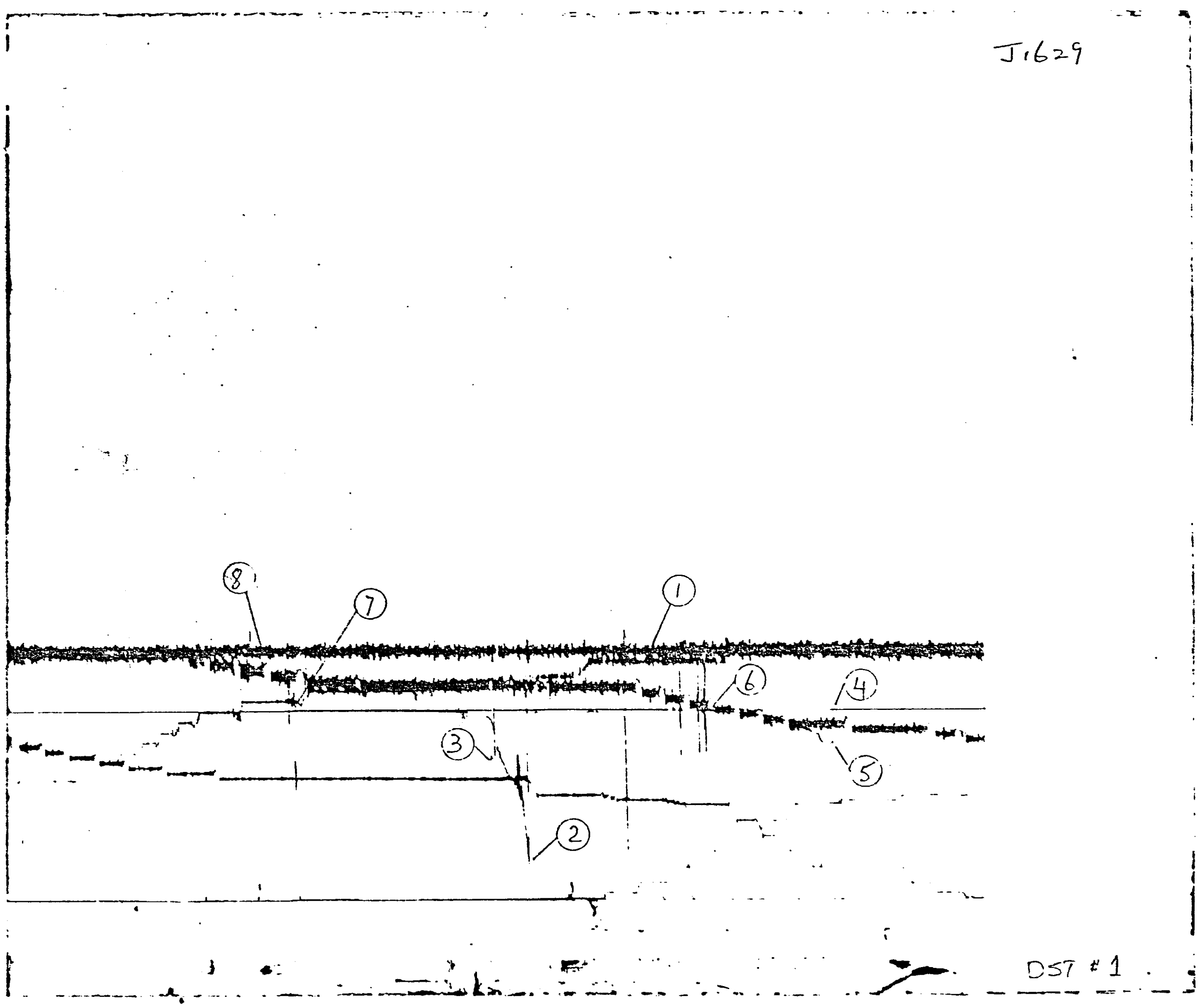
CALIBRATION DATA AT

M = 580.142

A = 0.378

PRESSURE (PSI) = DEFLECTION (INS) X M ± A

PRESSURE DATA FROM THIS CHART IS PRESENTED ON THE NEXT PAGE.



REPORT N° F S2024

PRESSURE DATA FOR RECORDER : J 1629

DESCRIPTION	LABEL POINT	PRESSURE (PSI)	TIME GIVEN	TIME COMPUTED
INITIAL HYDROSTATIC	1	855		
INITIAL FLOW (1)	2	124		
INITIAL FLOW (2)	3	504	5	5
INITIAL SHUT-IN	4	645	92	91
SECOND FLOW (1)				
SECOND FLOW (2)				
SECOND SHUT-IN				
THIRD FLOW (1)				
THIRD FLOW (2)				
THIRD SHUT-IN				
FINAL FLOW (1)	5	529	0	0
FINAL FLOW (2)	6	645	146	157
FINAL SHUT-IN	7	642	69	60
FINAL HYDROSTATIC	8	854		

REMARK :

REPORT N F 82024

RECORDER Nº : J 1630 | CAPACITY : 2800 PSI | DEPTH : 453.3 M

OPENING : OUTSIDE | TEMPERATURES : 101 DEG F

CLOCK Nº : 9-3813 CAP: 48 HRS | CLOCK TRAVEL : 0.021593 in/min

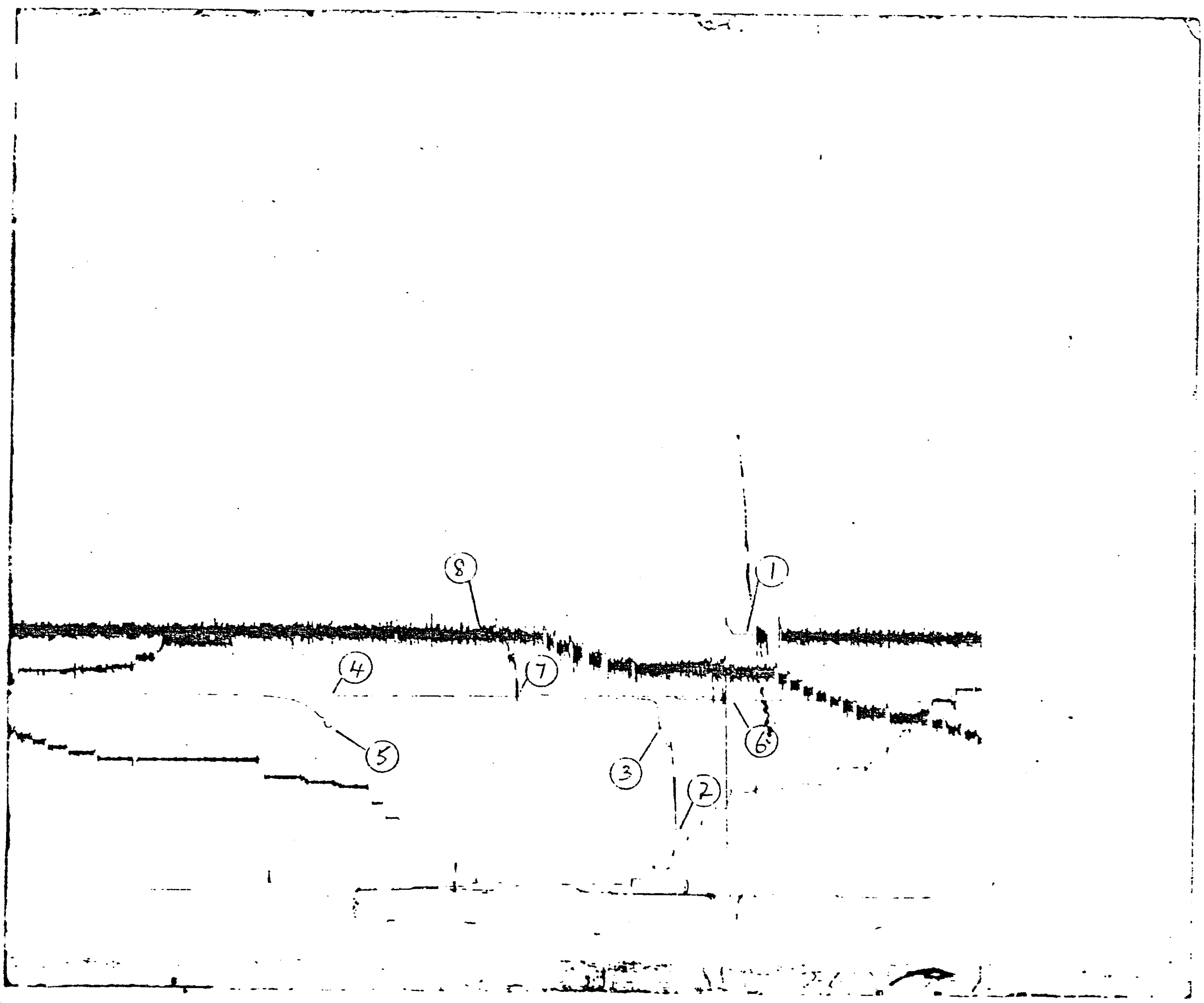
CALIBRATION DATA AT

M = 567.976

A = 5.357018

PRESSURE (PSI) = DEFLECTION (INS) X M ± A

PRESSURE DATA FROM THIS CHART IS PRESENTED ON THE NEXT PAGE.



REPORT Nº F 82024

PRESSURE DATA FOR RECORDER : J 1630

DESCRIPTION	LABEL POINT	PRESSURE (PSI)	TIME GIVEN	TIME COMPUTED
INITIAL HYDROSTATIC	1	913		
INITIAL FLOW (1)	2	206		
INITIAL FLOW (2)	3	592	5	5
INITIAL SHUT-IN	4	690	92	90
SECOND FLOW (1)				
SECOND FLOW (2)				
SECOND SHUT-IN				
THIRD FLOW (1)				
THIRD FLOW (2)				
THIRD SHUT-IN				
FINAL FLOW (1)	5	579	0	0
FINAL FLOW (2)	6	689	146	158
FINAL SHUT-IN	7	698	69	59
FINAL HYDROSTATIC	8	907		

REMARK :

Dowell Schlumberger

PRESSURE DATA FOR RECORDER : J 1630

LABEL POINT	ΔT (mins)	PRESSURE (PSI)	$\frac{T + \Delta T}{\Delta T}$	LOG	Pw − Pf (PSI)	COMMENTS
1		913				INITIAL HYDROSTATIC
2	0	206				INITIAL FLOW (1)
	2	524				
3	5	592				INITIAL FLOW (2)
3	0	592				START SHUT-IN
	1	673	6.00	0.78	81	T = 5
	2	682	3.50	0.54	90	
	4	686	2.25	0.35	94	
	6	688	1.83	0.26	96	
	8	688	1.63	0.21	96	
	10	689	1.50	0.18	97	
	15	689	1.33	0.12	97	
	20	689	1.25	0.10	97	
	30	690	1.17	0.07	98	
	50	690	1.10	0.04	98	
	70	690	1.07	0.03	98	
4	90	690	1.06	0.02	98	INITIAL SHUT-IN
5	0	579				FINAL FLOW (1)
	10	670				
	20	685				
	40	686				
	60	686				
	80	687				
	100	687				
	130	688				
6	158	689				FINAL FLOW (2)
6	0	689				START SHUT-IN
	1	691	164.00	2.21	2	T = 163
	2	692	82.50	1.92	3	

DOWELL Schlumberger

PRESSURE DATA FOR RECORDER : J 1630

LABEL POINT	ΔT (mins)	PRESSURE (PSI)	$\frac{T + \Delta T}{\Delta T}$	LOG	Pw – Pf (PSI)	COMMENTS
	3	696	55.33	1.74	7	
	5	697	33.60	1.53	8	
	10	697	17.30	1.24	8	
	20	697	9.15	0.96	8	
	30	698	6.43	0.81	9	
	40	698	5.08	0.71	9	
	50	698	4.26	0.63	9	
7	59	698	3.76	0.58	9	FINAL SHUT-IN
8		907				FINAL HYDROSTATIC

DOWELL Schlumberger

Formation Testing Field Report

Report No. F 82024

WELL IDENTIFICATION

Company : HUDBAY OIL Well No : WHALE 1 Test No. : 1

Field : WILDCAT Location : OFFSHORE Country : AUSTRALIA

Tested Interval : From 496 M ~~Ft~~ to 479 M ~~Ft~~.

Co-ordinates :

Type Test : Open Hole ☐ Casing ☒ Conventional ☐ Straddle ☐ Land rig ☐ Jack-up ☐ Floater ☒

Valve : MFE ☐ PCT ☒ SPRO ☒ Other : with Packer ☐ Retainer ☐

HOLE DATA

Geologic Level : Description :

Net Productive Interval : 5 M ft. Estimated Porosity : 10 - 20 %

Total Depth : 717 PB M ~~ft~~ Depths measured from : RT Elevation : - ft.

Open Hole Size : in. Rat Hole Size : in., from ft.

Casing Size : 9 in. - lbs/ft. Liner Size : 7 in., 29 lbs/ft. from 288.1 Mt

Before test : Caliper Yes ☐ No ☐ Scraper Yes ☒ No ☐ Circulation Yes ☒ for 3 hrs; No ☐

MUD DATA

Mud Type : POLYMER SEA WATER Weight : 11.3

Viscosity : 48.0 Water Loss 10.5 cc Mud Resistivity at °F

Filtrate Resistivity : at °F ; Chloride ppm :

INSTRUMENT AND CHART DATA

Recorder No.		J 1629	J 1630	J 1782	
Capacity (psig)		2880	2880	4280	
Depth		441.4 M	753.3	455.1	
Inside/Outside		INSIDE	OUTSIDE	OUTSIDE	
Above/Below valve		BELOW	BELOW	BELOW	
Clock No.		9-0718	9-3813	9-1467	
Capacity (hrs.)		24 HRS	48 HRS	48 HRS	
Temperature		98 DEG F	101 DEG F	101 DEG F	
Initial Hydrostatic Pressure		998	914	919	
Pre-flow	(1) Start Pressure	190	289	214	
	(2) Finish Pressure	572	588	597	
Initial Shut-in Pressure		677	698	702	
Second Flow	(1) Start Pressure				
	(2) Finish Pressure				
Second Shut-in Pressure					
Final Flow	(1) Start Pressure	568	588	599	
	(2) Finish Pressure	678	698	783	
Final Shut-in Pressure		679	699	704	
Final Hydrostatic Pressure		UNRELIABLE	UNRELIABLE	UNRELIABLE	

OPERATIONS SUMMARY

Left Station at : on On Location at : on

Started Operations at : on Finished Operations at : on

Off Location at : on Return Station at : on Mileage

Comments : OVER PRESSURE PCT USED - 2000 PSI (YELLOW DISC)

Station : SIR No. : Date : 19.12.81

Customer Tester JOHN VISCARDE Customer

DOWELL Schlumberger

Surface Data

Report No. F 82024

Customer: HUDBAY OIL | Well No: WHALE 1 | Test No. 1

TEST SEQUENCE AND FLOW RATE DATA

Description and Flow Rates	Date	Time hrs	Time mins	Pressure psig	Surface Choke
Packer Depth: 446.8 M KX Set at:	19.12.81	07	23		–
Opened Tool: 07 : 45 (Annulus pressure 1200 psi)		07	45	1200 (ANNULUS)	
CLOSED FOR INITIAL SHUT-IN		07	50		
MEDIUM BLOW CEASED IMMEDIATELY					
RE-OPENED PCT FINAL FLOW		09	22		
STRONG TO MEDIUM FLOW GRADUALLY					
WELL KILLED ITSELF					
CLOSED PCT FOR FINAL SHUT-IN		11	48		
Reverse Circulation Started (Pump pressure 500 psig)		11	50		
Reverse Circulation Finished		12	13		
Pulled Packer Loose/Pulled Out of Retainer		12	57		

Cushion Type: Amount bbls; Length ft; Pressure psi | Bottom Choke 1"

RECOVERY DATA

	Recovery Description	XFXXXM	Bbls	% Oil	% Water	% Other
1						
2	REVERSED OUT – MUD	38				
3						
4						
5						
6						

	Oil-API Gravity	Gas Gravity	G.O.R.	Resistivity	Chlorides
1	° at °F			at °F	ppm
2	° at °F			at °F	ppm
3	° at °F			at °F	ppm
4	° at °F			at °F	ppm
5	° at °F			at °F	ppm
6	° at °F			at °F	ppm

Comments: RECOVERED WATER FROM VOID BETWEEN PCT AND HRT.

DOWELL Schlumberger

Equipment Data

Report No. F 82024

Customer: HUDBAY OIL Well No.: WHALE 1 Test No.: 1

SAMPLE CHAMBER RECOVERY DATA

Sampler Drained	Recovery	Resistivity	Chlorides (ppm)
On Location [X]	Gas ____ cu ft.	Water ____ at ____ °F	
Elsewhere [ ]	Oil ____ c.c.	Mud ____ at ____ °F	
Name:	Water 200 c.c.	Mud Filtrate ____ at ____ °F	
Address:	Mud ____ c.c.	Pit Mud ____ at ____ °F	
	____ °API ____ °F	Pit Mud Filtrate ____ at ____ °F	

Gas/Oil Ratio ____ cu ft./bbl Sample Chamber Pressure 100 psi.

EQUIPMENT SEQUENCE

Components (including D.P. and D.C.)	Type	O.D. (in)	I.D. (in)	Length M	Depth
CONTROL HEAD (FLOPETROL)	HWDP	5	3.00	56.7	
3½ TUBING (TO SUBSEP TREE)	PH-6			159.9	
DRILL COLLAR	3½ IF	4¾	2.00		
SLIP JOINT	JOTCO	4¾	2.25		
DRILL COLLAR	3½ IF	4¾	2.00		
PUMP OUT SUB	JOTCO	4¾			
DRILL COLLAR	3½ IF		2.00		
PUMP OUT SUB	JOTCO	4¾			
DRILL COLLAR	3½ IF	4¾	2.00		
SPRO CONVERSION					432.2
PCT - 4¾ x 1					
MFE/HRT	JOTCO	4¾			
RECORDER CARRIER J 1629	JOTCO	4¾			441.4
TR 6[illegible] JAR	JOTCO	4¾			
SAFETY JOINT	JOTCO	4¾			
PACKER - 7" POSITEST - 29 LB	JOTCO				4141.8M
PERFORATED ANCHOR		4¾		6110	453.2
RECORDER CARRIER J 1630	JOTCO	4¾		1.80	453.3
RECORDER CARRIER J 1782	JOTCO	4¾		1.80	455.1
BULL NOSE		4¾		.25	
TOTAL TUBING				159.9	M
Total Drill Pipe HW				56.4	M
Total Drill Collar				196.06	M

Comments: SAMPLE CHAMBER SLIGHTLY PLUGGED WITH MUD.

DOWELL Schlumberger

Formation Evaluation Da

To be completed by Customer Representative

Report No. F 82024

Customer : HUDBAY OIL Well No. : WHALE 1 Test No. : 1

Tested Interval	Sand-stone	Lime-stone	Chalk	Clay	Shale	Other (please specify)
Major Mineral Species						
Minor Mineral Species						
Stringers or Lenses						

Is the tested interval : Open Hole : [ ] I.D. [ ] in

In Casing : [ ] O.D. [ ] in. Wt : [ ] lb./ft. I.D. [ ] in.

Open Hole Interval : (Total Depth) ______ (Foot of Casing) ______

Perforated Intervals : ______

In the tested interval how many productive zones do logs show : 1 [ ] 2 [ ] 3 [ ] more [ ]

What is the average porosity of the interval ? [ ] %

Is the interval homogeneous ? Yes [ ] No [ ]

Is formation consolidation : Good [ ] Mod [ ] Low [ ]

What is the clay content : % or High [ ] Mod [ ] Low [ ]

Is the formation fractured Heavily [ ] Mod [ ] Little [ ]

In this interval, is there expected near the wellbore :

- Geological fault ? Yes [ ] No [ ]
- Interval thickness change ? Yes [ ] No [ ]
- Fluid phase contact ? Yes [ ] No [ ]
- —If yes :— Oil-Water [ ] Gas-Water [ ] Oil-Gas [ ]

During drilling of the interval, was there :

- Lost circulation ? Yes [ ] No [ ]
- Sand production ? Yes [ ] No [ ]
- Other (please specify) ______

Before testing was there a :

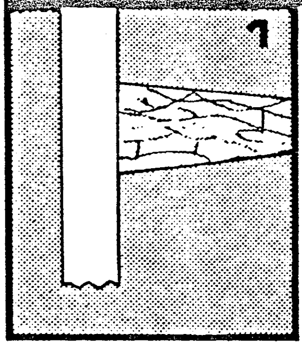
- Scraper run ? Yes [ ] No [ ]
- Caliper run ? Yes [ ] No [ ]
- Mud circulation to bottom ? Yes [ ] No [ ]
- —If yes :— for how long [ ] If no, how long since [ ]

Additional Comments : ______

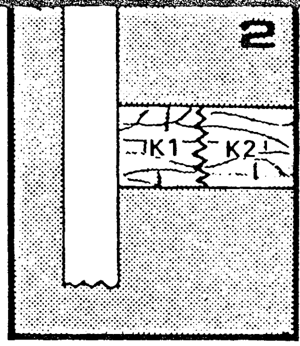
Customer Representative : ______

GEOLOGICAL INTERPRETATION GUIDE *

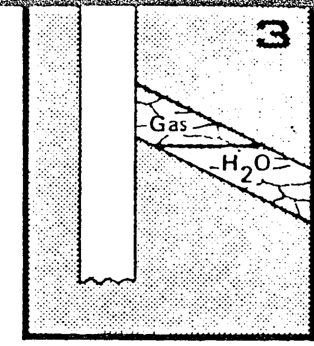
1 General Causes of a Break Upward in Slope Value



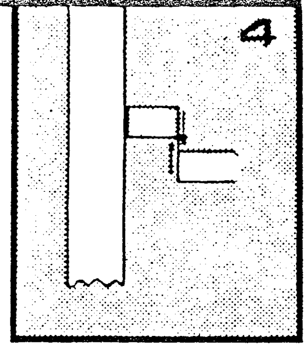
Decrease in thickness of pay zone away from well bore



Decrease in effective permeability away from well bore (facies change) K1 K2

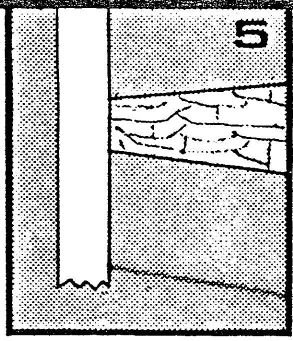


Increase in fluid viscosities away from the well bore (gas-water contact, gas-oil contact)

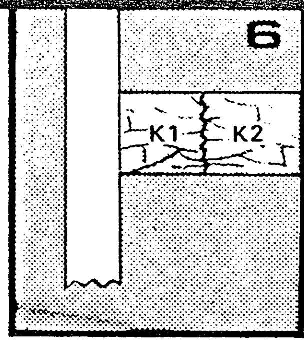


Sealing barrier (fault)

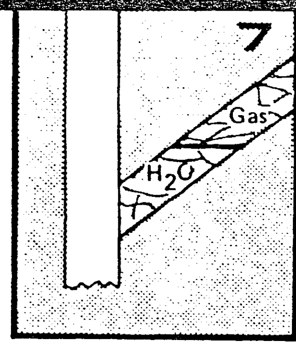
2 General Causes of a Break Downward in Slope Value



Increase in thickness of pay zone away from well bore

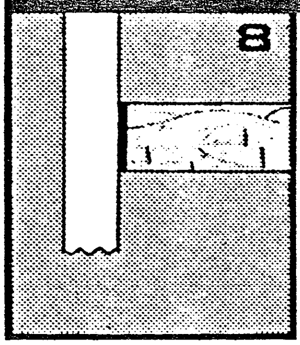


Increase in effective permeability away from well bore K1 K2

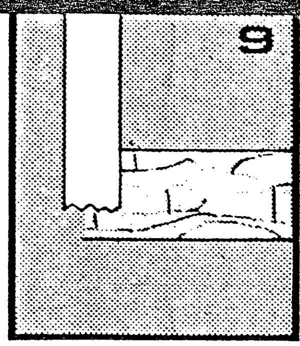


Decrease in fluid viscosities away from well bore

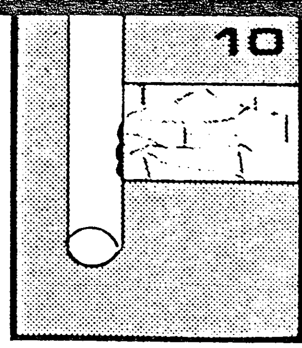
3 Conditions Which Will Give Indication of Damage or Stimulation



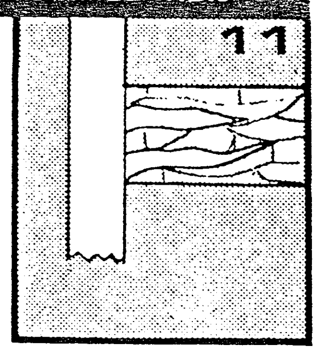
True Skin Damage - (Caused by : filtrate invasion, bit damage, drilling solids invasion, etc..)



Pseudo Damage - Incomplete penetration of porous zone



Pseudo Damage - Choking effect of perforations (cased hole)



Stimulation limited natural fracture system

* Illustrated causes of anomalies detected through pressure build-up analysis

APPENDIX A3 R I G   P O S I T I O N I N G   R E P O R T

WHALE-1

RIG POSITIONING REPORT

Submitted By: P.A. Carter,
GEOPHYSICIST

Supervised By: A. Ferworn,
CHIEF GEOPHYSICIST

December, 1981

TABLE OF CONTENTS

INTRODUCTION

FINAL POSITION

DAILY LOG

TRISPONDER BASE STATIONS

SURVEY NET VERIFICATION

INTRODUCTION

The proposed location for Whale-1 was SP 172.6 on line GB81-37. The co-ordinates for this position were:

Latitude	:	38^o	01'	18.61"	SOUTH
Longitude	:	148^o	33'	32.7 "	EAST

UTM co-ordinates from the central meridian 147^o

Easting	:	636848 metres
Northing	:	5790601 metres

The positioning survey consisted of four phases:

1. Setting up the Trisponder survey net.
2. Checking the Trisponder survey net.
3. Positioning the Moon Pool and eight anchor buoys.
4. Determining the final rig location.

The Trisponder System was the primary navigation system used for positioning the "Petromar North Sea" and the JMR-4 satellite receiver was an independent check on the system. Decca Survey Australia supplied and operated the survey equipment. A licensed surveyor from Navigation Australia checked the operations of the Decca personnel. Independent reports were prepared by Decca Survey and Navigation Australia.

FINAL POSITION

The "Petromar North Sea" was moored in the final position for Whale-1 on December 1, 1981. The calm seas and good Trisponder signals allowed the rig to be positioned and moored within twenty-one hours. The Trisponder System proved to be both accurate and reliable throughout the whole operation.

Final position of Whale-1

Latitude	:	38^{o}	01'	17.182"
Longitude	:	148^{o}	33'	34.172"

UTM co-ordinates from the 147^{o} central Meridian.

Northings	:	5790644
Eastings	:	636884

The distance and bearing between the proposed location and the final location: 56 metres at 040^{o}.

JMR-4 satellite observations were taken on the rig to check the locations of Whale-1. The final position determined by satellite was:

Latitude	:	38^{o}	01'	16.786"
Longitude	:	148^{o}	33'	33.691"

This position is within 10 metres of the Trisponder location.

DAILY LOG

Sunday - November 15

2300 R. Keene (Navigation Australia) and H. Sit (H.O.A.L.) departed Perth.

0500 Arrived Melbourne.

0530 Departed Melbourne.

1100 Arrived "Petromar North Sea".

Monday - November 16

Waited for Baleen-1 to be completed.

Tuesday - November 17

Waited for the evaluation of Baleen-1 to be completed.

Wednesday - November 18

H.O.A.L. decided to drill stem test Baleen-1.

Thursday - November 19

0730 H. Sit and R. Keene departed "Petromar North Sea" since D.S.T. was going to take 5 days.

0930 Departed Melbourne.

1200 Arrived Perth.

Tuesday - November 24

2300 P. Carter (H.O.A.L.) and R. Keene (Navigation Australia) departed Perth.

Wednesday - November 25

0500 Arrived Melbourne.

0530 Departed Melbourne by light aircraft.

0640 Arrived Bairnsdale.

0645 Departed Bairnsland by helicopter.

0700 Arrived "Petromar North Sea"
Waited on D.S.T. for Baleen-1.

Thursday - November 26

Waited on D.S.T. for Baleen-1

Friday - November 27

Waited on D.S.T. for Baleen-1.

Saturday - November 28

Waited on D.S.T. for Baleen-1.

Sunday - November 29

0800	"Yardie Creek" departed Baleen-1 location.
0930	Positioned moon pool buoy for Whale-1.
1200	Positioned all anchor buoys.
	Waited on completion of Baleen-1.

Monday - November 30

0520	"Petormar North Sea" departed Baleen-1 location.
0945	Rig dropped first stern anchor (No.5) at Whale-1 location. Sea state 2.
2115	Dropped last anchor (No.3). Anchors left to soak.

Tuesday - December 1

0400	Started to tension up anchors. Rig approximately 124 metres off porposed Whale-1 location. Trisponder signals good.
0530	Satellite pass placed rig within 15 metres of Trisponder location. Rig moved closer to proposed location by adjusting anchors.
0630	All anchors tensioned up. Trisponder ranges recorded. Rig 54 metres off proposed location. Given go ahead to spud.
0710	P. Carter and R. Keene departed rig for Bairnsdale.
0740	Departed Bairnsdale for Melbourne.
0930	Departed Melbourne for Perth.
1200	Arrived Perth.

TRISPONDER BASE STATIONS

The following base stations were used for the Trisponder survey net:

Mt. Cann

Lat.	37°	38'	54.48" S
Long.	148°	58'	40.36" E
N.	5 831 332.7		
E.	674 487.5		

Zone 55

Mt. Raymond

Lat.	37°	42'	47.87" S
Long.	148°	35'	55.78" E
N.	5 824 777.0		
E.	640 921.4		

Zone 55

Nowa Nowa Tower

Lat.	37°	41'	38.73"S
Long.	148°	05'	23.05"E
N.	5 827 552.2		
E.	596 073.9		

Zone 55

Jemmy's Lookout

Lat.	37°	52'	56.26"S
Long.	147°	57'	46.18"E
N.	5 806 793.0		
E.	584 670.0		

Zone 55

Computed distances to Whale-1 from base stations:

Mt. Cann	55470 metres
Mt. Raymond	34425 metres
Nowa Nowa Tower	55041 metres
Jemmy's Lookout	54646 metres

- SURVEY NET VERIFICATION

The Trisponder net was verified by rechecking the position of Baleen-1 before the "Petromar North Sea" had moved off location. The check gave a position within 2 metres of the known location.

The JMR-4 satellite receiver also checked the Trisponder net. The final location for Whale-1, given by satellite, was within 10 metres of the Trisponder location.

3.0 GEOLOGY

(Pages 17-37)

3.0 GEOLOGY

3.1 Summary of Previous Investigations

Gippsland Basin exploration commenced in 1924 with the reported discovery of oil and gas in a water bore drilled near Lakes Entrance. To date, over 125 wells have been drilled in the onshore part of the basin but only minor hydrocarbon accumulations have been encountered.

The first exploration in the offshore Gippsland Basin was by the Bureau of Mineral Resources, which conducted a regional gravity and aeromagnetic survey between the years 1951 and 1956. The first permits, covering a large part of the offshore Gippsland Basin, were taken up by BHP Co. Ltd. (later Hematite Petroleum Pty. Ltd.) in 1960. Esso joined the original permittee in 1964 and the first offshore well, Barracouta No.1, was drilled in 1965. Over eighty offshore wells have now been drilled in the basin, resulting in the discovery of recoverable reserves of approximately 3 billion barrels (465.8 gigalitres) of oil and 8 trillion cubic feet (220.4 GM^3) of gas.

A summary of early contributions to the understanding of the geology and hydrocarbon potential of the Gippsland Basin was presented by W.F. Threlfall and others, 1974. Esso-BHP have published several papers regarding their exploration and development of the basin, and several papers dealing with the geology of individual fields were published as the fields were developed.

Vic/P-11, the Exploration Permit in which Whale-1 was drilled, was a composite of blocks formerly held by Esso-BHP as part of Vic/P-1 and by a consortium headed by BOC Australia as part of Vic/P-8. The area now covered by Vic/P-11 was gazetted in December 1976. The Permit was granted to Gas and Fuel Corporation of Victoria on August 8, 1978, and Beach Petroleum subsequently became joint Permittee and Operator.

Hudbay Oil (Australia) Ltd. farmed into the Permit in December, 1980 and in February 1981 shot the GB81 Seismic Survey, consisting of 359 line kilometres of 36-fold seismic. Detailed mapping, incorporating data from the GB81 survey, Beach Petroleum's GB79 Seismic Survey and trade data from Esso's G80A Seismic Survey, defined several prospects. Whale-1 was the third well of a proposed four well drilling programme in Vic/P-11.

3.2 Geological Setting

3.2.1 Regional Setting

The Whale structure lies towards the northern margin of the Gippsland Basin. The Gippsland Basin is situated in south-eastern Australia and is bounded to the north and south by the Victorian Highlands and Bassian Rise respectively (Enclosure 2) The western limit of the basin is taken as the Mornington Peninsula and to the east the basin opens to the Tasman Sea. The Basin covers approximately 50,000 km^2 and is filled with up to 10,000 metres of Lower Cretaceous to Recent sediments.

3.2.2 Tectonic Elements (Enclosure 2 & Figure 13)

The offshore Gippsland basin is separated by fault complexes into three major divisions: The North Platform, or Lakes Entrance Platform; the Graben-like Central Deep (Basin) or Strzelecki Basin and the South Platform (Hocking & Taylor, 1964; James and Evans, 1971; Hocking, 1972).

The stable platforms to the north and south are areas where the Tertiary sequence unconformably overlies Palaeozoic basement. In these areas the structures within the Tertiary section consist simply of small scale draping over palaeotopographic ridges and small fault scarps.

The Southern Platform is separated from the Central Deep Basin by a major fault complex, the Foster Fault System or South Bounding Fault, a system of down-to-basin normal faults arranged en echelon. The northern boundary of the Central Deep is less well defined.

Major fault trends within the central part of the basin are the east-west trending Foster Fault and the antithetic, east-west trending Rosedale Fault System, which crosses the Vic/P-11 permit. This latter is known to be a reverse fault superimposed upon an older normal fault within the Lower Cretaceous, with a throw of over 300 metres in the Whale area. Reverse movement along the fault system is believed to have occurred as a result of the same stresses that led to the development of the major anticlines in the central basin during the late Eocene to early Oligocene.

Numerous northwest-southeast, basin-forming, normal faults have been recognized within the Central Deep. The general trend of the faulting is parallel to faulting in the neighbouring Bass Basin.

The major hydrocarbon bearing anticlinal structures in the central basin are elongate, with a dominantly southwest-northeast axial trend, and in some cases their culminations are subdivided into en echelon strings, e.g. the Bream - Kingfish trend. This is believed to be due to convergent, right-lateral shear movement between opposed continental plates, and is consistent with the observed reverse movement which has been superimposed upon many of the older, normal faults. It is this reverse movement which is responsible for producing the main hydrocarbon traps within the basin.

3.2.3 Geological Evolution and Regional Stratigraphy

During the Lower to Middle Palaeozoic a series of major orogenies occurred within the Tasman Geosyncline. This resulted in a dominantly north-south structural grain within the tightly folded and faulted Palaeozoic metamorphics. These geosynclinal sediments were subsequently intruded by Lower Devonian granitic rocks. A major rift formed across southern Australia during the Jurassic due to the separation of the Antarctic and Australian cratons. The rift valley formed over the entire length of the present southern coast of Australia. Into this major depositional axis a typical sequence of rift valley sediments was rapidly deposited, as clastics were stripped from the adjacent Palaeozoic highlands. The initial deposits of the Upper Jurassic to Lower Neocomian consist of conglomeratic wedges and alluvial fan detritus commonly of a quartzose sandstone nature. Jurassic intrusives and Lower Cretaceous extrusives, both associated with rifting, provided a major provenance for the 3,500 metres of Lower Cretaceous Strzelecki Group sediments.

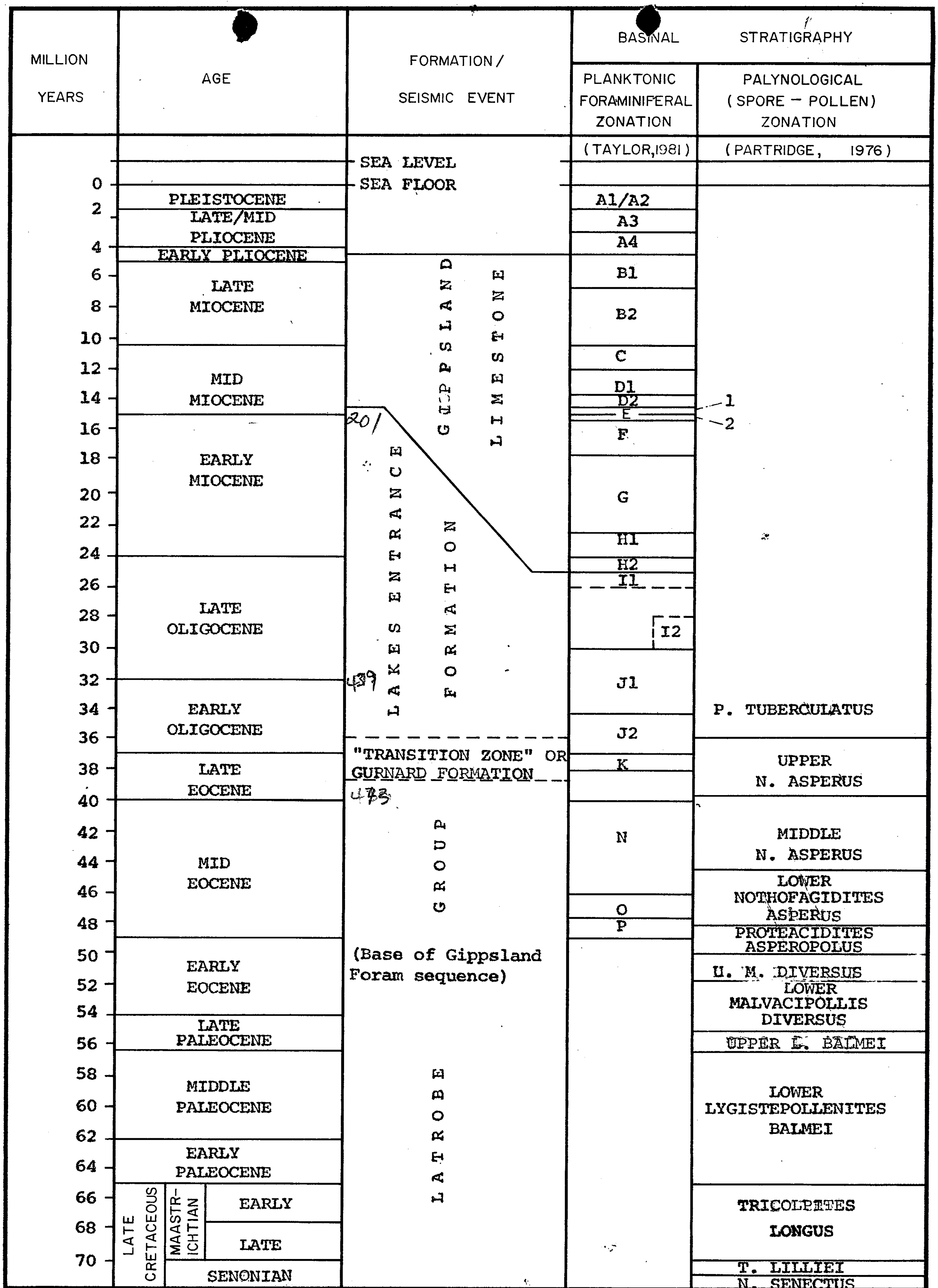
During Lower Cretaceous times the Gippsland Basin formed a half graben with the major subsidence along the southern Foster Fault system. The Strzelecki Group sediments are texturally mature but mineralogically immature, being felspathic and chloritic. They consist of a monotonous cyclic sequence of interbedded sands, silts and muds deposited on a subsiding fluvial plain. A large east-west rift developed, separating sediments of the Tasman Geosyncline. The eastern end of this rift probably terminated in a triple junction, formed by the Australian, Antarctic and Lord Howe Rise plates. The western arm of the triple junction was coincident with the ancestral Otway and Gippsland Basins and, as this arm of the triple junction failed during the Turonian, the Lord Howe Rise plate moved eastwards away from the Australian-Antarctic plate. This resulted in the rifting of the eastern portion of the Antarctic and Australian plates along a line parallel to, and off the west coast of Tasmania. Therefore the Tasmanian craton remained attached to the Australian plate but was separated from it by an east-west aborted rift valley basin.

The Lower Cretaceous Strzelecki Group sediments are unconformably overlain by up to 5,000 metres of fluviatile and lacustrine Latrobe Group sediments. Upper Cretaceous sedimentation tended to be superimposed on the underlying Strzelecki Group with the deposition of shales, minor coals and poorly sorted sandstones in a fluviatile environment. In the late Upper Cretaceous, approximately 85 million years B.P., the Lord Howe Rise Plate moved away resulting in the deposition of a complex system of fluvial and deltaic plain sediments sourced from the northwest and north. Growth and movement on the basin-forming normal faults resulted in continued subsidence of the basin during the Palaeocene and Eocene.

The northern part of the basin was uplifted as fault movement elsewhere in the basin lessened during the Eocene. A period of submarine and subaerial channel cutting occurred during the Middle to Upper Eocene in the Tuna-Flounder area. The channel cutting preceded the onset of a marine transgression from the southeast during the uppermost Eocene to Lower Oligocene. This was a period of instability and basin tilting. The en echelon disposition of the fold trends and fault systems is most likely the result of Upper Eocene east-west, right lateral, convergent shear deformation. The crestal areas of the folds were subsequently eroded during an associated period of relative sea level drop while the deeper parts of the basin continued to receive sediments. The compressional regime reactivated the severe channeling and the Marlin Channel was formed as subaerial and submarine drainage systems were laterally restricted.

The transgression continued into the Lower Oligocene with the deposition of shallow water glauconitic sands and silts of the Gurnard Formation. Around the margins of the basin sand buildups occurred as the transgression reached its maximum extent. During the uppermost Eocene to Lower Oligocene a marked change in sediment type occurred. The fluvial and deltaic coarse grained clastics were replaced by fine grained, calcareous shales and marls. The change in sediment type may be due, in part, to a change in provenance related to the widespread deposition onshore of volcanics during the Upper Eocene wrenching episode.

Sea level fluctuations during the Miocene produced a complex system of interfingering and overlapping channels. The channels were cut into the soft limestones and marls of the Lakes Entrance Formation and Gippsland Limestone. A linear, submarine slump zone of over 125 kilometres in length has been observed along the major south bounding fault. A wedge of sediment moved towards the centre of the basin as a result of reactivation of the fault during the Miocene. A major cratonic uplift, the Kosciusko Uplift, was initiated in the Miocene and culminated during the Upper Pliocene and Lower Pleistocene. The Victorian Highlands were uplifted and provided a renewed clastic provenance while faults and associated structures around the northern margins of the basin were rejuvenated. Extensive erosion is currently occurring in the Strzelecki Hills and a relatively thin veneer of Quarternary sediments is currently being deposited across the southeastern Gippsland coastal plain.



Author: B. Butcher	Hudbay Oil (Australia) Ltd.	Scale:
Drawn: A. Clark	OFFSHORE GIPPSLAND BASIN	
Date: April 1982	**REGIONAL STATIGRAPHIC COLUMN**	Drawing № A4-GL-490

Figure 13

3.3 Stratigraphy

A sedimentary sequence ranging in age from Lower Cretaceous to Lower Miocene was penetrated in Whale-1 (Figure 13 & 14).

Age determinations are based upon palaeontological and palynological studies of sidewall cores (Appendices B1 and B2). The boundaries of individual units were established using the age determinations in conjunction with lithological and wireline log interpretations. Time-rock subdivisions were placed midway between sidewall core points, unless more accurate subdivisions were made possible by log response or cuttings lithology.

No samples were collected prior to installing the 20" casing, thus no age determinations were made between 201 metres and the seabed.

The stratigraphy of Whale-1 is described as follows, in decreasing depth order.

Lower Cretaceous (810 - 473 metres)

Interbedded claystone, siltstone and argillaceous sandstone between 810 and 730 metres, with minor thin coal laminae at 779, 773 and 763 metres. The sandstones are less argillaceous towards the top of the sequence and contain minor carbonate stringers. Carbonaceous claystone grades into siltstone and argillaceous sandstone between 730 and 673 metres with minor carbonate stringers and coal laminae at 725 metres. The sequence reverts to a dominantly undifferentiated claystone, siltstone and argillaceous sandstone lithology between 673 and 473 metres with carbonate stringers and carbonate enriched zones between 660 and 507 metres and thin coal laminae between 556 and 479 metres. Palynologically this sequence was barren or indeterminate (Appendix B2).

Upper Eocene - Lower Oligocene (473 - 439 metres)

i) 473-465 metres. Sandstone, very coarse to granular, occasionally conglomeratic, angular to rounded, unconsolidated. This sandstone is generally clean but has some fine grained interbeds with minor coal laminae at 467 metres. This sequence has been dated palynologically as between upper M. Diversus to lower N. Asperus (Partridge 1976 APEA Journal).

ii) 465-459 metres. Sandstone brown to light brown to clear, very fine grained, and having extremely good fluorescence and visible oil stain.

iii) 459-444 metres. Sandstone goethitic, dark brown to brown, very fine grained occasionally silty, trace-40% glauconite, very good fluorescence, petroliferous odour and visible oil stain.

iv) 444-439 metres. Siltstone, goethitic, dark brown, 10-20% clay sized fraction, no fluorescence.

The palynological and palaeontological assembledges between 465 and 429 metres place this marine lithological sequence within the late Eocene-Early Oligocene N. Asperus (Partridge 1976), K-J2 planktonic foraminiferal zonation (Taylor 1981).

Lower Miocene (439 - 201 metres)

Calcarenite grading to calcisiltite and calcilutite with minor marl, trace-50% skeletal fragments, 10-40% clay minerals, occasional recrystallisation of calcite within skeletal tests, 20% glauconite at the base of the section. The glauconite is probably derived by reworking of the underlying glauconitic unit. Because of the lack of palaeontological and palynological differentiation no specific zonation was possible within the Lower Miocene sequence.

Lower Miocene - Recent (201 - Sea Floor)

No returns were taken prior to the installation of the 20" casing and the marine riser. This section is interpreted to contain limestones and marls based on regional geology.

STRATIGRAPHY	PLANKTONIC FORAM ZONE	PALYNOLOGICAL (SPORE - POLLEN)	DRILL DEPTH (metres)	SUBSEA DEPTH (metres)	EVENT	PALAEO DEPOSITIONAL ENVIRONMENT
	(Taylor, 1981)	(Partridge, 1976)				
			9.45	0	SEA LEVEL	
			52	42.5	SEA FLOOR	
RECENT TO MIDDLE MIOCENE	A TO D		240	230.5	TRANSITIONAL	
MIDDLE MIOCENE	D-Z		388	378.5	TRANSITIONAL	SHELF EDGE CANYON > 100 METRES
LOWER MIOCENE	F		395	385.5		SHELF EDGE CANYON > 200 METRES
	G		415	405.5	TRANSITIONAL	MID SHELF CANYON 40 METRES
			437	427.5		INNER/MID SHELF CANYON HEAD ≈ 40 METRES
		INDETERMINATE	439	429.5	UNCONFORMITY	
UPPER EOCENE TO ?OLIGOCENE	K TO J?	LATE N. ASPERUS	440	430.5		ESTUARINE TO BACK BARRIER LAGOON
		INDETERMINATE	442	432.5		
		N. ASPERUS	445	435.5		
		INDETERMINATE	457	447.5		
		NO OLDER THAN M. DIVERSUS	459	449.5	TRANSITIONAL	
			462	452.5		BACK BARRIER LAGOON TO DELTAIC
? BASE OF FORAMINIFERAL SEQUENCE			467	457.5	EXAMINED	
		BARREN	475	465.5	UNCONFORMITY	?MARINE
LOWER CRETACEOUS		INDETERMINATE	498	488.5	STRZELECKI GROUP	NON MARINE
		?	502	492.5		
APTIAN		DICTYOTOSPORITES	560	550.5		
		INDETERMINATE	810	800.5	TOTAL DEPTH	

Author: J. Roestenburg

Drawn by: K. Lynch

Hudbay Oil (Australia) Ltd.

WHALE - 1

STRATIGRAPHIC TABLE

Date: April, 1982

Drawing Nº A4-GL-535

Figure 14

3.4 Structure

The Whale anomaly is an antiformal flexure, located in the eastern portion of the Vic/P-11 permit. The structure is fault bounded to the north. The anomaly is thought to have resulted from tectonism associated with the continental breakup of Australia and Antarctica. Subsequent recurrent fault movement during the Eocene to Lower Oligocene caused reversal and growth on the northern bounding fault system. Contained within the anomaly is an upthrown block of Lower Cretaceous rocks, which is thought to be due to the Upper Miocene Kosciusko orogeny. The anomaly is sealed by calcilutites, marls and argillaceous siltstones of Lower Miocene age. The well was drilled to test the eastern flank of the anomaly, adjacent to the up-thrusted fault block. It is proposed that Lower Oligocene subaerial exposure of the Whale anomaly, indicated by a ferruginised glauconitic siltstone, suggests that the marine transgression which commenced during the uppermost Eocene was complete at Whale-1 during the Lower Oligocene. (See section 3.2.3 of this report).

A high resolution dipmeter was run from total depth to the base of the 9-5/8" casing shoe at 396 metres. Cyberdip processing of the dipmeter facilitated the interpretation.

Dips recorded in Whale-1 were distributed as follows:-

Lower Cretaceous (810 - 473 metres)

Interbedded claystone, siltstone and sandstone with dips generally high, varying between 10-20^{o} structural and sedimentary dip combined, with a dominant northwest-southeast sediment transport direction.

Upper Eocene - Lower Oligocene (473 - 439 metres)

Fine to coarse grained sandstones and ferruginous siltstones had generally low dips and displayed random azimuths.

Lower Miocene - Recent (439 - 201 metres)

Carbonate lithologies from 434-201 metres, had low dips with random azimuths. A very low 2^{o} structural dip is proposed for the calystone section from 439-434 metres. The occasional high dip readings at 431 and 422 metres are thought to be due to dipmeter measurements on isolated skeletal fragments within the carbonates.

Indications of depositional environment such as red patterns (dip increasing with depth) and blue patterns (dip decreasing with depth) were unresolvable from the dipmeter. No significant red or blue dip patterns were seen in the coarse sandstones and siltstones of the primary objective between 473 and 439 metres. This supports the proposal that these sediments are part of an Upper Eocene - Lower Oligocene marine transgression and are flat lying. See section 3.3 of this report for a detailed stratigraphic interpretation.

3.5 Predicted and Actual Depth to Seismic Markers

The depths to the main seismic events recognized in Whale-1 are listed in the following table. Further details are given in Enclosures 5 & 6, and Figure 15.

Horizon Identification - Whale-1

Location : Line GB81-41 Shot Point 134.9

Horizon	Predicted Depth	Actual Depth	Reflection Time (2t)
Water Bottom	52.0 m	52.0 m	0.068
Top Oligocene ferruginous unit	416.0 m	429.0 m	0.483
Top Strzelecki	480.0 m	463.6 m	0.520

Note: These depths are subsea.

3.6 Porosity and Permeability

Porosities at Whale-1 were estimated by wireline log interpretation and microscopic examination. The estimate of the permeability of selected lithologies was derived from two Drill Stem Tests (Appendices A1 and B3).

The porosities were distributed as follows:-

i) Lower Cretaceous sandstones and siltstones between 810-473 metres had generally low porosities:- 2-5% in siltstones and 2-10% in the sandstones. Partial calcite cementation, and varying clay content lowered porosities locally in this interval.

ii) Upper Eocene - Lower Oligocene primary objective rocks had varying porosities, reaching a maximum of 23% in coarse sandstones between 473 and 465 metres. A coarse grained, radioactive sandstone between 465 and 460 metres had porosities varying between 5 and 20%. Porosities between 5 and 10% were recorded in glauconitic sandstones between 460 and 444 metres, whilst lower values, generally less than 5% were recorded in ferruginous siltstones between 444 and 439 metres.

iii) Lower Miocene carbonates between 439 and 201 metres had no porosity. These form the seal to the primary objective.

Two Drill Stem Tests (DST) were conducted in Whale-1. DST No.1 (465-460 metres) indicated a permeability in excess of 1000 millidarcies (md), by a variable rate Horner analysis. DST No.2 (454-445 metres) provided an extremely low permeability of 0.025 md, by the same method.

Both DST's tested primary objective rocks and indicated that except for the interval 465-460 metres, the remaining critical zones have extremely low permeabilities.

3.7 Hydrocarbon Indications

3.7.1 Summary

Hydrocarbon analyses were initiated after the 20" casing was set at 201 metres. Gaseous hydrocarbons were collected at the flowline and analysed for Total Gas (TG) and Petroleum Vapours (PV's). Gas levels were recorded in units, one unit being 200 parts per million (ppm) of 1% methane in air. Maximum gas values were recorded at 460 and 436 metres in the well. These were: 38 units of TG, consisting of 8000 ppm methane with 30 ppm isobutane at 460 metres and 20 units TG, consisting of 4500 ppm methane at 436 metres.

Wireline log interpretation, sample fluorescence and sidewall core analyses indicated one oil bearing interval in the well between 473 and 439 metres. Oil staining and fluorescence were highest at 472 metres at the base of the primary objective.

The well contained no movable hydrocarbons.

3.7.2 During Drilling

Continuous Gas Monitoring

The following table summarizes the gas recordings of Whale-1:

Depth (m)	Total Gas	Pet. Vap.	C_1	C_2	C_3	iC_4	nC_4	C_5
220-404	tr-8	0-tr	tr-1590	0-4	0	0	0	0
404-436	3-11	0	573-2000	0	0	0	0	0
436-439	26	0	4488	0	0	0	6	0
439-500	2-40	0	114-8000	0	0	0	0-34	0
500-620	1-5	0-tr	133-874	43	0	0	0	0
620-665	1-2	0	134-287	0	0	0	0	0
665-850	½-2	0	10-206	0	0	0	0	0

Notes:
1) Two peaks at 436 and 460 metres contain connection gas.
2) Normal background gas throughout the well did not exceed 5 units.
3) TG and PV values are in units, C_1-C_5 are in ppm.
4) PV consist of "C_2" and higher gases.
5) The gas values were highest immediately above

PE905516

This is an enclosure indicator page.
The enclosure PE905516 is enclosed within the container PE900000 at this location in this document.

The enclosure PE905516 has the following characteristics:

```
     ITEM_BARCODE = PE905516
CONTAINER_BARCODE = PE900000
             NAME = Predicted and Actual Section
            BASIN = GIPPSLAND
           PERMIT = VIC/P11
             TYPE = WELL
          SUBTYPE = STRAT_COLUMN
      DESCRIPTION = Predicted and Actual Section (from WCR)
                    for Whale-1
          REMARKS =
     DATE_CREATED = 31/05/82
    DATE_RECEIVED = 13/07/82
             W_NO = W761
        WELL_NAME = WHALE-1
       CONTRACTOR =
     CLIENT_OP_CO = HUDBAY OIL (AUSTRALIA) LTD
```

(Inserted by DNRE - Vic Govt Mines Dept)

the primary objective (Upper Eocene - Lower Oligocene rocks) and at the base of the ferruginous siltstone unit at 439 and 460 metres respectively.

Fluorescence from Drill Cuttings

Substantial fluorescence was noted within part of the Upper Eocene - Lower Oligocene rocks between 473-439 metres. The highest fluorescence was at 472 metres. The fluoresence was typically very bright yellow to yellow gold over the entire sample or sidewall core examined and had an instant blue, white streaming solvent fluorescence, strong petroliferous odour, light brown stain and straw yellow to pale yellow solvent colour in white light.

From the wireline log analysis it has been determined that the hydrocarbon saturations were 40-50% over the interval 460-470.5 metres, and that water saturations vary between 35 and 90%. The water saturations across both Drill Stem Test intervals were calculated at 80% and between 35% and 60% respectively. Neither the calcareous Lower Oligocene and Miocene rocks, above 439, nor the Lower Cretaceous rocks below 473 metres had any fluorescence. Repeat Formation Testing (RFT's) and subsequent Drill Stem Testing failed to recover any hydrocarbons from the well.

Thus the hydrocarbons in Whale-1 are considered to be immovable and residual.

Note: Gas chromatograph malfunction was responsible for the loss of some higher hydrocarbon records, i.e. C_3, iC_4 and C_5.

3.8 Contributions to Geological Knowledge

1) No commercial hydrocarbons occur at the Whale-1 location.

2) Whale-1 intersected a rock sequence which is almost identical to that intersected in the nearby Flathead-1 well. This indicates a lateral continuity of lithology between the two wells which are separated by an uplifted Lower Cretaceous (Strzelecki Group) fault block.

3) A brown goethitic siltstone unit, was intersected in Whale-1 at 439 metres and in Flathead-1 at 448 metres. This is believed to represent the top of an Oligocene transgressive unit which extends between both wells.

4) The interval overlying the Lower Cretaceous Strzelecki Group was identified palynologically as being marine in origin. Therefore it is proposed that no Latrobe Group sediments were intersected in Whale-1.

5) It is proposed that the Whale-1 location was subaerially exposed during Upper Eocene - Lower Oligocene times, resulting in the oxidation of glauconite to goethite.

6) The marine transgression was complete at Whale-1 by the Lower Oligocene.

7) Geochemical analyses (Appendix B4) indicate that the immovable residual oil at Whale-1 is severely biodegraded.

4.0 WELL DATA

4.1 Formation Sampling

Exploration Logging of Australia Inc., provided a standard "Alpha" mud-logging service from the 20" casing shoe at 201 metres to total depth at 810 metres. The standard unit was upgraded by the addition of secondary equipment as follows:-

i) Auto Calcimeter - to determine carbonate content of drill cuttings, and core samples.

ii) Microcomputer Pit Volume Totalizer - to monitor the drilling mud volume on a 24 hour basis.

iii) Drill Monitor Panel - continuous digital read out of hookload, weight on bit, pump pressure, torque, rotary speed and casing pressure.

iv) Mud Weight Panel - dual mud weight in and out.

v) A Corrected Drilling Exponent Plot - aides in the prediction of over pressured formations. A manually drafted plot was made of the dxc based on values obtained from the secondary equipment (Enclosure 6).

5 metre representative washed and dried samples were taken for lithological and palaeontological identification. In addition, 15 metre composite palynological and geochemical samples were taken below the 20" casing shoe and the 9-5/8" shoe at 394.85 metres respectively.

Continuous ditch gas monitoring and gas chromatography systems were provided to assess the gaseous hydrocarbon phases. Standard microscopic and fluoroscopic techniques were utilized for identification of any liquid and residual hydrocarbon phases. The 5 metre representative ditch cutting samples were examined, tested and described by both Exploration Logging and Hudbay geologists.

The mudlog (Enclosure 6) was drawn at a scale of 1:500, recording penetration rate, lithology, liquid hydrocarbon indications, continuous ditch gas and chromatography, sample fluorescence, calcimetry and blendor/cuttings gas. An independent lithological log was maintained at well site by Hudbay personnel (Enclosure 5).

4.2 Coring Programme

4.2.1 Conventional Cores

No conventional cores were cut.

4.2.2 Sidewall Cores

Summary

Suite 1 (04/12/81)

Interval cored	:	228 - 400.1 metres
Shots attempted	:	30
Cores recovered	:	30
Bullets empty	:	nil
Bullets misfired	:	nil
Bullets lost	:	nil

Suite 2 (05/12/81)

Interval cored	:	395 - 810 metres
Shots attempted	:	60
Cores recovered	:	56
Bullets empty	:	2
Bullets misfired	:	nil
Bullets lost	:	2

In both runs the sample spread was designed to give the maximum distribution over the various lithologies encountered. The second run was designed to give the closest sidewall core spacing necessary to adequately test the reservoir sands, especially those with high fluorescence.

Palaeontological, palynological and geochemical analyses were carried out on selected sidewall cores (Appendices B1, B2 and B4). Sidewall cores analyses and descriptions are contained in Appendix B1, B2, B4 and B5.

4.3 Wireline Logs and Sampling

Schlumberger Seaco ran the following wireline logs and repeat formation tests:

Suite	Date	Logs	Interval (m)	Remarks
1	04/12/81	DIT/BHC/GR (1:200/1:500)	202.0 - 405.0	
1	04/12/81	FDC/GR (1:200/1:500)	202.0 - 405.0	
1	04/12/81	CST (1:200)	228.0 - 400.0	
1 & 2	12/12/81	BHC/GR spliced (1:200/1:500)	202.0 - 808.0	High GR background below 397 due to KCl in mud.
2	12/12/81	DLL/MSFL/GR (1:200/1:500)	396.0 - 806.0	Merged play back from run DLTB and MSFL/GR/ BHC.
2	12/12/81	FDC/CNL/GR (1:200/1:500)	396.0 - 809.0	MCl in mud = high GR
2	14/12/81	CST (1:200)	407.0 - 806.0	Two CST runs, 60 shots 56 recovered.
2	14/12/81	HDT (1:200)	396.0 - 809.0	Magnetic declination 13 degrees east.
2	13/12/81	CYBERLOOK (1:200)	396.5 - 805.0	High GR background caused by KCl in mud RWF unknown, hence several pass 2 films.
2	14/12/81	CYBERDIP (1:100)	396.0 - 810.0	Magnetic declination 13 degrees east.
2	13/12/81	RFT/GR	461.7 - 790	Inconclusive.
2	18/12/81	CBL/VAR DENS (1:200)	260.0 - 482.0	

Seismograph Service Limited were responsible for the velocity survey and the generation of a synthetic seismic trace.

4.3.1 Repeat Formation Tests (RFT)

The following table summarises the Repeat Formation Testing programme.

Date	Interval (m)	Pressure Tests	Sampling Attempts	Total
13/12/81	461.7 - 790	16	17	33

Two sample tests recovered filtrate and 12 pressure tests were successful.

The RFT programme indicated the following:

a) Water resistivities of the two recovered samples were 0.1623 and 0.063 ohms.

b) No movable hydrocarbons occur in the well.

Details of the RFT programme are given in Appendix B3.

Note: Appendix B3 represents an independent consultant's report. The stratigraphy listed uses formational nomenclature which is not necessarily supported by this well completion report.

5.0 REFERENCES

Partridge, A.D., 1976. The Geological Expression of Eustacy in the Early Tertiary of the Gippsland Basin; APEA J., V. 16, pt. 1, pp 73-79.

Taylor, David, 1981. Summary of Planktonic Foraminiferal Biostratigraphy - Gippsland Basin; Paltech P/L. Sept., 1981.

APPENDIX B1 PALAEONTOLOGY REPORT

FORAMINIFERAL SEQUENCE IN WHALE #1.

For: HUDBAY OIL (AUSTRALIA) LTD.

January 13th, 1982

Paltech Report
1982/02

PALTECH PTY LTD
MARINE MICROPALEONTOLOGISTS
SYDNEY NEW SOUTH WALES
MIDLAND WESTERN AUSTRALIA

THE FORAMINIFERAL SEQUENCE
IN WHALE # 1

Nineteen side wall cores from WHALE #1 were examined for foraminiferal content. On the basis of this examination the following biostratigraphic and environmental break-down of the sequence was noted:-

Sidewall Cores Depth (m)	Approx. E-log Unit Boundary	Age	Zone*	Paleoenvironment
388.3 to 394.2	Top	Early Miocene	F	Shelf edge canyon (>100m).
- - - - -	transitional	- - - - -	- - - - -	- - - - -
400.1 to 412.0		Early Miocene	G	Mid shelf canyon (>40m)
- - - - -	transitional	- - - - -	- - - - -	- - - - -
417.0 to 437.0		Early Miocene	H-1 to ?H-2	Inner/mid shelf Canyon Head (∿40m).
∿∿∿∿∿	439.0	∿∿∿∿∿	∿∿∿∿∿	∿∿∿∿∿
440.0 to 457.0		Late Eocene to ?Oligocene	K to ?J	Estuarine to back barrier lagoon
- - - - -	459.0	- - - - -	- - - - -	- - - - -
460.0 to 467.0		?	No forams found	back barrier lagoon to deltaic
- - -	base of sequence examined	- - - - -	- - - - -	- - - - -

*Planktonic foraminiferal zones after Taylor (in prep.).

A list of sidewall cores studied is shown on Tables 1 & 2. Side-wall cores at 470m, 472m & 475m were not examined as perusal indicated no meaningful yield of foraminifera would be obtained from destroying the sparse marterials recovered. Side-wall core at 407m was a very small sample and was not processed as samples above and below yielded sufficient data.

Planktonic foraminiferal content varied; being sporadic in the deltaic / estuarine sediments, but consistantly diagnostic in the marine carbonate sediments above 437m.

Tables I & II (herein) detail the record summarised on page 1. A correlation diagram, Figure 1, is included, as is a micropaleontological data sheet which shows the interpreted reliability of the planktonic foraminiferal zone determinations.

CORRELATION OF WHALE # 1 with ADJACENT WELLS and LAKES ENTRANCE

Figure 1, a fence diagram, demonstrates both biostratigraphic and approximate paleobathymetric correlation. As correlation with Baleen #1 is the most significant point, reference is made to the Baleen report (Paltech Report 1982/01) in order to avoid repetition.

Comparison between Whale and the nearby Flathead #1 sequence shows a remnant of Oligocene Zone I sediment in the latter sequence, whereas Zone I was not recognised in the former. It is noted that Oligocene planktonic foraminifera were recycled into basal Miocene sediments of Whale.

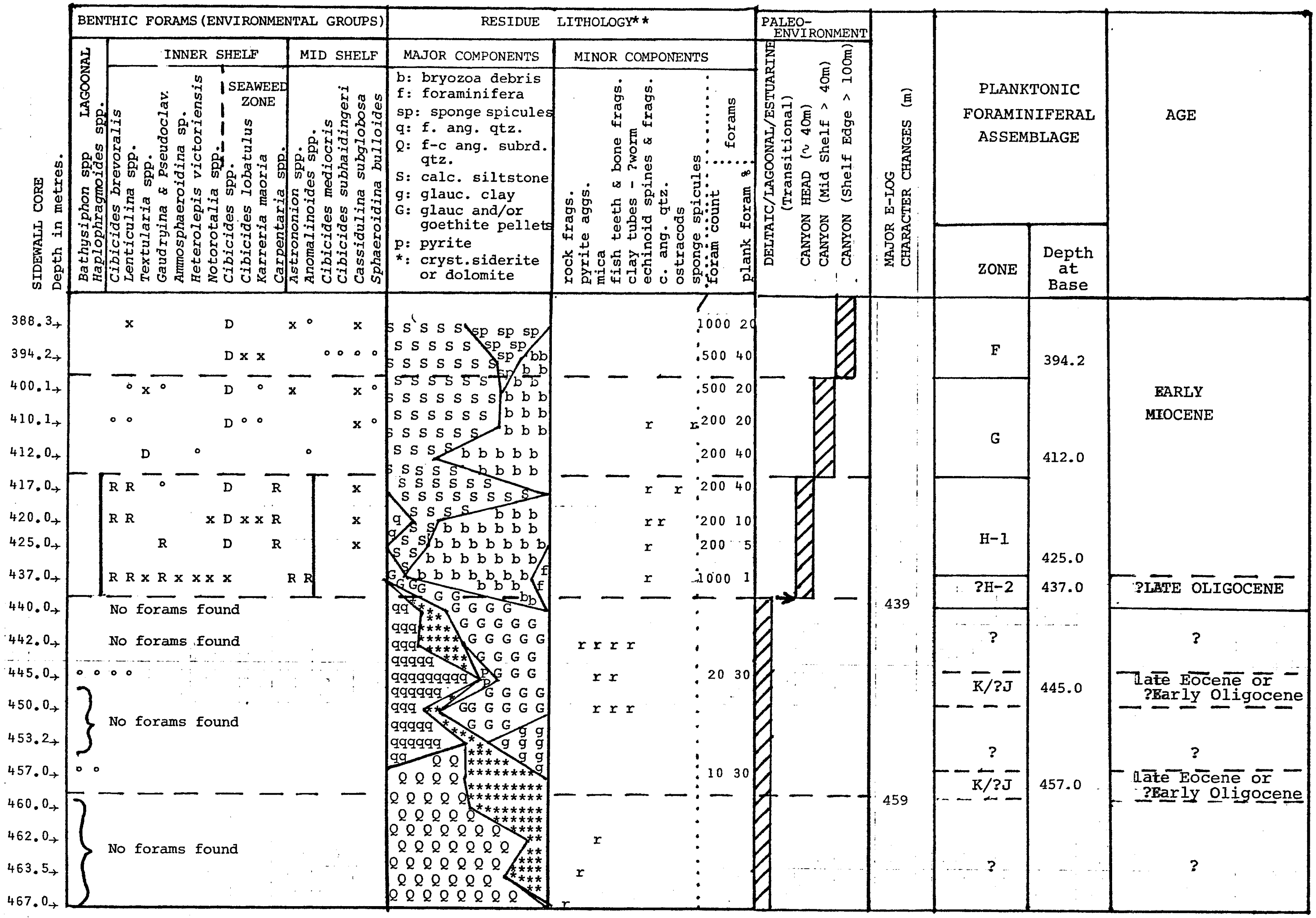
SIDEWALL CORE Depth in metres	G'ina angiporoides (s.s.)	G'ina labiacrassata	G'ina praebulloides	G'ina woodi woodi	G'ina woodi connecta	G'quad dehiscens (s.s.)	G'alia continuosa	G'alia zealandica (s.s.)	G'oides trilobus	G'alia bella	G'alia nana	G'alia miozea miozea	G'alia praescitula	G'ina bulloides	G'oides bisphericus	G'oides rubra	ZONE	Depth at Base	AGE
388.3				x		o		o	o			o		x	o		F	394.2	EARLY MIOCENE
394.2				x				o	x			o	o	x	x	o			
400.1				x	x				x			o	o	x			G	412.0	
410.0				x	o			o	x	o	o								
412.0				o	o	o	o	o	x	o									
417.0				o	o	o	o	o									H-1	425.0	
420.0			o	o	o														
425.0			o	o	o														
437.0	r	r	o	o													?H-2	437.0	?LATE OLIGOCENE
440.0	NO PLANKTONICS SEEN																?		?
442.0																			
445.0	o																K/?J	445.0	late Eocene or ?Early Oligocene
450.0	NO PLANKTONICS SEEN																?		?
453.2																			
457.0	o																K/?J	457.0	late Eocene or ?Early Oligocene
460.0	NO PLANKTONICS SEEN																?		?
462.0																			
463.5																			
467.0	Base of sequence examined																		

KEY: o <20 specimens
x >20 specimens
r recycled Eo/Oligocene specimens

TABLE 1:- PLANKTONIC FORAMINIFERAL DISTRIBUTION - WHALE #1

PALTECH REPORT 1982/02

GAF A4 2mm.



KEY: ° <20 specimens
x >20 specimens
D >60% of total count
R=reworked
r=rare
** visual estimate of processed sample.

TABLE 2: SIGNIFICANT BENTHONIC FORAMINIFERAL DISTRIBUTION, RESIDUE LITHOLOGY & PALEOENVIRONMENTAL ASSESSMENT - WHALE # 1.

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: 9.4 GL: 52.0

WELL NAME: WHALE # 1 — TOTAL DEPTH:

AGE		FORAM. ZONULES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4										
		B_1										
MIOCENE	LATE	B_2										
		C										
	MIDDLE	D_1										
		D_2										
		E_1										
		E_2										
	EARLY	F	388.3	1				394.2	0			
		G	400.1	0				412	1			
		H_1	417	1				425	1			
OLIGOCENE	LATE	H_2	437	2				437	2			
		I_1										
		I_2										
	EARLY	J_1	445*	2								
		J_2										
EOCENE		K						457*	2			
		Pre-K										

COMMENTS: SWCs at 445 and 457 contain only *Globigerina angiporoides angiporoides* which ranges from K to top J; therefore a K/J determination is all that can be given. However a Zone K designation is preferred.

CONFIDENCE RATING:

- O: 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: *PALTECH PTY. LTD.* DATE: 4/1/1982.

DATA REVISED BY: DATE:

APPENDIX B2 PALYNOLOGY REPORT

WHALE NO. 1 WELL

Palynological Examination and Kerogen Typing of Sidewall Cores

by

W.K. Harris

PALYNOLOGICAL REPORT

Client : Hudbay Oil (Australia) Ltd.

Study : Whale No. 1 Well, Gippsland Basin.

Aims : Determination of age and distribution of kerogen types and spore colour.

INTRODUCTION

Fifty three sidewall cores from Whale No. 1 Well drilled in the Gippsland Basin at Lat. 38°01'17.18"S, Long. 148°34'44.17"E in Vic. P-11 were processed by normal palynological procedures.

The basis for the biostratigraphic and consequent age determinations are based on Stover and Partridge (1973) and Partridge (1976) for the Tertiary sediments and principally on Dettmann (1963), Dettmann and Playford (1969) with the modifications of Dettmann and Douglas (1976) and Burger (1973) for the Early Cretaceous sequence.

OBSERVATIONS AND INTERPRETATION

A. Biostratigraphy

Table 1 summarises the biostratigraphy and age determinations for the samples studied. Tables II and III indicate the distribution of species encountered in the Early Cretaceous and Tertiary sequences respectively.

Several samples from this well are barren of plant microfossils and this is mostly due to unfavourable lithologies. These are dominated by light grey to white argillaceous sandstone and claystones generally representing oxidising environments of deposition.

Where plant microfossils have been recovered they are well preserved but assemblages were often not very diverse limiting the biostratigraphic precision.

1. Early Cretaceous - 806-475m.

Assemblages from this section in the interval from 806m to 586.5m are poorly diversified but well preserved. These are of Early Cretaceous aspect but a finer subdivision is not possible. At 560 and 502m good assemblages were recovered and the presence of Dictyotosporites speciosus indicates a correlation with the zone of that name. The age is Aptian. Elsewhere in the Otway and Eromanga Basins it has been possible to subdivide this unit into two sub-zones but the indicative species have not been recognised in this well.

From 498 - 475m the assemblages are again poorly diversified and mostly lack key species. However considering the overall assemblages and the interval involved there is nothing to suggest that any younger Cretaceous units are present. All assemblages are non-marine.

WHALE NO. 1

TABLE I

SUMMARY OF BIOSTRATIGRAPHY AND AGE

Depth in Metres	Biostratigraphic Unit	Age
228	Un-named	Mid-Tertiary
239.9	Un-named	Mid-Tertiary
293.3	Un-named	Mid-Tertiary
334.8	Un-named	Mid-Tertiary
382.3	Un-named	Mid-Tertiary
425	Un-named	Mid-Tertiary
437	Indeterminate	?Mid-Tertiary
440	Late N. asperus	Late Eocene-Oligocene
442	Indeterminate	?Late Eocene
445	N. asperus	Late Eocene
453.2	Indeterminate	?Eocene
457	Indeterminate	?Eocene
460	No older than M. diversus	Eocene
462	No older than M. diversus	Eocene
463.5	Indeterminate	?Eocene
467	Barren	-
470.5	Barren	-
472	Barren	-
475	Indeterminate	Early Cretaceous
478.5	-	Early Cretaceous
480	-	Early Cretaceous
484	-	Early Cretaceous
490	Barren	-
498.0	Indeterminate	?Early Cretaceous
502	-	Early Cretaceous
504.5	Indeterminate	?Early Cretaceous
526.0	Barren	-
548	Barren	-
560	-	Early Cretaceous
571	Barren	-
586.5	Indeterminate	?Early Cretaceous
590	Barren	-
610	-	Early Cretaceous
620	Barren	-
630	Barren	-
640	Barren	-
650	Barren	-
660	Barren	-
669.5	Indeterminate	?Early Cretaceous
680	-	Early Cretaceous
690	Barren	-
715.0	Barren	-
720.0	Barren	-
732.0	Barren	-
740.0	Barren	-
755.0	-	Early Cretaceous
763.0	-	Early Cretaceous

773.0	Barren	-
776.0	Indeterminate	?Early Cretaceous
780	Barren	-
785	-	Early Cretaceous
797.5	Barren	-
806	-	Early Cretaceous

TABLE II

Distribution of Cretaceous Species

Depth in metres	475	478.5	480	484	498	502	504.5	560	586.5	610	669.5	680	755	763	776	785	806
Arcellites nudus						X											
A. reticulatus		X				X											
Baculatisporites comaumensis	X	X	X	X			X	X		X	X	X	X	X	X	X	X
Balmeisporites holodictyus			X			X											
Biretrisporites spectabilis						X		X									
Ceratosporites equalis	X	X				X		X		X							
Cicatricosisporites australiensis		X	X							X			X	X	X		X
Cicatricosisporites ludbrooki						X				X			X	X			
Cingutriletes clavus		X	X														
Corollina classoides		X	X					X					X		X		X
Crybelosporites striatus						X											
Cyathidites australis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Dictyophyllidites sp.				X	X			X	X				X				
Dictyophyllidites pectinataeformis						X											
Dictyotosporites sp.																X	
Dictyotosporites complex						X											
Dictyotosporites speciosus		X				X		X									
Falcisporites grandis		X		X		X		X									
Falcisporites similis		X			X	X	X		X				X				
Foveosporites canalis						X											
Gingkocycadophytus nitidus			X					X					X				
Gleicheniidites sp.	X					X		X									
Laevigatosporites sp.					X	X			X								
Leptolepidites major						X		X									
Lycopodiacidites asperatus								X									
Lycopodiumsporites austroclavatidites	X	X	X	X	X	X		X			X		X	X			X
Lycopodiumsporites circolumensis								X									
Lycopodiumsporites facetus						X					X	X					
Matonisporites cooksoniae						X									X		
Microcachryidites antarcticus	X	X	X		X	X		X	X	X	X		X				
Neoraistrickia truncata						X										X	
Podocarpidites sp.	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Podosporites sp.			X			X		X							X		
Reticulatisporites pudens.					X		X		X								
Sestrosporites pseudoalveolatus																	X
Spheripollenites psilatus						X		X									
Stereisporites antiquasporites				X		X		X		X				X	X		

2. Eocene - ?463.5 - 440m

The assemblages at 463.5m yielded very rare spores and pollen which included Proteacidites pachypolus and occasional acritarchs. Samples at 462 and 460m yielded slightly more diverse assemblages which included Nothofagidites spp., Haloragacidites harrisii, Malvacipollis diversus and rare dinoflagellates and acritarchs - Paralecaniella indentata and Vozzhennikovia cf. V. apertura. The assemblage has a general Eocene aspect and is not older than Upper Malvacipollis diversus assemblage. It is probably no younger than lower Nothofagidites asperus.

The next reasonable but still very sparse assemblage is from 445m. In particular the dinoflagellate Deflandrea phosphoritica which ranges through the N. asperus Zone in the Gippsland Basin is recorded.

The assemblage from 440m was a reasonably diverse assemblage dominated by Nothofagidites spp. associated with Matonisporites ornamentalis and common conifer pollen. Proteacidites sp. are uncommon. Dinoflagellates are common and are dominated by Spiniferites spp. indicating a pronounced marine influence.

The assemblage is best equated with the late N. asperus Zone. No index species of younger zones were recorded however because of low yields and poor diversity some caution is necessary in interpreting the data.

The age of the late N. asperus zone is Late Eocene and possibly Early Oligocene.

3. Mid-Tertiary - ?437 - 228m

This unit dominated by argillaceous calcareous sediments yielded very low amounts of organic matter and spores and pollen were generally rare. Nothofagidites spp. dominated the assemblages together with Haloragacidites harrisii and podocarpaceous pollen. Because of the sparse nature of the assemblages no precise assignment to a biostratigraphic unit is possible. Accompanying the spores and pollen is a not very diverse suite of dinoflagellates which dominate the palynomorphs. These comprise mostly of Spiniferites spp. together with Operculodinium spp. Lingulolodinium machaerophorum Nematosphaeropsis balcombiana, Impagidinium sp. Polysphaeridium sp. and Hystrichostrogylou membraniphorum. These species are long ranging from the Late Eocene through to the Recent. There appears to be little differentiation of the assmeblages from this interval. The assemblages are dominated by marine components.

The distribution of the few species recorded is not recorded on Table III.

WHALE NO. 1

TABLE III

Distribution of Tertiary Species

	463.5	462	460	457.2	457	445	442	440
Proteacidites pachypolus	x							
Nothofagidites emarcidus	x	x		x		x	x	
Lygistepollenites florinii	x	x		x	x		x	x
Phyllocladidites mausonii	x	x	x		x	x	x	x
Malvacipollis diversus	x	x	x	x		x	x	
Baculatisporites comaumensis		x			x			x
Parvisaccites catastus		x						
Haloragacidites harrisii		x	x		x	x	x	x
Tricolporites adelaidensis		x						
Rhoipites sp.		x					x	
Proteacidites aff. P. obscurus		x				x		
Nothofagidites falcatus		x				x	x	x
N. deminutus		x		x		x	x	x
Vozzhennikovia cf V. apertura		x						
Camarozouosporites sp.			x					
Paralecaniella indentata			x					
Deflandrea phosphoritica						x		
Operculodinium centrocarpum							x	x
Nothofagidites asperus								x
Spiniferites sp.								x
Ilexipollenites angulolavatus								x
Proteacidites aff. P. truncatus								x
Matonisporites ornamentalis								x
Lingulodinium machaerophorum								x
Myrtaceidites parvus								x
Nematosphaeropsis sp.								x
Systematophora placacantha								x

B. Kerogen Types and Spore Colouration

During routine palynological processing of sidewall cores an unoxidised kerogen sample was taken and the nature of the kerogens and spore colouration are documented in Table V. Only those samples which yielded spore/pollen assemblages have been examined. Spore colour is expressed as the "Thermal Alteration Index" (TAI) of Staplin (1969) according to the scale in Table IV.

TABLE IV

Thermal - Alteration Index	Organic matter/spore colour
1 - none	fresh, yellow
2 - slight	brownish yellow
3 - moderate	brown
4 - strong	black
5 - severe	black and evidence of rock metamorphism

Total organic matter (TOM) is expressed semi-quantitatively in the scale-abundant, moderate, low, very low, barren. Samples classed as having abundant or moderate amounts of TOM would be expected to have TOC's (total organic content) greater than 1%.

In this report four classes of organic matter are recognised - amorphogen, phyrogen, hylogen and melanogen and these terms are more or less synonymous with amorphous, herbaceous, woody and coaly. For reasons as outlined by Bujak et al. (1977) the former terms are preferred because they do not have a botanical connatation. The thermal alteration index scale follows that of Staplin (1969) and as outlined by Bujak et al. (1977). At a TAI of 2+ all four types of organic material contribute to hydrocarbon generation whereas at a TAI of 2, only amorphogen forms liquid hydrocarbons. The upper boundary defining the oil window is at a TAI of approximately 3 but varies according to the organic type. Above TAI 3+ all organic types only have a potential for thermally derived methane.

1. Cretaceous Section

Kerogen types throughout this unit are characterised by high melanogen with only one or two exceptions (e.g. at 560m) where phyrogen becomes a significant component. If this section was mature for the generation of hydrocarbons it would yield dominantly gas with minor amounts of condensate.

Spore colour throughout is consistant at about 2 and cannot be considered to be mature especially when the kerogens are dominated by melanogen. These factors together with low to very low TOM values, imitigates agaist this section as a potential hydrocarbon source.

TABLE V

Distribution of Kerogen Types and Spore Colour in Selected Samples

Depth (m)	TAI	TOM	Amorpho %	Phyro %	Hylo %	Melano %
440	-	v. low	5	Tr	-	95
445	-	v. low	95	Tr	-	5
453.2	-	v. low	5	Tr	5	90
457	-	v. low	90	-	-	10
460	-	v. low	85	-	-	15
462	1+	v. low	5	10	5	80
463.5	-	v. low	-	Tr	5	95
475	1+	v. low	-	Tr	10	90
478.5	2	v. low	-	20	10	70
480	2	low	-	51	5	90
484	2^-	low	-	30	20	50
498	2	low	-	30	10	60
504.5	2^-	very low	-	Tr	5	95
560	2^-	low	-	60	10	30
586.5	2	very low	-	40	10	50
610	2	very low	-	15	30	55
660	2	very low	-	10	5	85
680	2	low	-	5	5	90
732.0	2	very low	-	10	-	90
755	2	very low	-	20	20	60
763	2	low	-	40	10	50
776	2^+	low	-	10	25	65
785	2^+	low	-	10	15	75
806	2^+	very low	-	10	-	90

2. Tertiary Section - Eocene

This section is characterised by very low TOM's and the dominant kerogen type is melanogen which appears to be mostly an inertinite-like maceral. Two samples have high amorphogen which is dominantly finely divided organic matter. In very low yielding sediments this is insignificant with regard to source rock potential.

Where spore colour was determined it is indicative of immaturity.

All of the evidence suggests that this section in the early Tertiary is immature and does not contain sufficient organic matter of a favourable nature to be considered as a potential source rock for the generation of hydrocarbons.

No kerogen analysis was undertaken on the mid-Tertiary sequence because of the extremely low organic yields.

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W.K. Harris
Consulting Geologist

21 May 1982

APPENDIX B3 W I R E L I N E L O G I N T E R P R E T A T I O N

(REFER TO ACCOMPANYING REPORT)

APPENDIX B4 GEOCHEMICAL ANALYSES

GEOCHEMICAL EVALUATION OF WHALE #1 SIDEWALL CORES

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February, 1982

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TABULATED DATA

WELLNAME = WHALE NO 1 S.W.C. DATE OF JOB = FEBRUARY 1982

COMPOSITIONAL DATA

DEPTH(m)	%SAT	%AROM	%NSO	PRIST/PHYT	PRIST/NC17	PHYT/NC18	PAP	AROM/SAT	CPI(1)	CPI(2)	21+22/28+29
447.4	58.2	29.7	12.0	nd	nd	nd	nd	0.51	nd	nd	nd
461.5	48.4	39.6	12.0	nd	nd	nd	nd	0.82	nd	nd	nd
468.5	44.3	37.9	17.8	nd	nd	nd	nd	0.86	nd	nd	nd

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WELLNAME = WHALE NO 1 S.W.C. DATE OF JOB = FEBRUARY 1982

ORGANIC CONTENT OF SEDIMENTS

DEPTH(m)	%SOM	%TOC	SOM(mg)/TOC(g)	SAT(mg)/TOC(g)	%SaOM
447.4	.682	nd	nd	nd	.397
461.5	.568	nd	nd	nd	.275
468.5	.228	nd	nd	nd	.101

GRAVITY AND SULPHUR DATA - WHALE #1

Sample Depth (m)	API Gravity	% Sulphur
447.4m	22.3	0.32
461.5m	19.9	0.54
468.5m	nd*	nd*

* no data due to insufficient sample size

KEY

%SOM = Percentage of soluble organic matter in the sediment sample (W/W)

%SAT = Percentage by weight of saturated compounds in the extract

%AROM = Percentage by weight of aromatic compounds in the extract

%NSO = Percentage by weight of asphaltenes plus resins in the extract

PRIST = Pristane

PHYT = Phytane

NC17 = n-heptadecane (i.e. n-alkane with 17 carbon atoms)

NC18 = n-octadecane (i.e. n-alkane with 18 carbon atoms)

PAP = Percentage of aromatic protons in the aromatic fraction

CPI = Carbon Preference Index

n-Alkane Composition: CN12 etc. = n-alkane with 12 carbon atoms etc. (Values are weight percent of the n-alkane fraction)

TOC = Total organic carbon (soluble + insoluble)

C_T = Total insoluble organic carbon

C_R = Residual organic carbon

HC = Hydrocarbon

nd = No data

21+22/28+29: Sum of percentages of n-alkanes with carbon numbers 21 and 22 divided by sum of percentages of n-alkanes with carbon numbers 28 and 29

%SaOM = Percentage of saturated organic matter in the sediment sample (W/W)

THEORY AND METHOD

THEORY AND METHOD

1. API GRAVITY

A 1 ml specific gravity (SG) bottle was accurately weighed, then filled with petroleum at 60°F and finally reweighed. The weight difference was divided by the weight of 1 ml of water at 60°F to obtain the specific gravity. The following formula was then used to calculate the API gravity :

$$\text{API Gravity} = \left(\frac{141.5}{\text{SG (60°F)}}\right) - 131.5$$

The reported gravity value is the average of duplicate determinations.

2. SULPHUR DETERMINATION

The % sulphur values were measured using an x-ray fluorescence spectrometer equipped with a liquid sample holder. This parameter is influenced by the nature of the source material from which a crude is derived, the depositional environment of the source rocks, and reservoir alteration processes such as bacterial alteration.

3. EXTRACTION OF SEDIMENT SAMPLES

Crushed sediment (maximum of 250g) and 320 mls of purified dichloromethane: methanol (10:1) were placed in a 500 ml conical flask. A double surface condenser was fitted to the flask, and the sample was then extracted under the influence of ultra-sonic vibration (60-70°C) using a Buehler Ultramet II sonic bath for 2 hours. The solvent was then separated from the sediment using a large Buchner filtration system. The extract was recovered by careful evaporation of the solvent on a steam bath and weighed. The weight of extract was used to calculate %SOM(UNC) using the following formula:

$$\%\text{SOM(UNC)} = \frac{\text{Wt. extract}}{\text{Wt. sediment extracted}} \times \frac{100}{1}$$

4. SEPARATION OF PETROLEUM INTO CONSTITUENT FRACTIONS

The petroleum was separated into saturated, aromatic and NSO (asphaltenes plus resins) fractions by column chromatography on silicic acid. The crude sample was applied to the top of a silicic acid column (sample to adsorbent ratio 1:50) and the saturated compounds were eluted with n-pentane, aromatic compounds with a 50:50 mixture of ether and n-pentane, and finally the NSO fraction was eluted with a 20:1 mixture of methanol and dichloromethane. The neat fractions were recovered by careful removal of the solvent by fractional distillation and weighed.

The sum weight of the three fractions was used to calculate the %SOM using the following formula:

$$\%SOM = \frac{\text{Wt. AROM.} + \text{Wt. SAT.} + \text{Wt. NSO}}{\text{Wt. SEDIMENT EXTRACTED}} \times \frac{100}{1}$$

This parameter can be used to assess the suitability of the sediments as source rocks according to the classification shown (later in this section) in the table "Classification of Source Rock Richness".

The weight of saturated compounds was used to calculate the percentage of saturated compounds in the sediment according to the following formula:

$$\%SaOM = \frac{\text{Wt. Saturates}}{\text{Wt. Sediment Extracted}} \times \frac{100}{1}$$

This parameter can be used to assess the suitability of the sediments as oil source rocks according to the classification shown in the table "Classification of Source Rock Richness".

The weight of each fraction was used to calculate the % by weight of each fraction in the extract according to the following formula:

$$\%\ \text{Fraction} = \frac{\text{Wt. Fraction}}{\text{Wt. All Fractions}} \times \frac{100}{1}$$

The composition of the extracts can provide information about their levels of maturity and/or source type (LeTran et al., 1974; Philippi, 1974). Generally, marine extracts have relatively low concentrations of saturated and NSO compounds at low levels of maturity, but these concentrations increase with increased maturation. Terrestrially derived organic matter usually has a low level of saturates and large amount of aromatic and NSO compounds irrespective of the level of maturity.

5. GLC ANALYSIS OF SATURATED COMPOUNDS

Capillary GLC traces were recorded for each saturate fraction. The following information was obtained from these traces:

(a) $\underline{n}$-Alkane Distribution - The C_{12}-C_{31} $\underline{n}$-alkane distribution was determined from the area under peaks representing each of these $\underline{n}$-alkanes. This distribution can yield information about both the level of maturity and the source type (LeTran et al., 1974).

(b) Carbon Preference Index - Two values were determined:

$$CPI(1) = \frac{(C_{23} + C_{25} + C_{27} + C_{29})Wt\% + (C_{25} + C_{27} + C_{29} + C_{31})Wt\%}{2 \times (C_{24} + C_{26} + C_{28} + C_{30})Wt\%}$$

$$CPI(2) = \frac{(C_{23} + C_{25} + C_{27})Wt\% + (C_{25} + C_{27} + C_{29})Wt\%}{2 \times (C_{24} + C_{26} + C_{28})Wt\%}$$

The CPI is believed to be a function of both the level of maturity (Cooper and Bray, 1963; Scalan and Smith, 1970) and the source type (Tissot and Welte, 1978). Marine extracts tend to have values close to 1 irrespective of maturity whereas values for terrestrial extracts decrease with maturity from values as high as 20 but don't usually reach a value of 1.

(c) C_{21}+C_{22}/C_{28}+C_{29} - This parameter provides information about the source of the organic matter (Philippi, 1974). Generally, a terrestrial source gives values <1.2 whereas a marine source results in values >1.5.

(d) Pristane/Phytane Ratio - This value was determined from the areas of peaks representing these compounds. The ratio renders information about the depositional environment according to the following scale (Powell and McKirdy, 1975):

<3.0 Marine depositional environment (i.e. reducing environment)

3.0-4.5 Mixed depositional environment (i.e. reducing/oxidising environment)

>4.5 Terrestrial depositional environment (i.e. oxidising environment)

(e) Pristane/$\underline{n}$-C_{17} Ratio - This ratio was determined from the areas of peaks representing these compounds. The value can provide information about both the source type and the level of maturation (Lijmbach, 1975). Very immature crude oil has a pristane/$\underline{n}$-C_{17} ratio >1.0, irrespective of the source type. However, the following classification can be applied to mature crude oil:

<0.5	Marine source
0.5-1.0	Mixed source
>1.0	Terrestrial source

In the case of sediment extracts these values are significantly higher and the following classification is used:

<1.0	Marine source
1.0-1.5	Mixed source
>1.5	Terrestrial source

(f) Phytane/n-C_{18} Ratio - This ratio was determined from the areas of peaks representing these compounds. The value usually only provides information about the level of maturity of petroleum. The value decreases with increased maturation.

(g) Relative Amounts of n-Alkanes and Naphthenes - Since n-alkanes and naphthenes are the two dominant classes of compounds in the saturate fraction, a semi-quantitative estimate of the relative amounts of these compounds was made. This information can be used to assess the degree of maturation and/or the source type of the petroleum (Philippi, 1974; Tissot and Welte, 1978). Very immature petroleum has only small proportions of n-alkanes, but as maturity increases the relative amount of n-alkanes increases. In addition, terrestrial petroleum has a greater proportion of high molecular weight naphthenes than marine petroleum.

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COMMENTS AND CONCLUSIONS

COMMENTS AND CONCLUSIONS

GENERAL

Three oil-stained sidewall cores from the Whale #1 exploration well were provided for geochemical analysis. To minimize the loss of volatile components from these samples they were each placed in a separate extraction flask, covered with a dichloromethane:methanol (10:1) solvent mixture, crushed as best as possible using a stainless steel rod and then ultrasonically extracted. After removal of the extracting solvent from the partially crushed SWC's each sediment sample was carefully dried, crushed to 0.1 mm and extracted for a second time. In the case of the 447.4m and 461.5m samples the soluble organic matter (SOM) recovered after the double extractions was subjected to analysis for its API gravity and sulphur content. This data could not be obtained for the 468.5m sample due to insufficient SOM.

An aliquot of the SOM from each of the three SWC's was liquid chromatographed to obtain saturate, aromatic and NSO fractions. The saturate fractions were then analysed by capillary column gas chromatography and combined capillary column gas chromatography/mass spectrometry (GC/MS). However, the data from , and discussion of, the GC/MS study is contained in a separate report.

It is normal practice for our geochemical reports on sediment extracts to include n-alkane distributions, pristane/phytane ratios etc. and for some discussion to be included on the maturity and type of organic matter contained in the sediments. However, in this case the composition of the extracts has prevented a report of this type although some discussion of the maturity and type of organic matter is included in the GC/MS report on these samples.

COMPOSITION OF THE SOM

In considering the composition of the SOM extracted from these SWC's it has been assumed that this SOM is migrated organic matter and that the extracts are in effect samples of crude oil. This assumption is supported by the very high %SOM values and the lithologies of the SWC's.

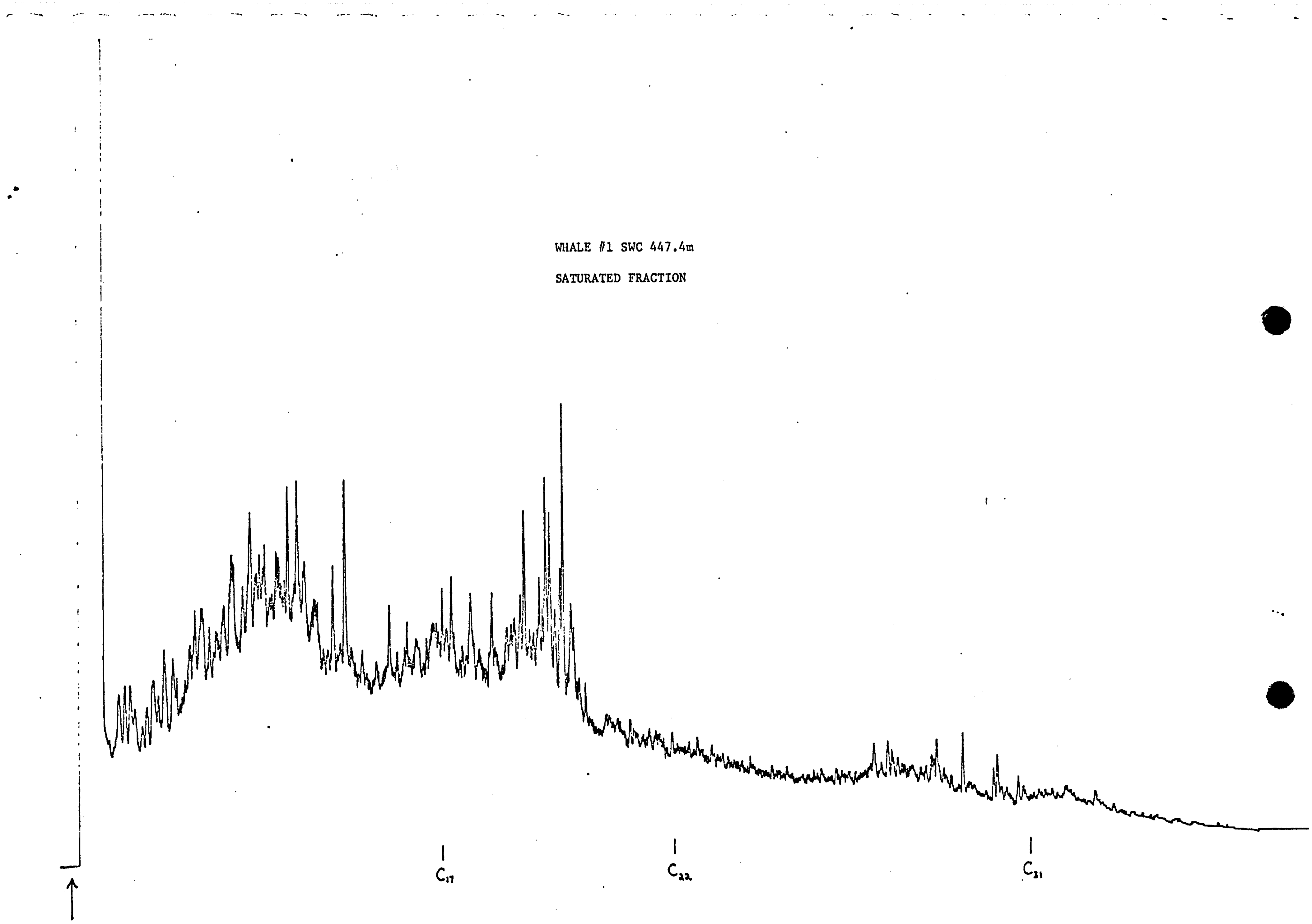
The capillary GLC traces of these samples clearly show that they are virtually devoid of n-alkanes and therefore have almost certainly undergone bacterial alteration. This contention is strongly supported by the proportion of saturates in the SOM and the API gravity, which are both much lower than the values normally observed for unaltered Gippsland crudes, and the % sulphur which is higher than that observed for an unaltered Gippsland oil.

OTHER COMMENTS

Although the %SOM values are all very large the higher values for the two shallowest samples is probably a function of the sediment lithologies. The two shallowest samples appeared to consist of moderately fine-grained sand whereas the deepest sample was largely composed of large pieces of what appeared to be a relatively poor porosity rock.

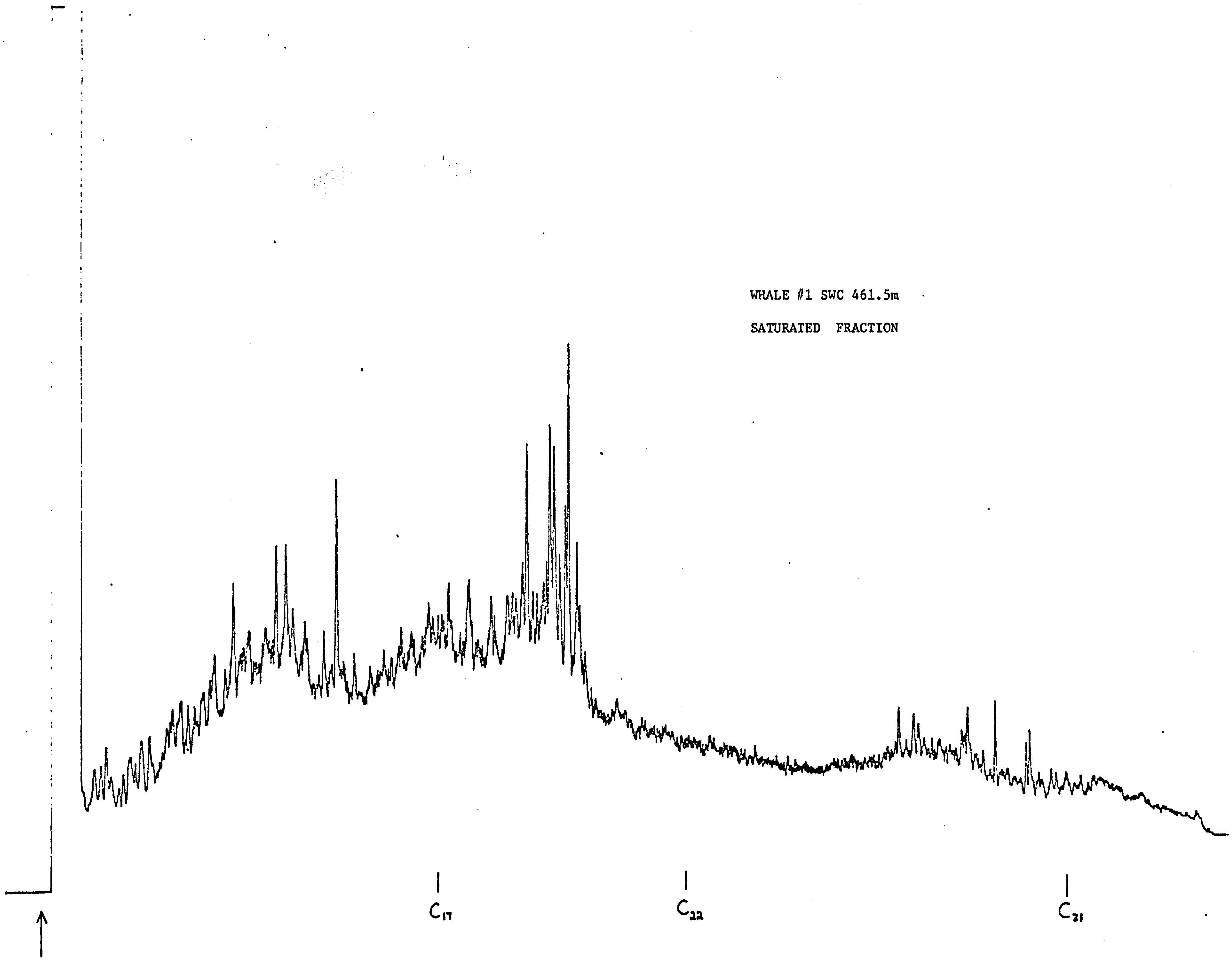
The higher proportion of saturates in the SOM, higher API gravity and lower % sulphur value for the 447.4m sample relative to the values for these parameters for the 461.5m sample suggest that the 461.5m sample may be slightly more biodegraded than the 447.4m sample.

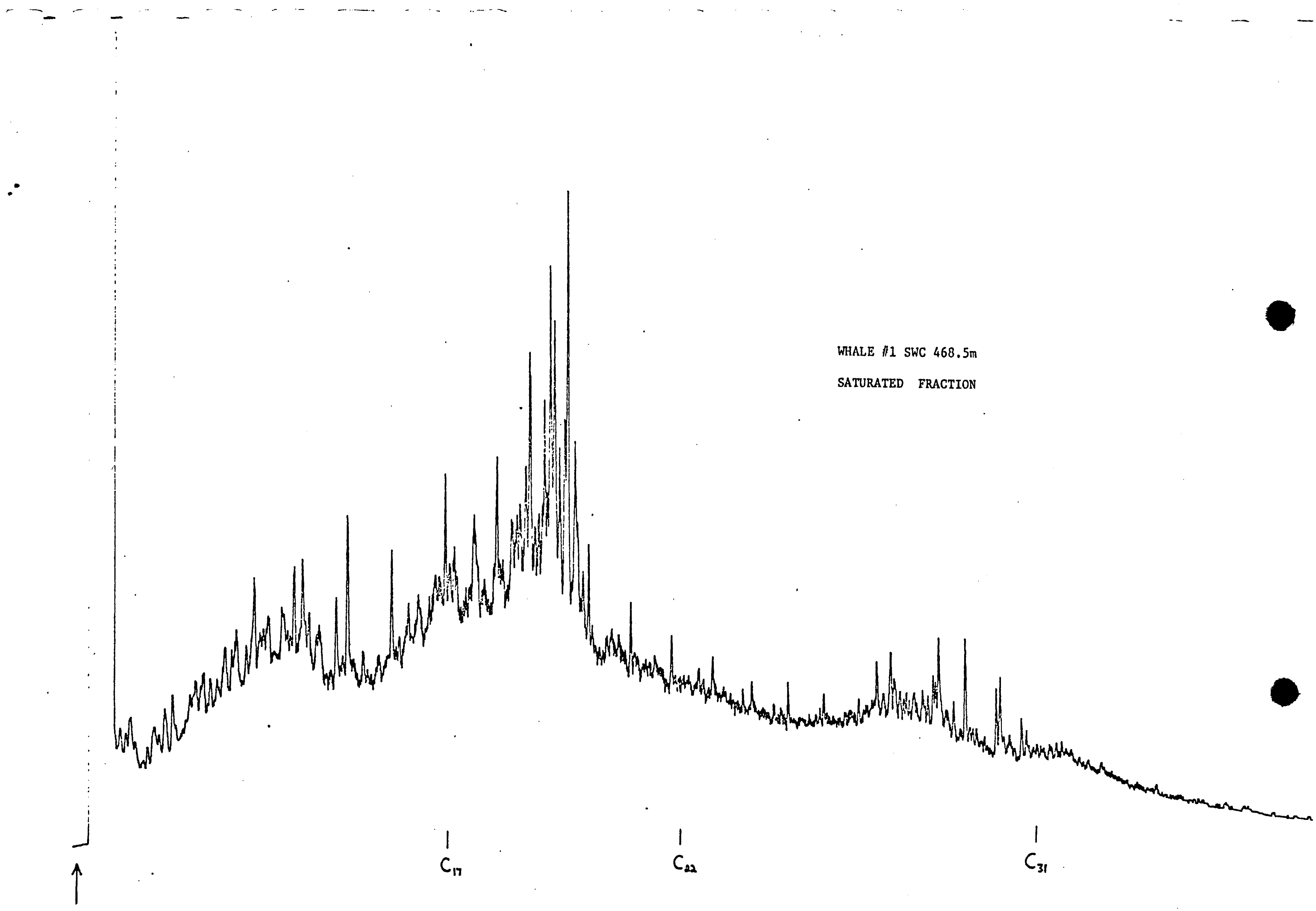
CAPILLARY GLC TRACES


WHALE #1 SWC 447.4m
SATURATED FRACTION
C_{17}
C_{22}
C_{31}

WHALE #1 SWC 461.5m

SATURATED FRACTION




WHALE #1 SWC 468.5m
SATURATED FRACTION
C17
C22
C31

APPENDIX B5 LOG OF CORES

Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE % CLAY MINERALS	CLAY SIZE % MICRITE	SILT SIZE % QUARTZ	SILT SIZE % CALCITE	GRAINS TYPE & % QUARTZ	GRAINS TYPE & % SKELETAL	GRAINS TYPE & % CALCITE	GRAINS SIZE RANGE	GRAINS SIZE DOMINANT	CEMENT TYPE & %	CEMENT TYPE & %	DIAGENESIS TYPE	DIAGENESIS %	DIAGENESIS TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES TYPE & %	ACCESSORIES TYPE & %	ACCESSORIES TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
228	5.7	CALCARENITE	Grnsh gry - dk grnsh gry	5	15	Tr	Tr		40	35	VF	VF			X	5	Mx			S	i 5				-	╪	Spicules/fossils abundant at replaced by calcite
233.9	5.7	CALCARENITE	Grnsh gry - dk grnsh gry	5	15	Tr	Tr		30	45	VF	VF			X	5	Mx			S	i Tr	Gl Tr			-	╪	Fossils are in general large sized, wrt calcite grains
239.9	5.5	CALCARENITE	Grnsh gry - dk grnsh gry	5	15	Tr	Tr		30	45	VF	VF			X	5	Mx			S		Gl Tr			-	╪	Recrystallisation of larger skeletal frags only.
245.8	5.4	CALCARENITE	Grnsh gry - dk grnsh gry	5	15	Tr	Tr		50	20	VF	VF			X	5	Mx			S		Gl Tr	Py 5		-	╪	Pyrite infilling larger skeletal frags
251.7	5.5	CALCISILTITE	Lt grnsh gry - dk grnsh gry	5	10		40		40	Tr					X	Tr	Mx			S			Py 5		-	╪	
257.6	5.5	CALCARENITE	Dk grnsh gry	10	15		10		30	30	VF	VF			X	5	Mx			S			Py Tr		-	╪	
263.6	5.5	Argillaceous CALCARENITE	Dk grnsh gry	20	15	Tr	10		30	25	VF	VF			X	Tr	Mx			S			Py Tr		-	╪	
269.5	5.0	CALCISILTITE	Dk grnsh gry	5	10		10		60	10	VF	VF			X	Tr	Mx			S		Gl 5			-	╪	
275.5	5.2	CALCISILTITE	Dk grnsh gry	15	25		40		20	Tr										S		Gl Tr			-	╪	
281.4	5.7	Argillaceous CALCISILTITE	Dk grnsh gry	20	20		40		20	Tr										S					-	╪	

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification
Parallel Type
Thickness of bedding
Metric System
millimeter bed 1mm-10mm mm
centimeter bed 1cm-10cm cm
Cross Bedding
in general
with angle indicated
chevron
climbing
festoon
planar.

Irregular bedding
Graded bedding
No apparent bedding
Nodular bedding

Current-produced markings
Ripple marks
asymmetrical
interference
symmetrical
Pull over flame structure
Scour and fill
Flute cast
Groove cast
Striation
Parting lineation

Organism-produced markings
Burrowed
slightly burrowed
moderately burrowed
well burrowed
Churned
Bored
Bored surface
Organism tracks and trails
Plant root tubes
Vertebrate tracks

Penecontemporaneous deformation structures
Mud cracks
Rain or hail prints
Pull-apart
Slump structures and contorted bedding
Convolute bedding
Load cast
Tepee structure
Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures
Breccia, solution, collapse
Disolution - compaction (horse tail)
Sylolite
Vadose pisolite
Vadose silt
Boxwork
Salt hoppers or casts

Tectonic structures
Fractures
Slickensides
Breccia, tectonic

Miscellaneous
Geopetal fabric
Cone-in-cone
Stromatactics
Boudinage, ball and age flow

Abbreviations:

GRAIN SIZE: VF Very Fine; F Fine; M Medium; C Course; VC Very Coarse; G Granule & larger

CEMENT: Q Silica; Py Pyrite; C Calcite; D Dolomite; Sd Siderite

DIAGENESIS: D Dolomitization; Q Silicification; X Recrystallization; Ce Chloritization

ROUNDING: R Rounded; SR Subrounded; SA Subangular; A Angular

SORTING: P Poor; M Moderate; W Well; VW Very Well

HARDNESS: U Unconsolidated; VS Very Soft; S Soft; M Moderate; H Hard

POROSITY: g Intergranular; v Vugular; i Intraskeletal

ACCESSORIES: Py Pyrite; Mc Mica; Ch Chert; Cc Lignite/Coal; Hm Heavy minerals; Lf Lithic fragments; Gl Glauconite

DIAGENETIC TEXTURES: CX Crypto <1/256mm; MX Micro 1/256 - 1/16mm

HYDROCARBONS: * Signifies presence. Full details described under supplementary data

A4-GL-480

Hudbay Oil (Australia) Ltd.

Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE % CLAY MINERALS	CLAY SIZE % MICRITE	SILT SIZE % QUARTZ	SILT SIZE % CALCITE	GRAINS TYPE & % QUARTZ	GRAINS TYPE & % SKELETAL	GRAINS TYPE & % CALCITE	GRAINS SIZE RANGE	GRAINS SIZE DOMINANT	CEMENT TYPE & %	CEMENT TYPE & %	DIAGENESIS TYPE	DIAGENESIS %	DIAGENESIS TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES TYPE & %	ACCESSORIES TYPE & %	ACCESSORIES TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
287.3	5.2	CALCARENITE	Grnsh gry - dk grnsh gry	5	10		10		20	35	VF	VF								S					-	╪	
293.3	5.7	CALCISILTITE	Dk grnsh gry	10	10		40		40	Tr										S			Py Tr		-	╪	
299.2	5.2	CALCISILTITE	Dk grnsh gry	Tr	10		60		30											S					-	╪	
305.1	4.8	CALCISILTITE	Dk grnsh gry	Tr	20		60		20											S					-	╪	
311.1	3.3	CALCISILTITE	Grnsh gry - dk grnsh gry	Tr	10	Tr	70		20											S					-	╪	
317	5.4	CALCISILTITE	Grnsh gry - dk grnsh gry	5	15	Tr	65		15											S					-	╪	
323	5.2	CALCISILTITE	Dk grnsh gry - grn gry	10	20	Tr	50		20											S					-	╪	
328.9	2.5	CALCILUTITE	Dk grn gry - grnsh gry	20	40	Tr	10		30											S					-	╪	
334.8	3.2	CALCARENITE	Grnsh gry - dk grnsh gry	5	10	Tr	5		5	55	VF-F	VF			X	20	Mx	A		M					-	mm	
340.8	5.3	CALCISILTITE	Grnsh gry - dk grnsh gry	5	20		60		15	Tr										S					-	╪	

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification

Parallel Type

Thickness of bedding

Metric System

- millimeter bed 1mm-10mm mm
- centimeter bed 1cm-10cm cm

Cross Bedding

- in general
- with angle indicated 10°
- chevron
- climbing
- festoon
- planar

Irregular bedding

Graded bedding

No apparent bedding

Nodular bedding

Current-produced markings

- Ripple marks
  - asymmetrical a
  - interference i
  - symmetrical s
- Pull over flame structure
- Scour and fill
- Flute cast
- Groove cast
- Striation
- Parting lineation

Organism-produced markings

- Burrowed
  - slightly burrowed s
  - moderately burrowed m
  - well burrowed w
- Churned
- Bored
- Bored surface
- Organism tracks and trails
- Plant root tubes
- Vertebrate tracks

Penecontemporaneous deformation structures

- Mud cracks
- Rain or hail prints
- Pull-apart
- Slump structures and contorted bedding
- Convolute bedding
- Load cast
- Tepee structure
- Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures

- Breccia, solution, collapse
- Disolution - compaction (horse tail)
- Sylolite
- Vadose pisolite
- Vadose silt
- Boxwork
- Salt hoppers or casts

Tectonic structures

- Fractures
- Slickensides
- Breccia, tectonic

Miscellaneous

- Geopetal fabric
- Cone-in-cone
- Stromatactics
- Boudinage, ball and age flow

Abbreviations:

GRAIN SIZE
- VF Very Fine
- F Fine
- M Medium
- C Course
- VC Very Coarse
- G Granule & larger

CEMENT
- Q Silica
- Py Pyrite
- C Calcite
- D Dolomite
- Sd Siderite

DIAGENESIS
- D Dolomitization
- Q Silicification
- X Recrystallization
- Ce Chloritization

ROUNDING
- R Rounded
- SR Subrounded
- SA Subangular
- A Angular

SORTING
- P Poor
- M Moderate
- W Well
- VW Very Well

HARDNESS
- U Unconsolidated
- VS Very Soft
- S Soft
- M Moderate
- H Hard

POROSITY
- g Intergranular
- v Vugular
- i Intraskeletal

ACCESSORIES
- Py Pyrite
- Mc Mica
- Ch Chert
- Cc Lignite/Coal
- Hm Heavy minerals
- Lf Lithic fragments
- Gl Glauconite

DIAGENETIC TEXTURES
- CX Crypto < 1/256mm
- MX Micro 1/256 - 1/16mm

HYDROCARBONS
- * Signifies presence
- Full details described under supplementary data

A4-GL-480

Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE %: CLAY MINERALS	CLAY SIZE %: MICRITE	SILT SIZE %: QUARTZ	SILT SIZE %: CALCITE	GRAINS TYPE & %: QUARTZ	GRAINS TYPE & %: SKELETAL	GRAINS TYPE & %: CALCITE	GRAINS SIZE: RANGE	GRAINS SIZE: DOMINANT	CEMENT: TYPE & %	CEMENT: TYPE & %	DIAGENESIS: TYPE	DIAGENESIS: %	DIAGENESIS: TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
346.7	5.0	CALCISILTITE	Grnsh blk - dk grnsh gry	15	30	Tr	40		10	5										S			Py Tr		-	╪	
352.6	5.1	CALCISILTITE	Dk grnsh gry - grnsh blk	15	30	Tr	40		5	5					X	5	Mx					Gl Tr			-	≋ mm	
358.6	0.5	CALCILUTITE	White		100										X	100	Mx			H					-	╪	
364.5	4.9	CALCISILTITE	Grnsh gry - dk grnsh gry	5	20		25		50						X	Tr	Mx			S			Py Tr		-	╪	
370.5	5.5	CALCISILTITE	Grnsh gry - dk grnsh gry	5	30		35		30											S					-	╪	
376.4	5.1	CALCISILTITE	Grnsh gry	10	20		40		25	5										S					-	╪	
382.3	5.4	CALCISILTITE	Grnsh gry	10	20		45		25											S					-	╪	
388.3	5.2	CALCISILTITE	Grnsh gry - grnsh blk	20	25		35		20						X	Tr	Mx			M		Gl Tr	Py Tr		-	╪	
394.2	6.0	Argillaceous CALCISILTITE	Grnsh gry - grnsh blk	25	20		50		15						X	Tr	Mx			M		Gl Tr	Py Tr		-	╪	Re-crystallisation in fossil tests only
400.1	5.0	Argillaceous CALCISILTITE	Grnsh gry	20	30		30		20											S			Py Tr		-	╪	

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification
Parallel Type

Thickness of bedding
Metric System
millimeter bed 1mm-10mm mm
centimeter bed 1cm-10cm cm

Irregular bedding
Graded bedding
No apparent bedding
Nodular bedding

Cross Bedding
in general
with angle indicated
chevron
climbing
festoon
planar

Current-produced markings
Ripple marks
asymmetrical
interference
symmetrical
Pull over flame structure
Scour and fill
Flute cast
Groove cast
Striation
Parting lineation

Organism-produced markings
Burrowed
slightly burrowed
moderately burrowed
well burrowed
Churned
Bored
Bored surface
Organism tracks and trails
Plant root tubes
Vertebrate tracks

Penecontemporaneous deformation structures
Mud cracks
Rain or hail prints
Pull-apart
Slump structures and contorted bedding
Convolute bedding
Load cast
Tepee structure
Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures
Breccia, solution, collapse
Disolution - compaction (horse tail)
Sylolite
Vadose pisolite
Vadose silt
Boxwork
Salt hoppers or casts

Tectonic structures
Fractures
Slickensides
Breccia, tectonic

Miscellaneous
Geopetal fabric
Cone-in-cone
Stromatactics
Boudinage, ball and age flow

Abbreviations

GRAIN SIZE
VF Very Fine
F Fine
M Medium
C Course
VC Very Coarse
G Granule & larger

CEMENT
Q Silica
Py Pyrite
C Calcite
D Dolomite
Sd Siderite

DIAGENESIS
D Dolomitization
Q Silicification
X Recrystallization
Ce Chloritization

ROUNDING
R Rounded
SR Subrounded
SA Subangular
A Angular

SORTING
P Poor
M Moderate
W Well
VW Very Well

HARDNESS
U Unconsolidated
VS Very Soft
S Soft
M Moderate
H Hard

POROSITY
g Intergranular
v Vugular
i Intraskeletal

ACCESSORIES
Py Pyrite
Mc Mica
Ch Chert
Cc Lignite/Coal
Hm Heavy minerals
Lf Lithic fragments
Gl Glauconite

DIAGENETIC TEXTURES
CX Crypto <1/256mm
MX Micro 1/256 - 1/16mm

HYDROCARBONS
* Signifies presence
Full details described under supplementary data

A4-GL-480

Hudbay Oil (Australia) Ltd.

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SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE %: CLAY MINERALS	CLAY SIZE %: MICRITE	SILT SIZE %: QUARTZ	SILT SIZE %: CALCITE	GRAINS TYPE & %: QUARTZ	GRAINS TYPE & %: SKELETAL	GRAINS TYPE & %: CALCITE	GRAINS SIZE: RANGE	GRAINS SIZE: DOMINANT	CEMENT: TYPE & %	CEMENT: TYPE & %	DIAGENESIS: TYPE	DIAGENESIS: %	DIAGENESIS: TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
407.0	1.0	CALCILUTITE	Lt gry - gry						Tr											S					-	∓	Sample reliability questionab mostly mudcake.
410.0	5.8	MARL	Dk grnsh gry	40	50			Tr	10											M					-	∓	
412.0	2.0	CALCILUTITE	Lt gry - gry	40	60				Tr											S					-	∓	
417.0	5.7	CALCILUTITE	Dk grnsh gry	40	55				Tr	5	VF	VF			X	5				M					-	∓	Skeletal replacement by calcite crystal growth
420.0	5.1	Skeletal CALCISILTITE	Lt gry - dk grnsh gry	20	10		20		50	Tr	VF									M					-	∓	
425.0	4.7	Skeletal CALCISILTITE	Lt gry - dk grnsh gry	20	10		30		40											M					-	∓	
437.0	5.5	Skeletal Glauconitic CALCARENITE	Dk grnsh gry	10	10		10		50											M		Gl 20			-	∓	
440.0	4.8	Nodular Geothitic SILTSTONE	Brnsh blk	10		20		Tr							Fe	65	Nd			M					-	∓	Geothitic nodules in silty/clayey matrix hydrolphillic
442.0	4.0	Nodular GEOTHITE	Dk brn - brnsh blk	20		10									Fe	70	Nd			M		Py-Tr			-	∓	Geothitic nodules in silty/clayey matrix hydrolphillic
445.0	5.0	Silty Geothitic SANDSTONE	Dk brn - brnsh blk	25		30		45			VF	VF			Fe	20	Nd		W	S	g 10	Gl Tr			*	∓	80% yel gold, instant bl wh streaming solv cut, strong petrol odour Lt brn stain Pale yel cut

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

Stratification

Parallel Type

Thickness of bedding

Metric System
- millimeter bed: 1mm-10mm mm
- centimeter bed: 1cm-10cm cm

Cross Bedding
- in general
- with angle indicated
- chevron
- climbing
- festoon
- planar

Irregular bedding; Graded bedding; No apparent bedding; Nodular bedding

SYNGENETIC STRUCTURES

Current-produced markings: Ripple marks (asymmetrical, interference, symmetrical); Pull over flame structure; Scour and fill; Flute cast; Groove cast; Striation; Parting lineation

Organism-produced markings: Burrowed (slightly burrowed, moderately burrowed, well burrowed); Churned; Bored; Bored surface; Organism tracks and trails; Plant root tubes; Vertebrate tracks

Penecontemporaneous deformation structures: Mud cracks; Rain or hail prints; Pull-apart; Slump structures and contorted bedding; Convolute bedding; Load cast; Tepee structure; Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures: Breccia, solution, collapse; Disolution - compaction (horse tail); Sylolite; Vadose pisolite; Vadose silt; Boxwork; Salt hoppers or casts

Tectonic structures: Fractures; Slickensides; Breccia, tectonic

Miscellaneous: Geopetal fabric; Cone-in-cone; Stromatactics; Boudinage, ball and age flow

Abbreviations:

GRAIN SIZE: VF Very Fine; F Fine; M Medium; C Course; VC Very Coarse; G Granule & larger

CEMENT: Q Silica; Py Pyrite; C Calcite; D Dolomite; Sd Siderite

DIAGENESIS: D Dolomitization; Q Silicification; X Recrystallization; Ce Chloritization

ROUNDING: R Rounded; SR Subrounded; SA Subangular; A Angular

SORTING: P Poor; M Moderate; W Well; VW Very Well

HARDNESS: U Unconsolidated; VS Very Soft; S Soft; M Moderate; H Hard

POROSITY: g Intergranular; v Vugular; i Intraskeletal

ACCESSORIES: Py Pyrite; Mc Mica; Ch Chert; Cc Lignite/Coal; Hm Heavy minerals; Lf Lithic fragments; Gl Glauconite

DIAGENETIC TEXTURES: CX Crypto<1/256mm; MX Micro 1/256 - 1/16mm

HYDROCARBONS: * Signifies presence. Full details described under supplementary data

A4-GL-480

Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE %: CLAY MINERALS	CLAY SIZE %: MICRITE	SILT SIZE %: QUARTZ	SILT SIZE %: CALCITE	GRAINS TYPE & %: QUARTZ	GRAINS TYPE & %: SKELETAL	GRAINS TYPE & %: CALCITE	GRAINS SIZE: RANGE	GRAINS SIZE: DOMINANT	CEMENT: TYPE & %	CEMENT: TYPE & %	DIAGENESIS: TYPE	DIAGENESIS: %	DIAGENESIS: TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
447.4	5.2	Geothitic SANDSTONE	Dk brn - brnsh blk	20		10		70			VF-F	VF			Fe	20		A	W	S	g 10	Gl Tr			*	≠	90% yel gold instant bl-wh stre[illegible] solv cut, strong aromatic odou[illegible]ale light brn vis oil staining yel cut
450.0	5.0	Nodular Silty SANDSTONE	Dk brn - brnsh blk - blk nodules	10		20		70			VF-G	VF			Fe	10	Nd	A	M	S	g 10	Gl ??			*	≠	50% yel gold instant bl-wh streaming solv cut, strong aromatic odour, lt brn stain.
453.2	3.5	Glauconitic Silty SANDSTONE	Dk brn - brn blk	5		20		35			VF-G	VF			Fe	Tr		A	M	S	g 15	Gl 40			*	≠	100% bright yel gold, instant bl-wh streaming v strong aromatic odour, lt brn oil stain.
457.0	5.5	Petroliferous SANDSTONE	Dk brn - lt brn	Tr		25		65			VF	VF			Fe	Tr		A	W	S	g 15	Gl 10			*	≠	100% bright yel gold, instant bl-wh streaming solv cut, v strong aromatic odour lt brn oil stain
460.0	2.5	SANDSTONE	Brn - dk brn	5		25		70			VF	VF			Fe	Tr		A	W	S	g 15				*	≠	100% V bright yel gold, instant bl-wh streaming solv cut, v strong odour Lt brn oil stain
461.5	5.2	SANDSTONE	Brn - lt brn	Tr		10		90			VF-F	VF						A	W	S	g 20				*	≠	100% V bright yel gold, instant bl-wh solv cut, strong pet odour, lt brn oil stain
462.0	5.0	SANDSTONE	Brn - med brn blk	Tr		10		90			VF-F	VF						A	W	S	g 20				*	≠	100% V bright yel gold, instant bl-wh solv cut, strong pet odour, lt brn oil stain
463.5	5.2	SANDSTONE	Clr - lt brn	Tr		10		90			VF-F	VF						A-SA	W	S	g 20				*	≠	100% Mod fast, solv cut Strong pet odour Pale yel cut
464.5		NO RECOVERY																									
467.0	2.0	SANDSTONE	Clr - wh - lt brn								M-G	C						SA-R	P	U	g 25				*	≠	100% yel gold instant streaming bl-wh strong pet odour

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification

Parallel Type

Thickness of bedding

Metric System
- millimeter bed 1mm-10mm mm
- centimeter bed 1cm-10cm cm

Cross Bedding
- in general
- with angle indicated
- chevron
- climbing
- festoon
- planar

- Irregular bedding
- Graded bedding
- No apparent bedding
- Nodular bedding

Current-produced markings
- Ripple marks
  - asymmetrical
  - interference
  - symmetrical
- Pull over flame structure
- Scour and fill
- Flute cast
- Groove cast
- Striation
- Parting lineation

Organism-produced markings
- Burrowed
  - slightly burrowed
  - moderately burrowed
  - well burrowed
- Churned
- Bored
- Bored surface
- Organism tracks and trails
- Plant root tubes
- Vertebrate tracks

Penecontemporaneous deformation structures
- Mud cracks
- Rain or hail prints
- Pull-apart
- Slump structures and contorted bedding
- Convolute bedding
- Load cast
- Tepee structure
- Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures
- Breccia, solution, collapse
- Disolution - compaction (horse tail)
- Sylolite
- Vadose pisolite
- Vadose silt
- Boxwork
- Salt hoppers or casts

Tectonic structures
- Fractures
- Slickensides
- Breccia, tectonic

Miscellaneous
- Geopetal fabric
- Cone-in-cone
- Stromatactics
- Boudinage, ball and age flow

Abbreviations:

GRAIN SIZE
- VF Very Fine
- F Fine
- M Medium
- C Course
- VC Very Coarse
- G Granule & larger

CEMENT
- Q Silica
- Py Pyrite
- C Calcite
- D Dolomite
- Sd Siderite

DIAGENESIS
- D Dolomitization
- Q Silicification
- X Recrystallization
- Ce Chloritization

ROUNDING
- R Rounded
- SR Subrounded
- SA Subangular
- A Angular

SORTING
- P Poor
- M Moderate
- W Well
- VW Very Well

HARDNESS
- U Unconsolidated
- VS Very Soft
- S Soft
- M Moderate
- H Hard

POROSITY
- g Intergranular
- v Vugular
- i Intraskeletal

ACCESSORIES
- Py Pyrite
- Mc Mica
- Ch Chert
- Cc Lignite / Coal
- Hm Heavy minerals
- Lf Lithic fragments
- Gl Glauconite

DIAGENETIC TEXTURES
- CX Crypto <1/256mm
- MX Micro 1/256 - 1/16mm

HYDROCARBONS
- * Signifies presence
- Full details described under supplementary data

Hudbay Oil (Australia) Ltd.

Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE %: CLAY MINERALS	CLAY SIZE %: MICRITE	SILT SIZE %: QUARTZ	SILT SIZE %: CALCITE	GRAINS TYPE & %: QUARTZ	GRAINS TYPE & %: SKELETAL	GRAINS TYPE & %: CALCITE	GRAINS SIZE: RANGE	GRAINS SIZE: DOMINANT	CEMENT: TYPE & %	CEMENT: TYPE & %	DIAGENESIS: TYPE	DIAGENESIS: %	DIAGENESIS: TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
468.5	2.0	Conglomeratic SANDSTONE	Wh - lt gry					100			C-G	G						A-R	P	M	g 25				*	≋	100% V brt yel gold Instant wh[illegible] cut streaming strong pet odour vis oil stain
470.5	2.8	SANDSTONE	Lt brn (due to oil)	Tr		Tr		100			VF	VF						A	W	S	g 10				*	cm	100% V brt yel gold instant blue wh solv cut Strong pet odour, vis oil stain Pale yel cut
472.0	2.0	SANDSTONE	Clr - wh - lt gry	10		Tr		85			C-G	C						A-SR		S	g 15	Cc 5			*	≠	100% V brt yel gold instant bl wh solv cut Strong pet odour, vis oil stain No cut
475.0	5.6	SANDSTONE	Wh - med lt gry	20		10		70			VF	VF						A		M	g 5	Cc Tr			-	⊥	V mnr carbonaceous mat in thin laminae
478.5	5.4	CLAYSTONE	Med dk gry - dk gry	100																H					-	≠	
480.0	4.2	CLAYSTONE	Med dk gry - dk gry	100																H					-	≠	
484.0	5.0	SANDSTONE	Lt gry - gry - dk gry	20				80			VF	VF						A	W	M		Cc Tr			-	⊥	
490.0	3.0	CLAYSTONE	Med dk gry - dk gry	100																S					-	≠	Hydrolphyllic
498.0	2.5	CLAYSTONE	Med dk gry - dk gry	100																S					-	≠	Hydrolphyllic
502.0	5.3	Argillaceous SILTSTONE	Med gry - med dk gry	30		70														M					-	≠	

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification

Parallel Type

Thickness of bedding
Metric System
millimeter bed 1mm-10mm mm
centimeter bed 1cm-10cm cm

Cross Bedding
in general
with angle indicated 10°
chevron
climbing
festoon
planar

Irregular bedding
Graded bedding
No apparent bedding
Nodular bedding

Current-produced markings

Ripple marks
asymmetrical a
interference i
symmetrical s
Pull over flame structure
Scour and fill
Flute cast
Groove cast
Striation
Parting lineation

Organism-produced markings

Burrowed
slightly burrowed s
moderately burrowed m
well burrowed w
Churned
Bored
Bored surface
Organism tracks and trails
Plant root tubes
Vertebrate tracks

Penecontemporaneous deformation structures

Mud cracks
Rain or hail prints
Pull-apart
Slump structures and contorted bedding
Convolute bedding
Load cast
Tepee structure
Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures

Breccia, solution, collapse
Disolution - compaction (horse tail)
Sylolite
Vadose pisolite
Vadose silt
Boxwork
Salt hoppers or casts

Tectonic structures

Fractures
Slickensides
Breccia, tectonic

Miscellaneous

Geopetal fabric
Cone-in-cone
Stromatactics
Boudinage, ball and age flow

Abbreviations:

GRAIN SIZE
VF Very Fine
F Fine
M Medium
C Course
VC Very Coarse
G Granule & larger

CEMENT
Q Silica
Py Pyrite
C Calcite
D Dolomite
Sd Siderite

DIAGENESIS
D Dolomitization
Q Silicification
X Recrystallization
Ce Chloritization

ROUNDING
R Rounded
SR Subrounded
SA Subangular
A Angular

SORTING
P Poor
M Moderate
W Well
VW Very Well

HARDNESS
U Unconsolidated
VS Very Soft
S Soft
M Moderate
H Hard

POROSITY
g Intergranular
v Vugular
i Intraskeletal

ACCESSORIES
Py Pyrite
Mc Mica
Ch Chert
Cc Lignite/Coal
Hm Heavy minerals
Lf Lithic fragments
Gl Glauconite

DIAGENETIC TEXTURES
CX Crypto <1/256mm
MX Micro 1/256 - 1/16mm

HYDROCARBONS
* Signifies presence
Full details described under supplementary data

Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE % CLAY MINERALS	CLAY SIZE % MICRITE	SILT SIZE % QUARTZ	SILT SIZE % CALCITE	GRAINS TYPE & % QUARTZ	GRAINS TYPE & % SKELETAL	GRAINS TYPE & % CALCITE	GRAINS SIZE RANGE	GRAINS SIZE DOMINANT	CEMENT TYPE & %	CEMENT TYPE & %	DIAGENESIS TYPE	DIAGENESIS %	DIAGENESIS TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES TYPE & %	ACCESSORIES TYPE & %	ACCESSORIES TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
504.5	5.0	SANDSTONE	Med gry - med dk gry	5		30		65			VF	VF						A-SA		M	g 5	Cc Tr	Gl Tr		-	[No apparent bedding]	Thin band of broken coal
514.0		NO RECOVERY																									
526.0	4.0	SANDSTONE	Med dk gry - dk gry	5		30		65			VF	VF						A-SA		M	g 5	Cc Tr	Gl Tr		-	[Irregular bedding]	Partly siltstone on edge of core
548.0	3.4	SANDSTONE	Med dk gry - dk gry	10		35		55			VF	VF						A-SA		M	g Tr	Cc Tr			-	[Graded bedding] [Irregular bedding]	Grading to siltstone for half of the core
560.0	4.2	SANDSTONE	Med dk gry - dk gry	10		35		55			VF	VF						A-SA		M	g Tr	Cc Tr			-	[No apparent bedding]	
571.0	2.0	SANDSTONE	Med gry - clr med dk gry-grn	5	Tr	20		40		10	VF-F	F	C 5		X	10%		A-SR		M	g 5	Lf 20			-	[No apparent bedding]	Salt & pepper Sandstone
586.5	3.3	SANDSTONE	Med gry - clr - med dk gry-wh-grn	10		20		55										A-SR		M	g 5	Lf 25	Cc Tr		-	[Irregular bedding]	Salt & pepper Sandstone Kaolinised
590.0	3.3	SANDSTONE	Med gry - med dk gry	15		20		60			VF-F	F						A-SR		M	g 5	Lf 5	Cc Tr		-	[No apparent bedding]	
610.0	3.2	CLAYSTONE	Med gry - med dk gry	100																H					-	[No apparent bedding]	Hydrophyllic
620.0	4.0	SANDSTONE	Med dk gry - dk gry	15							VF	VF						A		M	g Tr	Lf Tr	Cc Tr		-	[No apparent bedding]	Very tight

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification
Parallel Type

Thickness of bedding
Metric System
millimeter bed 1mm-10mm mm
centimeter bed 1cm-10cm cm

Cross Bedding
in general
with angle indicated
chevron
climbing
festoon
planar

Irregular bedding
Graded bedding
No apparent bedding
Nodular bedding

Current-produced markings
Ripple marks
asymmetrical
interference
symmetrical
Pull over flame structure
Scour and fill
Flute cast
Groove cast
Striation
Parting lineation

Organism-produced markings
Burrowed
slightly burrowed
moderately burrowed
well burrowed
Churned
Bored
Bored surface
Organism tracks and trails
Plant root tubes
Vertebrate tracks

Penecontemporaneous deformation structures
Mud cracks
Rain or hail prints
Pull-apart
Slump structures and contorted bedding
Convolute bedding
Load cast
Tepee structure
Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures
Breccia, solution, collapse
Disolution - compaction (horse tail)
Sylolite
Vadose pisolite
Vadose silt
Boxwork
Salt hoppers or casts

Tectonic structures
Fractures
Slickensides
Breccia, tectonic

Miscellaneous
Geopetal fabric
Cone-in-cone
Stromatactics
Boudinage, ball and age flow

Abbreviations

GRAIN SIZE
VF Very Fine
F Fine
M Medium
C Course
VC Very Coarse
G Granule & larger

CEMENT
Q Silica
Py Pyrite
C Calcite
D Dolomite
Sd Siderite

DIAGENESIS
D Dolomitization
Q Silicification
X Recrystallization
Ce Chloritization

ROUNDING
R Rounded
SR Subrounded
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SORTING
P Poor
M Moderate
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VW Very Well

HARDNESS
U Unconsolidated
VS Very Soft
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POROSITY
g Intergranular
v Vugular
i Intraskeletal

ACCESSORIES
Py Pyrite
Mc Mica
Ch Chert
Cc Lignite/Coal
Hm Heavy minerals
Lf Lithic fragments
Gl Glauconite

DIAGENETIC TEXTURES
CX Crypto <1/256mm
MX Micro 1/256 - 1/16mm

HYDROCARBONS
* Signifies presence
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Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE %: CLAY MINERALS	CLAY SIZE %: MICRITE	SILT SIZE %: QUARTZ	SILT SIZE %: CALCITE	GRAINS TYPE & %: QUARTZ	GRAINS TYPE & %: SKELETAL	GRAINS TYPE & %: CALCITE	GRAINS SIZE: RANGE	GRAINS SIZE: DOMINANT	CEMENT: TYPE & %	CEMENT: TYPE & %	DIAGENESIS: TYPE	DIAGENESIS: %	DIAGENESIS: TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
630.0	1.0	Calcareous SANDSTONE	Cl-wh-lt gry occ org-blk	10		10	10	45		20	VF-M	F						A-SR	M	M	g Tr	Lf 5			-		Salt & pepper Sandstone
640.0	3.9	Siltitic SANDSTONE	Med gry - med dk gry	10		30		60			VF	VF						A	W	H		Lf Tr			-		Tight
650.0	3.3	SANDSTONE	Med gry - med dk gry	5		25		70			VF	VF						A	W	H					-		Tight
660.0	3.7	SANDSTONE	Lt gry - med lt gry - dk gry	Tr		10		90			VF	VF						A	W	H		Cc Tr			-		Carbonaceous band - brecciated
669.5	3.5	SANDSTONE	Med gry - med dk gry	Tr		20		80			VF	VF						A	W	H		Cc Tr			-		
680.0	3.7	SILTSTONE	Med dk gry - dk gry	10		90														H					-		
690.0	4.0	SANDSTONE	Med gry - med dk gry			10		90			VF-F	VF						A-SR	W	H		Cc Tr			-		
706.0	0.0	NO RECOVERY																									
715.0	3.0	SANDSTONE	Spkld med gry - med dk gry-blk			10		60			VF-F	F						SA-R	M	M		Lf 30			-		
720.0	3.0	SANDSTONE	Med gry - med dk gry-blk			10		80			VF-F	F						SA-R	M	M		Lf 20	Cc Tr		-		

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

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Stratification
Parallel Type
Thickness of bedding
Metric System
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Ripple marks
asymmetrical
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symmetrical
Pull over flame structure
Scour and fill
Flute cast
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slightly burrowed
moderately burrowed
well burrowed
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Bored surface
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Plant root tubes
Vertebrate tracks

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Mud cracks
Rain or hail prints
Pull-apart
Slump structures and contorted bedding
Convolute bedding
Load cast
Tepee structure
Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures
Breccia, solution, collapse
Dissolution - compaction (horse tail)
Stylolite
Vadose pisolite
Vadose silt
Boxwork
Salt hoppers or casts

Tectonic structures
Fractures
Slickensides
Breccia, tectonic

Miscellaneous
Geopetal fabric
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Abbreviations

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ACCESSORIES
Py Pyrite
Mc Mica
Ch Chert
Cc Lignite/Coal
Hm Heavy minerals
Lf Lithic fragments
Gl Glauconite

DIAGENETIC TEXTURES
CX Crypto <1/256mm
MX Micro 1/256 - 1/16mm

HYDROCARBONS
* Signifies presence
Full details described under supplementary data

Hudbay Oil (Australia) Ltd.
Subsidiary of Hudson's Bay Oil and Gas Company Limited

SIDEWALL CORE DESCRIPTIONS

WELL: WHALE - 1

DEPTH (metres)	RECOVERY (centimetres)	ROCK TYPE	COLOUR	CLAY SIZE %: CLAY MINERALS	CLAY SIZE %: MICRITE	SILT SIZE %: QUARTZ	SILT SIZE %: CALCITE	GRAINS TYPE & %: QUARTZ	GRAINS TYPE & %: SKELETAL	GRAINS TYPE & %: CALCITE	GRAINS SIZE: RANGE	GRAINS SIZE: DOMINANT	CEMENT: TYPE & %	CEMENT: TYPE & %	DIAGENESIS: TYPE	DIAGENESIS: %	DIAGENESIS: TEXTURE	ROUNDING	SORTING	HARDNESS	POROSITY TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	ACCESSORIES: TYPE & %	HYDROCARBONS	SEDIMENTARY STRUCTURES	SUPPLEMENTARY DATA
732.0	2.5	CLAYSTONE	Med dk gry - dk gry	100																M					-	╪	
740.0	3.6	SANDSTONE	Med gry - dk gry			10		70			VF-F	F						A-SR	M	M	g Tr	Cc 5	Lf 15		-	╪	
755.0	3.4	SILTSTONE	Med gry - dk gry	20		80														M					-	╪	
763.0	2.3	CLAYSTONE	Dk gry - gry blk	90		10														M					-	╪	Brittle
773.0	3.7	SANDSTONE	Lt gry - wh - blk occ-orange					80			VF-F	F						A-SR	W	M		Lf 10	Cc Tr		-	╪	
776.0	3.7	CLAYSTONE	Dk gry - blk	100																			Cc Tr		-	ꜰꜰ	
780.0	3.3	SANDSTONE	Med gry - med dk gry	5		10		65			VF	VF						A	W	M		Lf 20			-	╪	
785.0	3.4	SANDSTONE	Med gry - gry	5				70			VF	VF						A-SR	W	M		Lf 25			-	╪	
797.5	4.8	SILTSTONE	Med gry - med bl-gry	20		80														M					-	╪	
806.0	2.5	SANDSTONE	Med gry - dk gry			10		80			VF	VF						A	W	M		Lf 10			-	╪	

STRUCTURES (STRATIFICATION, SEDIMENTARY, DIAGENETIC)

SYNGENETIC STRUCTURES

Stratification

Parallel Type

Thickness of bedding

Metric System
millimeter bed 1mm-10mm mm
centimeter bed 1cm-10cm cm

Irregular bedding
Graded bedding
No apparent bedding
Nodular bedding

Cross Bedding
in general
with angle indicated
chevron
climbing
festoon
planar

Current-produced markings

Ripple marks
asymmetrical
interference
symmetrical
Pull over flame structure
Scour and fill
Flute cast
Groove cast
Striation
Parting lineation

Organism-produced markings

Burrowed
slightly burrowed
moderately burrowed
well burrowed
Churned
Bored
Bored surface
Organism tracks and trails
Plant root tubes
Vertebrate tracks

Penecontemporaneous deformation structures

Mud cracks
Rain or hail prints
Pull-apart
Slump structures and contorted bedding
Convolute bedding
Load cast
Tepee structure
Birdseye, fenestral fabric

EPIGENETIC STRUCTURES

Solution structures

Breccia, solution, collapse
Disolution - compaction (horse tail)
Sylolite
Vadose pisolite
Vadose silt
Boxwork
Salt hoppers or casts

Tectonic structures

Fractures
Slickensides
Breccia, tectonic

Miscellaneous

Geopetal fabric
Cone-in-cone
Stromatactics
Boudinage, ball and age flow

Abbreviations

GRAIN SIZE
VF Very Fine
F Fine
M Medium
C Course
VC Very Coarse
G Granule & larger

CEMENT
Q Silica
Py Pyrite
C Calcite
D Dolomite
Sd Siderite

DIAGENESIS
D Dolomitization
Q Silicification
X Recrystallization
Ce Chloritization

ROUNDING
R Rounded
SR Subrounded
SA Subangular
A Angular

SORTING
P Poor
M Moderate
W Well
VW Very Well

HARDNESS
U Unconsolidated
VS Very Soft
S Soft
M Moderate
H Hard

POROSITY
g Intergranular
v Vugular
i Intraskeletal

ACCESSORIES
Py Pyrite
Mc Mica
Ch Chert
Cc Lignite/Coal
Hm Heavy minerals
Lf Lithic fragments
Gl Glauconite

DIAGENETIC TEXTURES
CX Crypto<1/256mm
MX Micro 1/256 - 1/16mm

HYDROCARBONS
* Signifies presence
Full details described under supplementary data

A4-GL-480

APPENDIX B6

LOG OF SAMPLES

LOG OF SAMPLES

220 - 240 metres (20 metres)	Calcarenite, skeletal, light yellow grey to medium light grey, occasionally light orange, 20% quartz grains, trace clay minerals, medium to granular, dominantly very coarse, grained, poorly sorted, angular (skeletal fraction) to rounded (quartz grains) trace micrite, good to fair intraskeletal porosity dominant, intragranular porosity subdominant, soft.
240 - 290 metres (50 metres)	Calcilutite, skeletal, very light grey to medium grey, 5% calcite grains, 30-60% fossil fragments, trace-10% calcite silt, trace clay minerals, trace glauconite, trace pyrite, no visual porosity, soft.
290 - 380 metres (90 metres)	Calcarenite, calcilutitic, very light grey to medium grey, 20-30% fossil fragments, 20-30% calcite silt, very fine to medium sized calcite grains, angular, moderately sorted, 20-35% micrite, 0-5% clay minerals, soft.
380 - 404 metres (24 metres)	Calcilutite, argillaceous, medium grey to greenish grey, 5-10% calcite grains, 5-20% fossil fragments, 10-20% calcite silt, 5-40% clay minerals, soft.
404 - 420 metres (16 metres)	Marl, very light grey to green grey, trace skeletal fragments, trace calcite silt, 45% clay minerals, trace glauconite, trace pyrite, soft to moderately hard. With trace Sandstone, clear to white, medium to coarse grained, dominantly coarse, well sorted, angular, unconsolidated.
420 - 430 metres (10 metres)	Calcilutite, argillaceous, trace skeletal fragments, 0-20% calcite silt, 30% clay minerals, trace glauconite, trace pyrite, soft.

430 - 438.5 metres
(8.5 metres)

Calcarenite, skeletal, glauconitic, white to light green grey, 45% skeletal fragments, 5% quartz grains, fine to medium grained, moderately well sorted, angular to subangular, occasionally rounded, trace-5% micrite, trace clay minerals, 20-30% glauconite, trace pyrite, unconsolidated.

438.5 - 445 metres
(6.5 metres)

Siltstone, ferruginous, glauconitic, dark brown to brown, 5-20% clay minerals, 10-80% iron nodules, very fine to granular, poorly sorted, dominantly well rounded, 10-30% glauconite, trace pyrite, soft.

445 - 460 metres
(15 metres)

Sandstone, silty, glauconitic, dark brown to brownish black, very fine grained to occasionally granular (iron nodules) dominantly very fine, moderately well sorted, trace-20% clay minerals, trace-40% glauconite, 10-25% quartz silt, soft.

460 - 475 metres
(15 metres)

Sandstone, becoming conglomeratic below 465 metres, clear to white, fine to granular, dominantly very coarse, poorly sorted, angular to rounded, 5-10% glauconite, trace pyrite, trace Coal at 467 metres.

475 - 495 metres
(20 metres)

Claystone, medium dark grey, moderately hard to hard.

With interbeds of Sandstone, argillaceous, light grey, very fine grained, angular, well sorted, trace Coal at 475 metres, hard.

495 - 560 metres
(65 metres)

Siltstone, argillaceous, light grey to grey, 30-60% clay matrix, trace quartz grains, trace glauconite, trace carbonaceous material, soft, trace pin-point fluorescence.

With 10-60% Sandstone, clear to white, 0-5% glauconite, trace pyrite, very fine to coarse grained, dominantly medium grained, moderately well sorted, subangular to subrounded, trace silica cement, unconsolidated.

560 - 620 metres
(60 metres)

Sandstone, clear to white, fine to coarse, dominantly medium, well sorted, angular to subrounded, trace-10% clay matrix, trace glauconite, trace pyrite, trace lithic fragments, trace carbonaceous material, trace silicification, moderately hard to soft.

With interbeds of Siltstone, argillaceous, light grey to grey, 15-40% quartz grains, very fine to medium, dominantly fine, angular, 30-45% clay matrix, trace glauconite, soft.

620 - 720 metres
(100 metres)

Siltstone, argillaceous, light grey to dark grey, trace-20% quartz grains, very fine to medium, dominantly fine, 35-65% clay matrix, trace calcite cement, trace glauconite, trace carbonaceous material, moderately hard.

With 5-20% Sandstone, clear to white, fine to coarse, dominantly medium, moderately well sorted, angular, moderately hard, poor intergranular porosity.

720 - 810 metres T.D.
(90 metres)

Claystone, light grey to grey to dark grey, 10-15% quartz grains, 20% quartz silt, soft.

With interbeds of Sandstone, as between 620-720 m.

And Siltstone, as for between 620-720 m.

PE601364

This is an enclosure indicator page.
The enclosure PE601364 is enclosed within the container PE900000 at this location in this document.

The enclosure PE601364 has the following characteristics:

ITEM_BARCODE =	PE601364
CONTAINER_BARCODE =	PE900000
NAME =	Exlog Formation Evaluation Log
BASIN =	GIPPSLAND
PERMIT =	VIC/P11
TYPE =	WELL
SUBTYPE =	MUD_LOG
DESCRIPTION =	Exlog Formation Evaluation Log(enclosure from WCR) for Whale-1
REMARKS =	
DATE_CREATED =	1/12/81
DATE_RECEIVED =	13/07/82
W_NO =	W761
WELL_NAME =	WHALE-1
CONTRACTOR =	EXLOG
CLIENT_OP_CO =	HUD OIL AUSTRALIA LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE601365

This is an enclosure indicator page.
The enclosure PE601365 is enclosed within the container PE900000 at this location in this document.

The enclosure PE601365 has the following characteristics:

```
     ITEM_BARCODE = PE601365
CONTAINER_BARCODE = PE900000
             NAME = Wellsite Lithology Log
            BASIN = GIPPSLAND
           PERMIT =
             TYPE = WELL
          SUBTYPE = WELL_LOG
      DESCRIPTION = Wellsite Lithology Log
          REMARKS =
     DATE_CREATED = 25/12/81
    DATE_RECEIVED = 13/07/82
             W_NO = W761
        WELL_NAME = Whale-1
       CONTRACTOR = Hudbay Oil Australia Ltd
     CLIENT_OP_CO = Hudbay Oil Australia Ltd
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601366

This is an enclosure indicator page.
The enclosure PE601366 is enclosed within the container PE900000 at this location in this document.

The enclosure PE601366 has the following characteristics:

ITEM_BARCODE =	PE601366
CONTAINER_BARCODE =	PE900000
NAME =	Composite Well Log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	COMPOSITE_LOG
DESCRIPTION =	Composite Well Log (enclosure from WCR) for Whale-1
REMARKS =	
DATE_CREATED =	25/12/81
DATE_RECEIVED =	13/07/82
W_NO =	W761
WELL_NAME =	Whale-1
CONTRACTOR =	Hudbay Oil Australia Ltd
CLIENT_OP_CO =	Hudbay Oil Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE604507

This is an enclosure indicator page.
The enclosure PE604507 is enclosed within the container PE900000 at this location in this document.

The enclosure PE604507 has the following characteristics:

ITEM_BARCODE =	PE604507
CONTAINER_BARCODE =	PE900000
NAME =	Velocity Log
BASIN =	GIPPSLAND BASIN
PERMIT =	VIC/P11
TYPE =	WELL
SUBTYPE =	VELOCITY_CHART
DESCRIPTION =	Velocity Log (enclosure from WCR) for Whale-1
REMARKS =	
DATE_CREATED =	12/12/81
DATE_RECEIVED =	
W_NO =	W761
WELL_NAME =	WHALE-1
CONTRACTOR =	SEISMOGRAPH SERVICE (ENGLAND) LTD
CLIENT_OP_CO =	HUDBAY OIL (AUS) LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE900001

This is an enclosure indicator page.
The enclosure PE900001 is enclosed within the container PE900000 at this location in this document.

The enclosure PE900001 has the following characteristics:

ITEM_BARCODE =	PE900001
CONTAINER_BARCODE =	PE900000
NAME =	Whale-1 Well Velocity Survey
BASIN =	GIPPSLAND
PERMIT =	VIC/P11
TYPE =	WELL
SUBTYPE =	VELOCITY_CHART
DESCRIPTION =	Whale-1 Air Gun Well Velocity Survey and Calibrated Log Data. (From Schlumberger Sonic Logs). Enclosure 3 from WCR.
REMARKS =	The condition of the paper is good though the data is a little hard to read on some of the graphs.
DATE_CREATED =	12/12/1981
DATE_RECEIVED =	13/07/1982
W_NO =	W761
WELL_NAME =	Whale-1
CONTRACTOR =	Seismograph Service (England) Limited
CLIENT_OP_CO =	Hudbay Oil (Australia) Limited

PE902675

This is an enclosure indicator page.
The enclosure PE902675 is enclosed within the container PE900000 at this location in this document.

The enclosure PE902675 has the following characteristics:

ITEM_BARCODE =	PE902675
CONTAINER_BARCODE =	PE900000
NAME =	Tectonic Elements Map
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	map
DESCRIPTION =	Tectonic Elements Map
REMARKS =	
DATE_CREATED =	1/05/82
DATE_RECEIVED =	13/07/82
W_NO =	W761
WELL_NAME =	Whale-1
CONTRACTOR =	Hudbay Oil Australia Ltd
CLIENT_OP_CO =	Hudbay Oil Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)