WCR FOR VOLADOR-1

W794

SHELL - AUSTRALIA E. & P. OIL AND GAS

I.D. PT 1 0696A/0011A
PT 2 0600A/0011A

SDA 494

VOLADOR-1
WELL COMPLETION REPORT
GIPPSLAND BASIN
OFFSHORE VICTORIA
(VIC/P19)

OFFSHORE VENTURES TEAM/
PETROLEUM ENGINEERING

AUGUST 1983

Keywords: exploration well, Latrobe, intra-Latrobe, coastal, barrier, plain, alluvial, carbonaceous, mudstone, coal, glauconite, Eocene, Paleocene, Upper Cretaceous, co-venturers, drilling, navigation, rig positioning, casing, logging, production test.

SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

CONTENTS

CONTENTS

Attachments:

7. Velocity Survey

FIGURES

TABLES

ENCLOSURES

5. Formation Evaluation Log (Mud_Log)
6. Pressure Evaluation Log.
7. Temperature Data Log.
8. Wireline Data Pressure Log
9. Time Vs Depth Curve.

1. SUMMARY

Volador-1, the second well to be drilled in Permit VIC/P19, was spudded on the 26th December 1982 by the semi-submersible rig Nymphea and plugged and abandoned on 16th April 1983. No hydrocarbon indications were encountered in the upper objective, an erosional high underlying the Tuna channel. Fluorescence and gas shows were encountered in intra-Latrobe fluvial sandstones of Campanian age, which formed the secondary objective of the well. Small amounts of carbon dioxide-rich gas, waxy crude oil, water and condensate were produced during production testing of these sandstones. The well was abandoned at a total depth of 4611m without establishing economic hydrocarbon reserves. However, the well demonstrated the existence of mature Upper Cretaceous source rocks generating oil and gas in the southern part of VIC/P19.

PE905485

This is an enclosure indicator page.
The enclosure PE905485 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905485 has the following characteristics:

ITEM_BARCODE	= PE905485
CONTAINER_BARCODE	= PE902608
NAME	= Well Location Map
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= GENERAL
SUBTYPE	= PROSPECT_MAP
DESCRIPTION	= Well location Map, Fig 1 for Volador-1 from WCR
REMARKS	=
DATE_CREATED	= 9/11/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

2. INTRODUCTION

Volador-1 was the second well drilled by the permit holders of VIC/P19, and the first in Permit Year Two (2/9/82 - 1/9/83). It was proposed as a test of an erosional high in the upper Maastrichtian Latrobe Group with potential for deeper Campanian dip closed traps. As one of the prime targets in the permit area it had originally been programmed to be drilled in permit year one as the first commitment well (2/9/81 - 1/9/82). However, at that time, no suitable rigs were available for anchoring in deep water (over 250m) so a shallower target, Hammerhead-1, (120m water) was selected. Volador was the first well drilled by the deep-water rig 'Nymphea' after its construction in Japan.

3. WELL HISTORY

3.1 Summary of Well Data

Well Classification	:	Expendable exploration well
Final Location co-ordinate	:	38°25' 28.26" South
	:	148°32' 36.67" East
Contractor/Rig	:	Foramer/Nymphea
Derrick Floor Elevation	:	25m above MSL
Water Depth	:	260m below MSL
BOP Stack	:	10,000 psi, 18-3/4" Cameron
Start of Operations	:	0000 hrs 25/12/82
Spudded	:	1715 hrs 26/12/82
Abandoned	:	0130 hrs 16/4/83
End of Operations	:	0625 hrs 19/4/83
Objective	:	Upper Cretaceous sandstones of the Latrobe Group
T.D.	:	4611m (4612m loggers depth) 4618M
Formation at T.D.	:	Latrobe Group
Results	:	Dry hole (non producable). Hydrocarbon saturation of up to 56% in some intra-Latrobe sands
Casing Record	:	30" at 332m
	:	20" at 551m
	:	13-3/8" at 1308m
	:	9-5/8" at 2814m
	:	7" liner at 4404m
Logs	:	DIL/LSS/SP/GR (2 runs) 2827- 551m
		LSS/GR 4361-2814m
		LDL/CAL/GR (4 runs) 4363- 551m
		CNL/GR 4345-2814m
		LDL/CNL/CAL/GR (2 runs) 4612-4100m
		DLL/MSFL/SP/CAL/GR (4 runs) 4612-2814m
		CST Interval 2827-1308m
		Interval 4400-2814m
		Interval 4617-4404m
		RFT (9 measurements) 3237-2814m
		(4 measurements) 3457.4-3913.3m
		HDT 4361-2814m
		CBL/VDL/CCL/GR 4406-2655m
		BHC/GR 4602-4404m
Production Test		Test 1 Interval 3911-3914m
		Test 2 Intervals 3777-3783.5m
		3767-3773m
		3756-3759.5m

3.2 Site Survey

Prior to the arrival of the Nymphea, a site survey (GSS-1) and sea bed sample programme was performed over the immediate vicinity of the Volador location.

For this purpose, E G & G were contracted to provide a 9 kJoule Sparker System with 1200 ft 24 group (50 ft/group) streamer to record seismic data on a 24 channel Electromechanical digital system. Survey data was sampled at 1/2 millisecond, and 386.4km of 24 fold coverage recorded over the Volador area (GSS-1). Profiles were spaced 200 metres apart in the NE-SW direction, 200 metres apart in the NW-SE direction. Data over the 13 x 4km site was later processed by Digicon (Singapore). To aid interpretation, a High Resolution Boomer was also employed to provide near surface data. A geological consultant was contracted to interpret the seismic sections. Three sea bed cores were taken, two in the GSS-1 site and one in a deep water channel outside the survey area (Fig. 2). On average, a metre of fine sand, silt and clay was recovered from every drop core.

Prior to its use, the 'Sunrad EA' echosounder was calibrated to an accuracy of 0.5% with a bar check to 70 metres: the resultant analog display proved that the water depth at the location was approximately 260 metres. A side scan sonar was also used to locate and display sea bed features. The main conclusions of the interpretation (Ref. 1) were as follows:

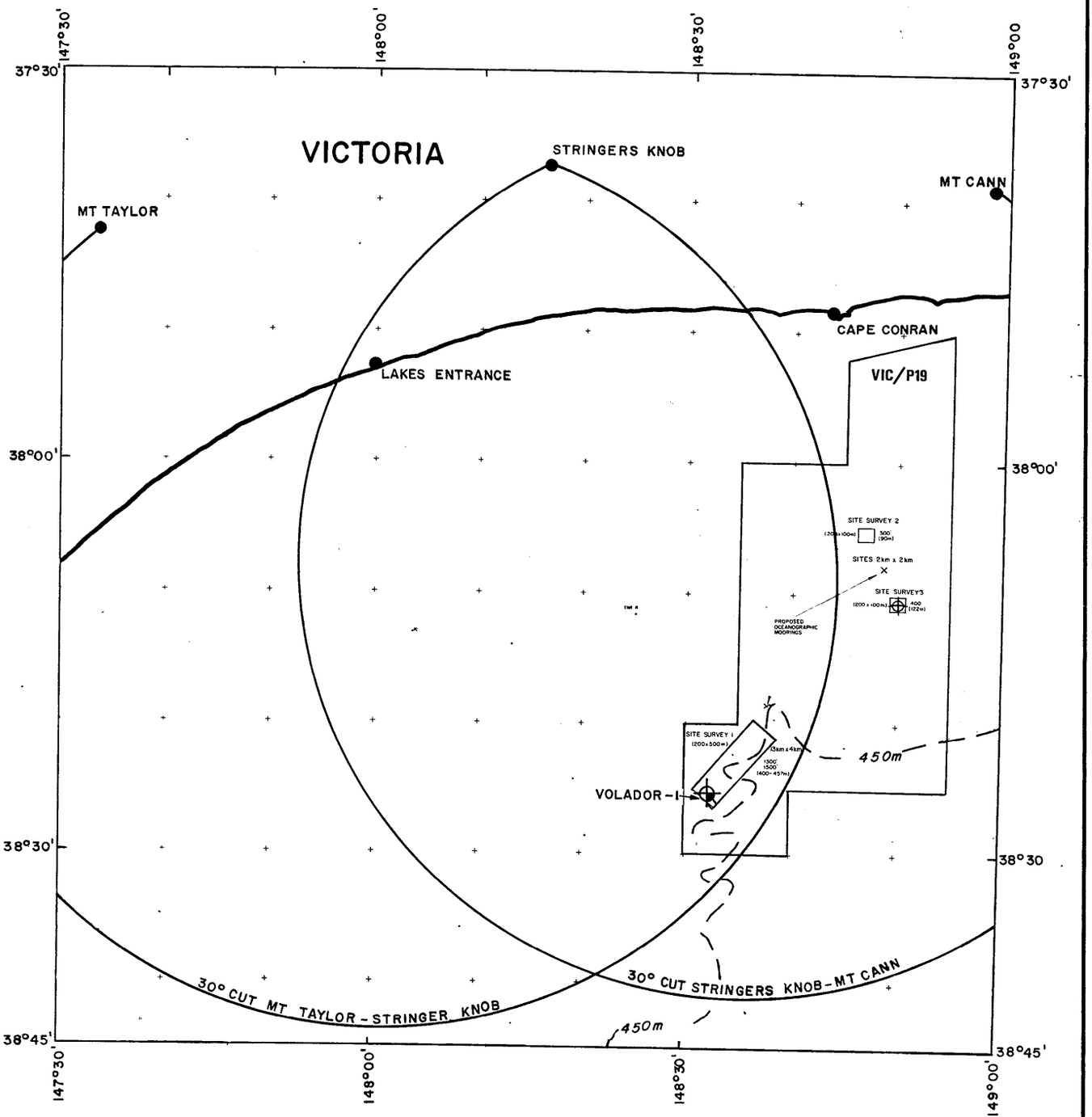
- The seabottom of the study area varies in depth from 230-450m. At the Volador-1 location the waterdepth is 261m.
- The Volador-1 location is situated on a ridge, 500m SW of a steep slope, with a gradient up to 40°.
- Slumping occurs in the area but the location is interpreted to be outside of the slump influence.
- A deep channel system occurs north of the location. Occasionally turbidity-currents could occur in these channels.
- No evidence of gas is observed on the seismic sections.
- No deep seated faults are recognised on the seismic.

The survey vessel used was M/V Halcyon, working out of Portland, Victoria. During the survey, the vessel travelled to Eden where its propeller was removed and repaired.

3.3 Navigation and Positioning

3.3.1 General

The rig Nymphea was constructed in Japan and made her maiden voyage to the location, departing during October 1982. Personnel for the positioning embarked by helicopter from Sydney. The rig was successfully navigated directly on to the Volador location without calling at any ports.



SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

VIC/P19
SITE SURVEY LOCATIONS

SCALE = 1:800,000 approx

Author: EPE/1	Date: June 1983	Fig. 2
Report No.: SDA 494	Drawing No.: 16426	

Positioning details for the Nymphea on Volador-1 are given in Reference 2. Duration and cost of the rig move cannot be compared with that of a routine move as the equipment was included in the contract with G.S.I. for seismic acquisition.

Positioning was provided by a Syledis B radio positioning system interfaced to a Hewlett Packard 85 computer. Mobiles and shore stations were provided by GSI as the chain had been used for a seismic survey directly before drilling activity.

Attempting to run the second and subsequent anchors was unsuccessful due to a mechanical defect in the windlasses, and the rig was towed into Portland for repairs and modifications. As accurate navigation was not necessary until returning to location, the system on board was dismantled although the shore stations were maintained.

The contractor also supplied a rig positioning system and surveyor by sub-contract to BTW Survey Services for the original positioning during November. It was decided to save the expense of this service for the final completion in late December using only a HP85 computer and plotter interfaced to the Syledis.

The positioning was carried out by G.M. Mason, Contract Surveyor to SDA, supervised by P. Hug of Shell International (Holland).

3.3.2 Calibration of Chain

The calibration was carried out at a navigation range near Seaspray, Victoria. Baseline crossings using a small fishing vessel were also carried out prior to positioning in order to ensure that the beacon positions were correct (Ref. 3).

3.3.3 Sequence of Events

Nov	8	: Bench calibration
	9	: Short base line calibration
	10-11	: Inspection of stations
	12	: Base line crossings
	15	: Embarkation from Sydney
	17	: Arrival on location
	18	: Dismantling of equipment
	19	: Depart Nymphea
Dec	8	: Check equipment on board, vessel in dock at Portland
	21	: Reboard rig in Portland

3.3.4 Operations

Positioning equipment performed without major defects and the final well position was accurately established. Minor problems were experienced with the reception of Syledis signals during final positioning.

It was found that placing the Syledis antenna on top of the derrick provided numerous advantages. Although some loss of signal could be expected from the long cable length, this was outweighed by the superior reception and transmission of signals at this height. The antenna was positioned exactly at the centre of derrick, and hence no offset was necessary. When the second mobile was utilised with its antenna on the control room roof, the effect of moving cranes and other obstacles was noticed.

The method of direct positioning of the vessel without the use of buoys to mark the position was very successful. The rig made a long run-in along a line to the position of anchor number 6, which dropped from the stern of the vessel as its desired location was passed. The rig was held in position using the tow vessel and thrusters while the remaining anchors were run to their required locations.

3.3.5 Shore Stations

Shore stations are positioned on the National Trigonometrical System. Point Hicks and Cape Conran were surveyed by tellurometer traverse from trigonometrical stations by BTW Surveys in October 1982.

It was found during the seismic survey previously carried out by G.S.I. that signals from Seacombe and Lakes Entrance were not very reliable. Movement of two of the beacons to higher locations at Mt Taylor and Stringers Knob significantly improved reception. The recommended four stations to be used for all future site surveys and rig navigation are:

Mt Taylor
Stringers Knob
Cape Conran
Point Hicks

3.3.6 Syledis Performance

During the aborted positioning operation during November, the Syledis performed extremely well using the 4 stations shown above. The only exception was when the range to Seacombe dropped out for only a few minutes.

During the seismic survey in early December, considerable problems were experienced with the signals from Seacombe and Lakes Entrance. Low signal strengths, with rolling and dropping out of these ranges made these stations unusable for long periods. During the final rig positioning, similar phenomena were experienced. Rolling, even at high AGC values, caused problems on the two longer ranges, although the height of the antenna seemed to reduce their tendency to drop out altogether.

3.3.7 Anchor Handling

The thrusters on the rig make anchor handling a simple and safe operation. After the winch repair, anchor handling proceeded smoothly and in good time in good weather. The method of using anchor chasers, rather than buoys, was extremely successful. Although extra time was involved in chasing the wires back to the rig, this was easily compensated for by not having to deal with buoys on deck. No slipping of anchors or problems with the anchor configuration were encountered.

3.3.8 Rig Orientation

Taking into account prevailing wind directions for the months of January to March, a rig heading of 217° was selected which provided reasonable positions for the anchors on the seabed.

The anchor pattern was a regular octagon, providing 30° to 45° between consecutive anchors. Although different to that for Hammerhead-1 (semi-submersible rig Diamond M. Epoch), no problems were encountered.

3.3.9 Contractor Performance

The operators of the Syledis system (G.S.I.) are not normally involved in rig moving operations. Their performance however was good, as there were no interruptions of any beacon or mobile performance apart from meteorological effects during rig moving operations.

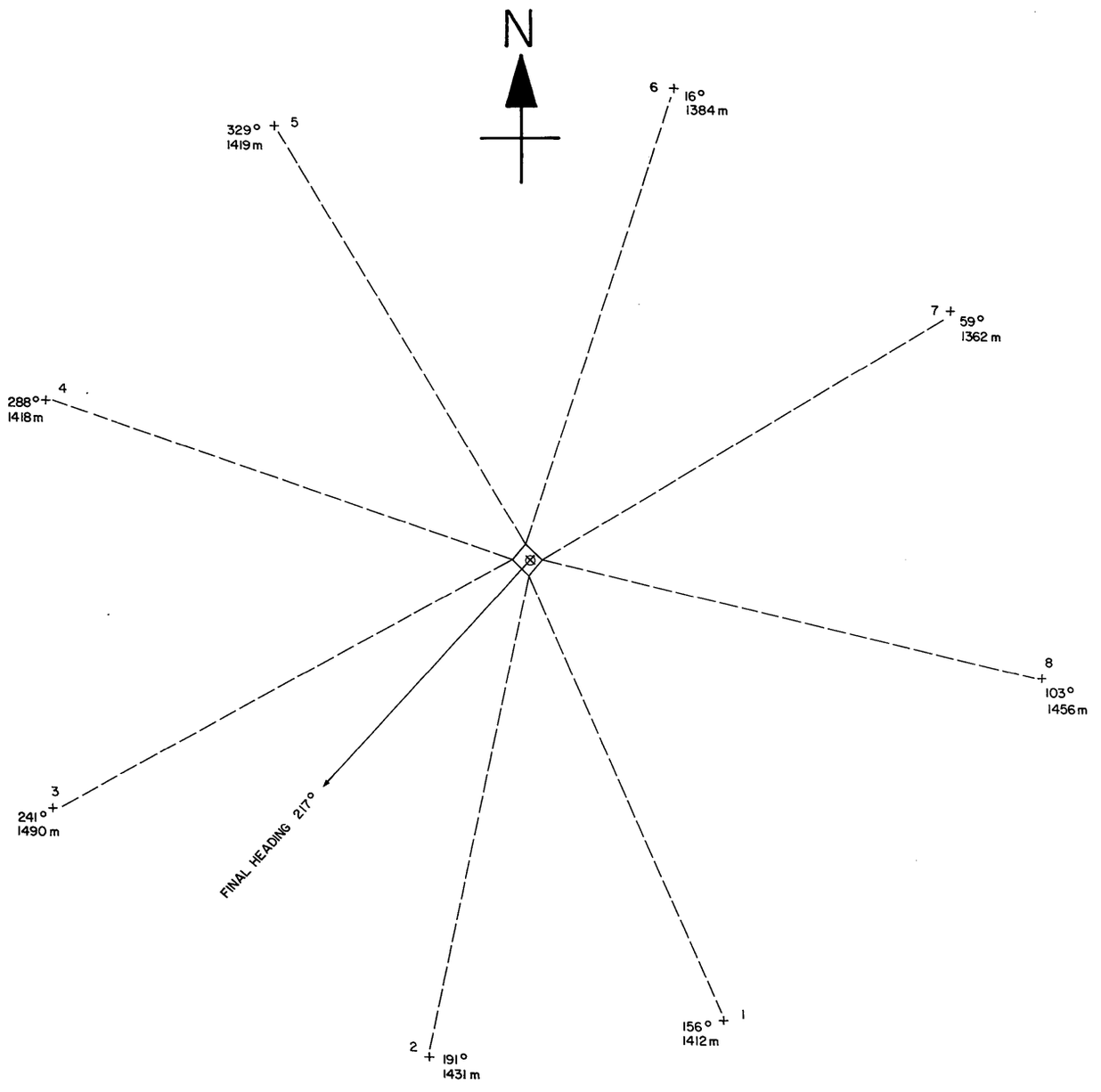
3.4 Drilling History

The Nymphea arrived on location at 0600 hrs on 24/12/82 following modifications to the anchor winches in Portland and commenced running anchors. The anchors were satisfactorily tested in pairs to 158 tonnes minimum.

The Shell contract was started at 0000 hrs on 25/12/82. After adjusting anchor tensions to 100 tonnes and ballasting to 19.8m, a penetration test was carried out (tagged bottom at 285m, washed down to 288m, 3T WOB) and the temporary guide base rigged up and run. The TV wires and guide wires became tangled and were subsequently freed using the diving bell manipulator arms.

The well was spudded at 1715 hrs on 26/12/82 and the 36" hole drilled to 339m in 9 hours using seawater and viscous pills. The 30" casing together with the permanent guide base was run and the casing cemented with returns to the seabed.

The 26" BHA was made up and the shoe track and pocket cleaned. A 12-1/4" pilot hole was drilled to 560m in 9 hours, then opened up to 26" using seawater and viscous pills. The hole was subsequently displaced to viscous mud. Twenty two joints of 20" casing together with a cement stinger were run. The wellhead housing was landed successfully and followed by a pick-up test of 10 MT. 20" casing was cemented with the shoe at 551m and returns were observed on the



FINAL CO-ORDINATES
38°25'28·26"S 148°32'36·67"E

SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

ANCHOR PATTERN AND HEADING OF NYMPHEA AT VOLADOR - 1

Author: EPE / 1	Date: APRIL 1983	Fig. 3
Report No.: SDA 494	Drawing No.: 16601	

seafloor. After releasing the running tool and retrieving the tool and stinger, preparations were made to run the BOP stack and marine riser.

The BOP stack was run, testing every third riser connection. Divers were used to assist in positioning and landing the stack because three guidelines broke on the first attempt to land it. Total time taken to run the stack, including testing, was 20 hours. The wear bushing was run after stack testing was completed. However whilst recovering the running tool, 6 singles and the running tool were dropped in the hole resulting in nine hours fishing.

After making up a 17-1/2" slick assembly and tagging cement at 540m, the shoe track and pocket were drilled out with seawater to 565m and the hole subsequently displaced to seawater-lignosulphonate-bentonite mud. A leak-off test gave an equivalent maximum mud gradient of 1.32 SG. Drilling continued to 664m, when a stabiliser was added to the BHA. 17-1/2" hole was drilled to 1318m and viscous mud circulated to clean the hole. During a wiper trip to the shoe an overpull of 40 MT was experienced, so further circulating occurred to clean both the hole and stabiliser. No problems were encountered on pulling out prior to logging and two logging runs were made (DIL/LSS/SP/GR and LDL/GR/CAL) were made.

A check trip was made following logging, the hole circulated clean, and the wear bushing retrieved. Ninety joints of 13-3/8" N80 casing were then run in 13 hours, with the shoe at 1308m. A Halliburton subsea release system was used for the cementation. On bumping the top plug the casing was tested successfully to 2000 psi. The seal assembly was energised and tested to 5000 psi, and the casing running tool retrieved.

The 12-1/4" BHA was made up and run in the hole to the top of cement at 1285m, which was then drilled and cleaned to 1334m. An F.I.T. test was performed resulting in a maximum equivalent mud weight of 1.91 SG. Drilling continued to 1417m. After changing the bit and adding 2 stabilisers to the BHA, reaming was required below 1366m: however the string torqued up and the connection below the kelly backed off. 86 joints of drillpipe were recovered using an overshot and spiral grapple, and it was found that the pin on the last joint had twisted off. Fishing continued for a further 43 hours with all the BHA recovered except the remains of the bit (which had shattered). After attempting to mill the junk a 50m cement plug was set from 1418-1368m.

The plug was dressed off to 1382m with a Dynadrill with 2° bent sub and a new hole drilled to 1397m (inclination 2°). The Dynadrill was then pulled and a new bit and drop-off BHA was run in the hole. Maximum inclination was 3° at 1400m, and by 1600m reduced to 1-1/2°. Drilling continued to 1962m (with occasional reaming and washing on connections) where balling-up of stabilisers associated with a hydratable clay fraction in the marls became a problem. Frequent reaming became necessary and check trips were required in order to drill to casing depth at 2842m.

A wiper trip was made to the shoe before rigging up Schlumberger and the mud conditioned. Two log runs were made (DIL/LSS/GR and LDT/GR/CAL) before a 51 gun CST (42 recovered, 7 misfired, 1 lost, 1 empty). After rigging down Schlumberger a check trip was made to TD and the hole circulated clean. On attempting to pull out of the hole, 40 MT overpull was experienced and cavings began to be a serious problem. Viscous mud was pumped and 7 singles were pumped out of the hole. A check trip was made to the 13-3/8" shoe and on running back to bottom the mudweight was increased to 1.16 SG and the API water loss reduced from 10ml/30 min to 7ml/30 min. A further check trip to the shoe with a 1-3/4 hr wait resulted in 12m fill on bottom but a stable hole and consequently it was decided to shorten the casing string by one joint to prevent the possibility of standing up.

After retrieving the wearbushing and rigging-up, 214 joints of 9-5/8" N80 casing were run to 2814m in 11 hours. The casing was cemented using a Halliburton subsea release system (pump pressure = 1500 psi) and pressure tested successfully to 3100 psi for 15 minutes. The seal assembly was energised, tested to 5000 psi, and the running tool was retrieved. The wear bushing was reset and an Eastman gyro multi-shot survey run on Schlumberger cable in the 9-5/8" casing before drilling out the cement. The BHA for the 8-1/2" hole was made up and the collar, shoe track and pocket drilled out. At 2857m a Formation Intake Test was performed, giving a maximum equivalent mud gradient of 1.73 SG.

The 8-1/2" hole was drilled to about 2900m with the low solids mud that had been in use prior to running the 9-5/8" casing. Below 2900m the mud was converted to a seawater/polymer system to prevent further problems when hydratable clays were encountered. Drilling continued to 3040m, when torquing was experienced. No junk was recovered after running a reverse circulating basket and the hole was drilled to 3244m with high and fluctuating torque. The hole was circulated clean prior to rigging up Schlumberger for intermediate logging. Two combination electric logs were run, DLL/MSFL/GR/CAL/SP and LDL/CNL/GR/CAL. The CNL tool failed and in addition, an RFT run was aborted due to tool failure. A new BHA with reamer was made up and the hole deepened to 3349m before rigging up and running the RFT again. Nine pressure measurements were made and two samples recovered but no indications of oil or gas were found.

The 8-1/2" hole was drilled to 3922m with occasional torquing and overpulls during trips. At 3922m the pump pressure dropped 3000 psi and it was subsequently found that a nozzle had washed out. The 8-1/2" hole was drilled to 4372m, at which depth high torquing occurred and drilling was stopped. High gas readings (20-30%) and hole cavings required circulation and conditioning of the mud. The mudweight was increased from 1.17 SG to 1.24 SG over a number of circulations before a 10 stand wiper trip was made to check the hole stability. This trip resulted in a 32% trip gas reading when bottoms were circulated up. The hole was then displaced to 1.26 SG mud prior to pulling out for logging.

Five log runs were made: DLL/MSFL/GR/SP/CAL, LDL/CNL/GR (CNL Tool Failed) and LSS/GR. After Run 3 a checktrip was made to T.D. and the mud conditioned (the maximum gas reading at this stage was 98%) prior to running LDL/CNL/GR (CNL Tool failed) and CNL/GR. A second check trip was made and the mud was conditioned prior to two RFT runs (4 pressures, 2 non-segregated samples and 1 segregated sample), a velocity survey (26 levels), and an HDT run.

At this stage it was decided to continue drilling beyond 4372m and consequently check trips were made to establish a stable hole and to condition the mud. Gas levels were about 68% and cavings still occurred so the mud weight was increased to 1.29 SG, and the hole cleaned with viscous mud. It was necessary to ream out to 4372m before drilling to 4381m. Further reaming was required after more fill was found on bottom and eventually the hole stabilised on reaching a depth of 4402m.

Two log runs were made: DLL/MSFL/GR/SP/CAL and LDL/CNL/GR/CAL. After unsuccessful RFT measurements in the range 4402 to 4000m due to tight formation and seal failures, three CST runs were made (132 fired, 18 lost, 7 empty).

Schlumberger was rigged down and a RTTS packer set at 1190m in order to pressure test the 9-5/8" casing to 2750 psi. After testing the casing, a bit and junk sub were run to break up and fish lost CST bullets. When no indications of junk remained, preparations were made to run a 7" liner.

146 joints of 7" N80 liner were run on 5" drillpipe in 15 hours. The liner was set on bottom after difficulties in setting the hanger (at 2656m) and was cemented satisfactorily. After running in the hole with a 7" - 9-5/8" tandem scraper and 6" bit, the cement was drilled to 4376m, and the hole cleaned.

A subsequent inflow test resulted in 400 psi drawdown and an initial flow of 48 litres/hour which stopped after 3 hours (temperature stabilised).

Extra 4-3/4" drill collars were added to the BHA and the cement, landing collar and shoe track drilled out. New 6" hole was drilled to 4413m with torque problems, probably caused by CST junk. A jar was added to the BHA and careful working of the string to bottom removed the torque problem. The 6" hole was then drilled to 4452m when a 425 psi pressure loss occurred. No washouts were observed on pulling the string.

T.D. was decided on at 4611m. Schlumberger ran DLL/MSFL/GR/CAL and LDL/CNL/GR/CAL. A check trip was made prior to running an RFT, which recovered 4.5 litres of contaminated mud but was unsuccessful in obtaining formation pressure readings. A final log run was made: BHC/GR (CBL/CCL/GR in liner) and CST (21 shot, 1 lost, 10 empty, 10 recovered).

The 6" hole was plugged back after the above logging was completed and the results assessed. A 21 joint 2-7/8" tubing stinger was run on 18 joints 3-1/2" drill pipe and 5" drill pipe to surface. The

hole was circulated free of gas. Plug No. 1 was set from 4600-4500m and plug No. 2 from 4450-4308m. The tubing was laid down, the liner then scraped to 4308m and the cement plug dressed. The hole was displaced to seawater holding constant BHP and subsequently displaced to 1.13 SG brine.

An Fl packer was set by Schlumberger at 3884m, the production string run, tested, and the tubing contents displaced to diesel. The interval 3911-3914m was perforated using a through tubing 2-1/8" Enerjet perforating gun (4 shot/foot) and Production Test No. 1 carried out. The well was opened up and approximately 3 bbls oil, 40 bbls water and small quantities of CO_2 rich gas were produced before the well killed itself.

The tubing contents were reverse circulated and the test string laid down. For further details of Production Test No. 1 procedure and results see Section 3.9.

A model N bridge plug was set at 3883m on top of the packer using Schlumberger. A 2-7/8" cement stinger was made up, and run in hole. A cement plug was set from 3883-3807m and subsequently weight tested to 7 MT and dressed to 3808m.

An Fl packer was set by Schlumberger at 3720m. The production string was run, tested, and the tubing contents displaced to diesel. The intervals 3777-3783.5m, 3767-3773m, 3756-3759.5m were perforated by Schlumberger in 3 runs using a 2-1/8" Enerjet perforating gun (4 shot/foot). The well was opened on various chokes up to 5/8" for 11 hours intermittent shut-ins to carry out repairs to the separator instrumentation. After clean up, the well was shut in for 10 hours during which time a Flopetrol SRG gauge was run with gradient stops. When the well was opened up for a main flow period, THP and BHP dropped rapidly. After 28 minutes flow, the well was shut in for a pressure build up. After three further flowing and shut in periods, THP had decreased to zero so the Flopetrol gauges were retrieved with gradient stops. The interval 3756-3759.5m was reperforated. However no change in THP was noted, which bled down rapidly to zero on opening the well. After running a bottom hole sampler (recovered water), the tubing contents were reverse circulated and the test string laid down. Total cumulative production during Production Test No. 2 was 5 bbl oil, 28 bbl condensate, 160 bbl water and 2 MMSCF CO_2 rich gas (See 3.9).

Total time spent on production testing operations was 15 days.

A model N bridge plug was set at 3719m. The following abandonment cement plugs were then set.

Plug 4	3719-3619m
Plug 5	2684-2499m
Plug 6	373-321m

Plug 5 was tagged at 2499m and weight tested with 12 MT. The 3-1/2" drill pipe, 4-3/4" collars and 5" drillpipe were laid down. The H4 connector was disconnected from the wellhead, and the riser and BOP stack retrieved. A 25 kg ICI explosive charge was made up and run

in to 4.9m below seabed. The detonator was run and the charge fired. Three unsuccessful attempts were made to pull the well head and guide bases. A 9-5/8" spear was then run and the 9-5/8" hanger and 6m of casing retrieved. A second 15 kg charge was fired 4.9m below seabed. The 18-3/4" running tool was run and the TGB, PGB and well head retrieved with 25 mt overpull. Volador-1 was abandoned at 0130 hours on 16/4/83.

Due to adverse weather conditions, three further days were spent on a sea bed survey (all clear) and pulling anchors. Operations ended at 0625 hours on 19/4/83 and the rig was towed to the Basker-1 location. Supply boats used for the anchor retrieving operations were the M/V Herdentor and the M/V Lady Penelope, with the M/V Christmas Creek put on temporary charter as standby boat.

3.5 List of Contractors, Service Companies and Main Equipment

The Nymphea was brought into Australian waters under a one year contract between Shell Development (Australia) Pty Ltd and Foramer S.A.

The following contractors and service companies have contracts with Shell Development for the duration of the drilling programme.

Drilling Contract	:	Foramer S.A.
Supply Vessels	:	Australian Offshore Services Vessels - Herdentor and Lady Penelope
Helicopter Services	:	Commercial Aviation 2 Bell 212 Helicopters
Electric Logging	:	Schlumberger
Mud Logging	:	Exlog Gemdas Unit
Subsea Support Services	:	Solus Ocean Systems OMBV System
Surface Producting Testing	:	Flopetrol Schlumberger
Cementing Services	:	Halliburton Australia
Mud Service and Materials	:	Baroid Australia Pty Ltd

Main Equipment

Drilling Vessel		
Design	:	Enhanced Pacesetter Semisubmersible
Built	:	1982 Hitachi Zosen
Derrick	:	160 ft; 1,000,000 lbs
Drawworks	:	National 1625DE: 16,000'-25,000' rating
Mud Pumps	:	National 12P 160 7*12
BOP's	:	Cameron 18-3/4" (10,000 psi)
Well Head Equipment	:	Vetco SG-5
Anchors	:	8 x 20 Stevin type anchors 8 x 3" chain 3 - breaking load 474 mt
Cementing Unit	:	Halliburton
Solids Control Equipment		- Harrisburg triple tandem shale shaker - Pioneer Sandmaster Desander T8-6 capacity 800 GPM - Pioneer Siltmaster Desilter T16-4 capacity 800 GPM - Thule VMS 200 Mud Cleaner 16 cones - 1 Swaco degasser

3.6 Drilling Data

3.6.1 Bit Record

See Table 1: Bit Record

3.6.2 Casing Summary

See Table 2: Casing Summary

3.6.3 Cement Summary

See Table 3: Cement Summary

3.6.4 Mud Summary

See also Table 4: Mud Record

36" and 26" Hole Section

The 36" and 26" holes were drilled with seawater and viscous pills with minimum control of properties. Before running the 20" casing the 26" hole was displaced to viscous mud (prehydrated bentonite).

17-1/2" Hole Section

The 17-1/2" hole was drilled with a seawater-bentonite-CMC-lignosulphonate system. A mud weight of 1.11-1.12 SG was used wtih MBC of c. 25 lb/bbl. No hole problems were experienced except for slight balling up of the the stabiliser on one occasion.

12-1/4" Hole Section

The 12-1/4" hole was drilled with similar mud to the 17-1/2" hole. Mud weight was 1.10-1.12 SG, MBC 20-25 lb/bbl, Yield point 10-18 lb/100 sq feet, and API water loss at 12-20 cc. Frequent reaming and check trips were required in the Gippsland Limestone marls due to balling up of the stabilisers. This was particularly bad in the interval 1962m to 2842m (casing depth). Subsequently the Schlumberger caliper log showed the interval 2725-2675m to be seriously undergauge (8"). On attempting to pull out of the hole after a checktrip, 40MT overpull was experienced. The mudweight was increased to 1.16 SG with barite and the API water loss reduced to 7 cc. A further check trip indicated the hole to be stable and the 9-5/8" casing was run trouble free.

8-1/2" Hole Section

In view of the hole problems which occured in the 12-1/4" hole due to hydratable clays, the mud system was converted to a seawater/polymer system designed to use Celpol to control rheology and Dextrid/CMC to control API water loss. Due to the active clays picked up from the formation it was not possible to add significant quantities of Celpol, and the mud was maintained with Dextrid, CMC, Q-Broxin and barite. (Mud weight 1.14-1.16 SG, MBC 13-20 lb/bbl, yield point 12-19 lb/bbl, API WL 5 cc). The main problem experienced in the 8-1/2" hole (particularly in the interval 3000-3500m) was high and fluctuating torque. This was overcome by addition of a roller reamer to the BHA. At 4372m high torque was experienced. High gas readings and hole cavings required circulation and conditioning of the mud. The mudweight was increased over a number of circulations to 1.26 SG prior to pulling out for logging.

PE905486

This is an enclosure indicator page.
The enclosure PE905486 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905486 has the following characteristics:

ITEM_BARCODE	= PE905486
CONTAINER_BARCODE	= PE902608
NAME	= Bit Record Summary-Well
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Bit Record Summary Table 1 from WCR for Volador-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

TABLE 2: CASING SUMMARY - VOLADOR-1

Date Run	Size (ins)	Grade	Weight (lbs/ft)	Coupling	Shoe Depth (m.bdF)	Remarks
27/12/82	30	B	310	ATD	332	3 joints.
31/12/82	20	X56	133	Vetco LS	551	22 joints. 18-3/4" 10,000 psi SG-5 wellhead system.
11/1/83	13-3/8	N80	72	BTC	1308	90 joints.
31/1/83	9-5/8	N80	47	BTC	2814	214 joints.
14/3/83	7	N80	29	BTC	4404	Liner. 146 joints. Top of liner at 2655m, SS packer at 2654.6m, top tie-back sleeve 2652.5m.

PE905487

This is an enclosure indicator page.
The enclosure PE905487 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905487 has the following characteristics:

ITEM_BARCODE	= PE905487
CONTAINER_BARCODE	= PE902608
NAME	= Cement Summary
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Cement Summary Table 3 from WCR for Volador-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE905488

This is an enclosure indicator page.
The enclosure PE905488 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905488 has the following characteristics:

ITEM_BARCODE	= PE905488
CONTAINER_BARCODE	= PE902608
NAME	= Mud Record
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Mud Record Table 4 from WCR for Volador-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

After logging at 4372m, the mud weight was increased to 1.29 SG and the well deepened to 4404m without significant problems.

6" Hole Section

6" hole was drilled from 4404m to 4611m with the mud weight at 1.30 SG, YP 15-20 lb/100 sq.ft, API WL 4-5 cc. Large amounts of Dextrid and Durenex were required to control API fluid loss due to the high bottom hole temperature (139°C) and resultant thermal degradation of the mud.

3.6.5 Formation Intake Test

Formation intake tests were carried out on drilling out the 20", 13-3/8", and 9-5/8" casing shoes. The following results were obtained.

Depth m	Surface Pressure psi	Mud S.G.	EMG	Formation
551	220	1.04	1.32	Marl
1308	1500	1.10	1.91	Marl
2814	2300	1.15	1.73	Claystone

3.6.6 Lost Circulation

None

3.6.7 Perforations

The following intervals were perforated

Production Test 1	3911-3914m
Production Test 2	3777-3783.5m
	3767-3773m
	3756-3759.5m

The interval 3756-3759.5 was reperforated to check whether plugging had occured during the production test. All perforations were carried out using a through tubing 2-1/8" Enerjet perforating gun (4 shot/foot).

3.6.8 Fishing

A total of 68 hours were spent on fishing operations.

a) Whilst pulling out the 20" wear bushing running tool, the elevator hit the slip handle. As a result, the running tool and 6 joints of pipe dropped in the hole with the top of the fish at 225m. On the second attempt, the fish was latched onto with an overshot and pulled out of the hole (total 9 hours).

b) At 1417m, whilst running in after a bit change, resistance was noted at 1366m. During reaming, the kelly bushing jumped out with loss of weight. The string backed off below the kelly with the top fish at 57m. An overshot was run in the hole and 86 joints of drill pipe recovered (50% bent) and the pin on the last joint had twisted off (see below). The top fish was then at 873m. After several unsuccessful fishing attempts were made with overshot and mill control, the fish was engaged but was found stuck. With 25 mt overpull the fish parted when the jars were activated. 30 joints of 5" drill pipe were pulled out plus 11 joints of 5" HWDP which were all bent and the pin off the last joint HWDP had damaged threads. The top fish was then at 1258m. An overshot was run into the hole and recovered 1 joint of HWDP (badly bent), 14 joints of 8-1/4" DC (visually OK), 1 hydromechanical jar (up jar damaged), bit sub and only the pin of the bit (all cones had shattered). Further milling was attempted, but no progress was made and the decision was made to sidetrack (See section 3.6.9) (total 59 hours).

The following conclusions were reached by Metlab Mapel Pty Ltd, Melbourne, on the 5" drill pipe pin specimen from the fish in Volador-1:

1. The drill pipe material conformed to the composition, mechanical and microstructural requirements of an SAE Grade 4140 steel.

2. No cracking was detected in the root of the remaining threads of the section submitted.

3. No fatigue cracks or initiating sites were noted on the fracture surface.

4. The undamaged fracture surfaces exhibited features indicative of an overload failure along the planes of maximum shear stress under torsional loading.

As there has been no reoccurrence, the failure was most likely due to mishandling of the pipe in the early stages when the drilling crew was new and untrained.

3.6.9 Side Tracking

See section 3.4 Drilling History.

Prior to sidetracking, a cement plug was set over the interval 1418-1368m using an open ended drill pipe. A mud motor assembly and 2° bent sub were run in locating the top cement plug at 1368m. The plug was dressed to 1382m and the well was sidetracked to 1397m using the mud motor and thereafter a pendulum (drop off) assembly (Max inclination 3°)

3.6.10 Deviation

See Table 5- Deviation Record
See Figure 4- Well Path (Plan view)

3.6.11 Abandonment

See Fig 5- Well Status Diagram

Table 5: Deviation Record - Volador-1

See Eastman Survey Fig. 4 of well path to the 9-5/8" casing shoe.

Depth A.H.	Inclination Degree	Remarks
307	0.75	Totco
338	0.5	"
398	0.75	"
400	0.25	"
557	0	"
758	0.25	"
883	0.25	"
1089	0.25	"
1318	1.0	"
1417	1.25	"
1389	2.0	Sidetrack Kick off at 1382m
1400	3.0	Totco
1506	2.0	"
1600	1.5	"
1750	1.0	"
1911	1.5	"
2195	0.75	"
2529	0.5	"
2842	0.5	"
2997	0.5	"
3098	1.0	"
3173	0.5	"
3244	0.75	"
3349	1.75	"
3529	1.0	"
3702	1.25	"
3896	1.0	"
4081	1.0	"

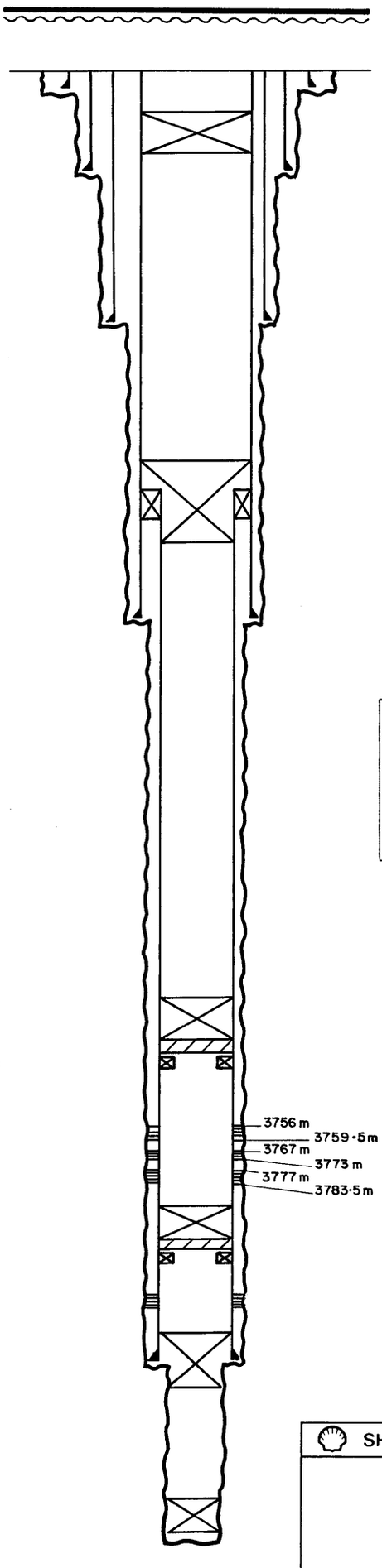
PE905489

This is an enclosure indicator page.
The enclosure PE905489 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905489 has the following characteristics:

ITEM_BARCODE	= PE905489
CONTAINER_BARCODE	= PE902608
NAME	= Plain Veiw of Well Path
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Plan Veiw of Well Path from WCR for Volador-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)



Rig Floor Om
MSL 25m

Seabed 285m
30" Csg 332m
36" Hole 339m

20" Csg 551m
26" Hole 560m

13⅜" Csg 1308m
17½" Hole 1318m

Top Liner Lap 2653m

9⅝" Csg 2814m
12¼" Csg 2842m

ABANDONMENT PLUG No. 6
373-321m

ABANDONMENT PLUG No. 5
2684-2499m

ABANDONMENT PLUG No. 4
3719-3619m

BRIDGE PLUG No. 2 3719 m
PT No. 2 PACKER 3720 m

PERFORATION SET PT No. 2

3756 m
3759·5m
3767 m
3773 m
3777 m
3783·5m

ABANDONMENT PLUG No. 3
3883-3808 m

BRIDGE PLUG No. 1 at 3883 m
PT No. 1 PACKER at 3884 m

PERFORATION SET PT No. 1
3911-3914 m

ABANDONMENT PLUG No. 2
4450-4308 m

ABANDONMENT PLUG No. 1
4600-4500 m

6" HOLE TD 4611 m

FINAL CO-ORDS 38°25'28·26"S
148°32'36·67"E
SPUDDED 1715hrs 26/12/82
ABANDONED 0130hrs 16/4/83

7" Liner shoe 4404m
8½" Hole 4404m

SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

VOLADOR-1

WELL STATUS DIAGRAM

Author: EPE/1	Date: April 1983	Fig. 5
Report No.: SDA 494	Drawing No.: 16599	

3.7 Formation Evaluation

3.7.1 Mudlogging Services

The mudlogging services on the Nymphea were provided by Exploration Logging Australia (EXLOG).

The unit was crewed by two mudloggers and one 24 hour Gemdas computer operator.

Services included collection, washing, drying and packing of cuttings samples, routine examination of cuttings and checking for hydrocarbon indications; continuous monitoring of drilling parameters (ROP, WOB, torque, pump rate), mud tank levels, and mud weight; continuous monitoring and chromatographic analysis of gas. These values were recorded at one metre intervals for 8-1/2" and 6" hole, and 5 metre intervals in top hole by an on-line computer which also produced real-time prints and plots (against driller's depth) of this data. Logged depths were calculated automatically by the computer.

A package of interactive programs to assist in drilling control, drilling optimisation, pressure evaluation and formation evaluation were available from the Gemdas unit. Examples of these programs include hydraulics analysis, D exponent analysis, kick analysis and fracture gradient analysis. A summary of this data is given in the "Exlog Final Well Completion Report: Volador-1".

3.7.2 Cuttings

Ditch cuttings were collected every 10m below 20" casing (551m) down to 9-5/8" casing depth and thereafter every 3m to total depth. The samples were bagged and distributed as follows.

(a) Four sets of washed and dried samples (in 100gm packets) were prepared; one set each was sent to the Bureau of Mineral Resources and the Victorian Department of Minerals and Energy, and two sets were sent to Corelab, Perth to be stored on behalf of Shell Development.

(b) An additional set of washed and dried samples was packed into miniature plastic samplex trays and sent to Shell Development in Perth for office use.

(c) Two sets of unwashed cuttings packed in half-kilogram bags were sent to Corelab, Perth (for Shell).

Descriptions are given in Reference 4.

3.7.3 Sidewall Samples

A total of 204 shots were fired with a total recovery of 159 samples. For descriptions of samples see Reference 4.

3.7.4 Velocity Survey

The velocity survey, performed by Seismograph Service Limited comprised of 27 levels (Ref. 5).

3.8 Petrophysics

3.8.1 Wireline Logs

The following wireline logs were run

Date	Interval		Type
9/1/83	17-1/2" hole	: 1310-551m	DIL/LSS/SP/GR/CAL (LSS recorded from 1281m)
		: 1314-551m	LDL/GR/CAL
28/1/83	12-1/4" hole	: 2827-1308m	DIL/LSS/SP/GR/CAL (SP affected by cable drum magnetisation)
		: 2827-1308m	LDL/GR/CAL CST 51 shots, recovered 42
10/2/83	8-1/2" hole	: 3240-2814m	DLL/MSFL/GR/SP/CAL
		: 3240-2814	LDL/GR/CAL (CNL tool failed) RFT tool failed at surface
13/2/83	8-1/2" hole		RFT 3237-2814m 9 Formation pressure measurements. (2 x 2-3/4 gal samples). See section 2.8.4.
3/3/83	8-1/2" hole	: 4359-3198	DLL/MSFL/GR/SP/CAL
		: 4363-2790	LDL/GR/CAL (CNL Tool Failed twice)
		: 4345-2814	CNL/GR
		: 4361-2814	LSS/GR
		: 4361-2814	HDT
	RFT		4 Formation Pressure Measurements (2 x 2-3/4 gal samples)

Date	Interval		Type
	RFT		Segregated sample at 3756.2m
9/3/83	8-1/2" hole	: 4400-4098	DLL/MSFL/SP/CAL/GR
		: 4397-4100	LDL/CNL/CAL/GR
	RFT		Attempted 26 pressure measurements deeper than 4000m - No success.
	CST		132 shots, recovered 107 (18 lost)
24/3/83	6" hole	: 4612-4406	DLL/MSFL/SP/CAL/GR
		: 4612-4406	LDL/CNL/CAL/GR
		: 4406-2655	CBL/VDL/CCL/GR
		: 4602-4404	BHC/GR
	RFT		No successful measurement taken
	CST		21 shot 10 recovered. (1 lost)

3.8.2 Evaluation/Discussion

3.8.2.1 General

The logged intervals down to and including the upper objective are water-bearing, which was confirmed by RFT's and SWS. Porosities average 23% and are as high as 27% in the cleaner sands.

Marginal hydrocarbon saturations up to 20% are indicated over the interval 3550-3750m with weak hydrocarbon indications from either ditch cuttings or sidewall samples.

The lower intra-Latrobe objective is hydrocarbon-bearing with hydrocarbon saturations up to 55% in places and porosities up to 18%. A porosity deterioration is observed below 4200m indicating poor reservoir quality.

3.8.2.2 Problems posed in log interpretation

a) Deep invasion

Despite the substantial separation between the readings of the deep and shallow Dual Laterolog in the most porous sands, a proper Rt determination was not possible as in some cases invasion of mud filtrate reaches 150-180cms (Fig. 7). Distinction of hydrocarbon fluid type by means of the LDT/CNL disappears completely as these tools read quite shallow (15-30cm).

b) Porosity Determination in the Interval 4400-4608m

The excessive washouts in sands prevented the use of the LDT for porosity determination. A Sonic/Neutron combination was used instead.

c) Rw Determination

Resistivity of formation water over the lower objective was initially derived from a reverse SP over the interval 3750-4000m. The tentative calculated value was 0.085 ohm.m (Approx. 25,000 ppm NaCl).

3.8.2.3 Production Tests Nos. 1 and 2

In view of the difficulties in log interpretation and the ambiguity of RFT results (recovered mud filtrate), it was decided to production test the most porous intervals (see 3.9).

Both tests recovered formation water which had the following properties (field determined):

	Production Test 1	Production Test 2
Form. water Resistivity (Rw)	.39 ohm.m at 17°C (equiv. to 17,000 ppm NaCl)	.32 ohm.m at 18°C (equiv. to 22,000 ppm NaCl)
Chlorides	10,000 ppm (equiv. to 16,500 ppm NaCl)	13,000 ppm (equiv. to 21,500 ppm NaCl)

For comparison purposes, the resistivity of the mud filtrate (Rmf) was 0.2 ohm.m at 17°C or 35,000 ppm NaCl equivalent.

3.8.2.4 Evaluation Method

Due to the absence of core data, which is needed for the Waxman-Smit technique, the Simandoux method was used.

1) $$Sw = \left[A.Rw \quad \phi^{-m} \quad \left(\frac{1}{R_t} - \frac{Vsh.Sw}{R_{sh}} \right) \right]^{1/n}$$

2) $$Sh = 1 - Sw$$

where:

S_w = water saturation in the virgin zone as fraction of pore volume

S_h = hydrocarbon saturation in the virgin zone as fraction of pore volume

A = constant from Archie's formula

R_w = formation water resistivity in ohm.m

ϕ = porosity as fraction of bulk volume

m = cementation factor

R_t = true resistivity in ohm.m

V_{sh} = fraction of shale

R_{sh} = shale resistivity in ohm.m

n = saturation exponent

For details of deckcard structure and list of parameters refer to appendix.

3.8.2.5 Evaluation Results

Results of petrophysical evaluation for the hydrocarbon bearing interval (3750-4608m) are summarised as follows:

Gross thickness	868.0m
Total sand	151.6m
Net sand	24.4m
Average porosity (in net sands)	15%
Average hydrocarbon saturations (in net sands)	56%

Above net values are based on following cut offs;

Porosity	12%
Hydrocarbon saturation	50%
Shale fraction	50%

Refer to enclosure 4 for the depth plot of the petrophysical evaluation.

3.8.3 Repeat Formation Test Results

Measured formation pressures are presented in Table 6. A graph of these measurements is shown in Fig. 6.

The following samples were taken.

1) Depth 3171m
   Type Non segregated
   Recovery 10.1 litre water, no oil or gas

   R sample 0.228 ohm-m at 72° F

2) Depth 3019.6, 3023, 3040.5, combined
   Type Non segregated
   Recovery 9.2 litres water, no oil or gas

   R sample 0.226 ohm-m at 72° F

3) Depth 3913.3m
   Type Non segregated
   Recovery 9.8 litres water, no oil or gas

   R sample 0.171 ohm-m at 29°C.
   NaCl 34650 ppm (from titration)

4) Depth 3756.2m
   Type Non segregated
   Recovery 10.1 litres water, no oil or gas

   R sample 0.177 ohm-m at 29°C
   NaCl 33,000 ppm (from titration)

5) Depth 3756.2m
   Type Segregated (1 x 6 gallon, 1 x 2-3/4 gallon)
   Recovery 6 gallons water (R = 0.186 ohm-m at 25°C)
   9.4 litres water - No oil, gas

   R sample 0.185 ohm-m at 25°C
   NaCl 34650 ppm (from titration)

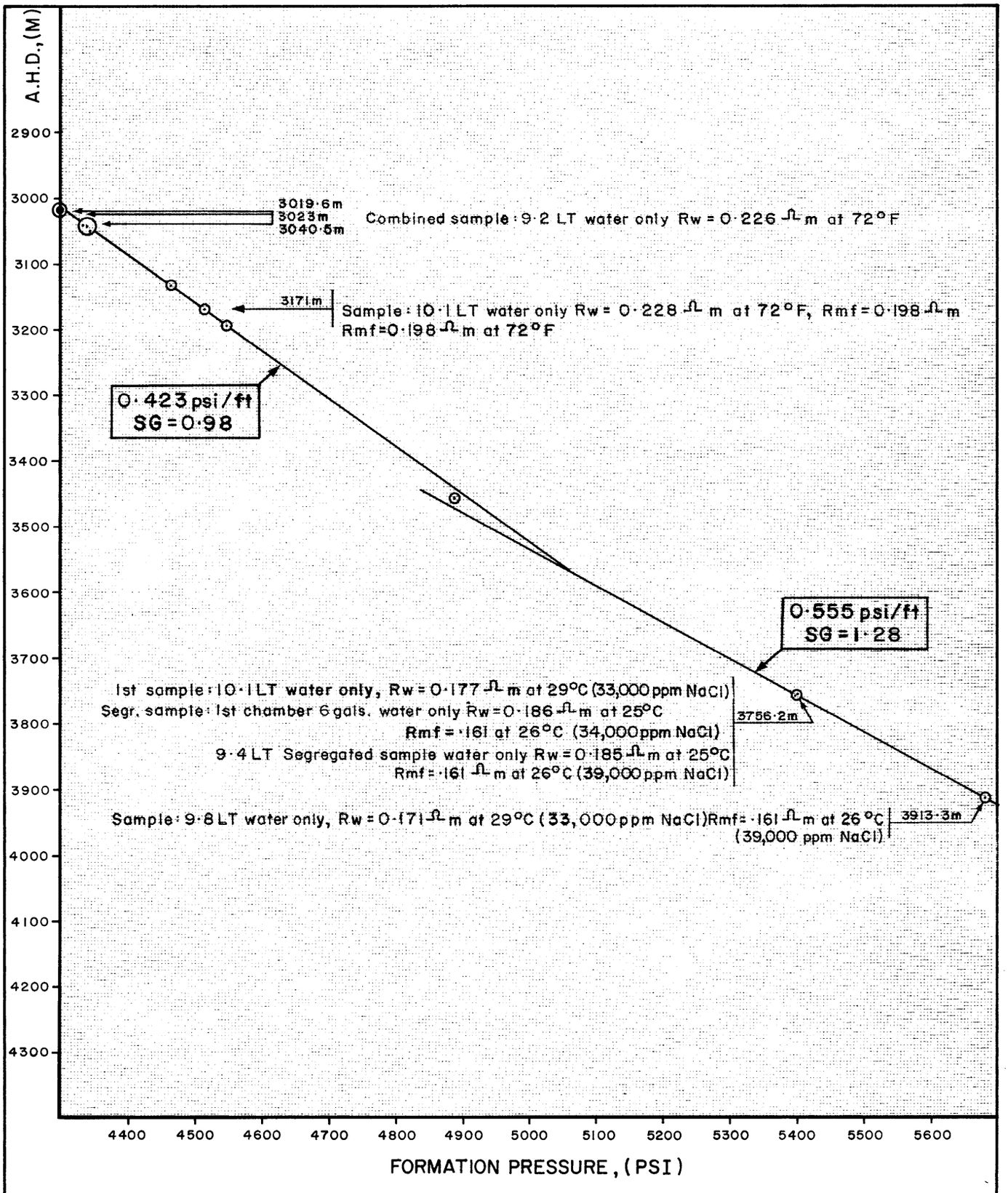
   The above samples are all mud filtrate or at least heavily contaminated with mud filtrate. Typical properties of mud filtrate whilst drilling 8-1/2" hole was:

   R_{mf} 0.161 ohm-m at 26°C
   NaCl 34500-38000 PPM

Table 6: RFT Formation Pressure Measurements

Depth (m)	Corrected Pressure (psig)
3019.4	4304
3019.6	4298
3023.0	4303
3040.5	4329
3042.3	4340
3049.5	4343
3136.0	4466
3171.0	4513
3195.0	4545
3457.4	4886
3756.2	5399
3757.5	5396
3913.3	5680

All attempts (30) to measure formation pressures deeper than 4000m failed due to tight formation and/or RFT seal failure.



NB:

SEVERAL ATTEMPTS TO MEASURE PRESSURES BELOW 4000m FAILED DUE TO TIGHT FORMATION AND/OR SEAL FAILURES.
NO ATTEMPTS WERE MADE FOR FLUID SAMPLES. DEEPER THAN 4000m.

SHELL - AUSTRALIA E.& P. OIL AND GAS.

BASS BASIN

VOLADOR-1 RFT Nº 1 & 2 RESULTS (TEMP. CORR)

Author: EPE	Date: March 1983	Fig. 6
Report No.: SDA 494	Drawing No.: 16236	

3.9 Production Testing

After RFT's proved inconclusive it was decided to production test the zones of interest.

Two separate tests were run over the intervals 3911-3914m (Prod. Test No.1) and 3756-3759.5m, 3767-3773m and 3777-3783.5m (Prod. Test No.2). Test intervals, recoveries from each production test, water resistivities and RFT results are summarised and shown against resistivity and GR logs in Figure 7. Both tests were conducted successfully and no mechanical problems were encountered. Analysis of samples recovered and pressure data are given in the subsequent sections.

Tests produced small amounts of hydrocarbon and non-hydrocarbon gases, waxy crude oil, condensate and formation water. Tested formations were found to be essentially tight. The first test was terminated when the well died after a short flow period. During the second test, the well was practically dead after a reasonable clean-up flow period and an attempted main flow period which was followed by a short pressure build-up period. Having achieved the primary objectives of the test, the testing programme was terminated and consequently the well was plugged back and abandoned.

Further details on the production testing of Volador-1 are given in Reference 6.

3.10 Geopressure Engineering

Pore pressure gradient was normal with no evidence of any overpressure down to c. 3550m. Hole problems encountered immediately prior to running the 9-5/8" casing (2842m) were probably due to hydrating clays rather than any significant overpressures. The mud weight used to drill to 9-5/8" casing depth was 1.10-1.12 SG, which was increased to 1.15 SG at the end of the 12-1/4" hole section to stabilise the swelling clays.

From 3550m the pore pressure gradient appeared to increase. Background gas increased, and D exponent started to show a change in trend (decrease). RFT pressure measurements between 3913.3m and 3457.4m indicate a pore pressure gradient of c. 0.53 psi/foot for the interval. Mud weight used to drill this section was 1.15 SG.

From 4320m to 4350m, the appearance of abundant cavings and the rapid increase in background gas indicated a sharp increase in pore pressure and that the section was being drilled significantly underbalanced (mud weight 1.16 SG). It was only after increasing the mud weight to 1.29 SG that the hole was stabilised and background gas decreased to a reasonable level. Below 4400m the background gas steadily decreased and there were no further hole problems.

For further details on pore pressure analysis of Volador-1 refer to Reference 7.

PE603885

This is an enclosure indicator page.
The enclosure PE603885 is enclosed within the container PE902608 at this location in this document.

The enclosure PE603885 has the following characteristics:

ITEM_BARCODE = PE603885
CONTAINER_BARCODE = PE902608
NAME = RFT & Production Test Intervals/Results
BASIN = GIPPSLAND
PERMIT = VIC/P19
TYPE = WELL
SUBTYPE = RFT
DESCRIPTION = RFT & Production Test Intervals/Results from WCR for Volador-1
REMARKS = 2 Logged Intervals. 1st interval from 3100m to 3500m, 2nd Interval form 3700m to 3950m
DATE_CREATED = 31/08/83
DATE_RECEIVED = 9/11/83
W_NO = W794
WELL_NAME = VOLADOR-1
CONTRACTOR =
CLIENT_OP_CO = SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

3.11 Well Cost, Time Allocation

See Fig. 8 : Drilling Time Graph

See Table 7 : Chemical Consumption Cost

See Table 8 : Time Allocation

See Table 9 : Well Cost

PE905492

This is an enclosure indicator page.
The enclosure PE905492 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905492 has the following characteristics:

ITEM_BARCODE	= PE905492
CONTAINER_BARCODE	= PE902608
NAME	= Drilling Time Graph
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Drilling Time Graph from WCR for Volador-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

Table 7 - Chemical Consumption Cost - Volador 1

Interval : Surface - 551m

Casing size 30" and 20"

Product	Quantity
Gel	51 mt
Barite	169 sacks
Caustic	20 drums
Soda Ash	15 sacks
Lime	1 sack
$CaCl_2$	70 sacks
Surflo W300	1/2 drum

Total Cost	$16,021
Cost/Metre	$29.08

Interval : 551-1308m
Casing Size 13-3/8"

Product	Quantity
Gel	41.6 mt
Barite	7 mt
Caustic	21 drums
Soda Ash	28 sacks
Lime	2 sacks
CMCHV	65 sacks

Total Cost	$17,954.2
Cost/Metre	$23.76

Interval: 1308-2814m
Casing Size 9-5/8"

Product	Quantity
Gel	42 mt
Barite	49 mt
Caustic	45 drums
Soda Ash	33 sacks
Lime	16 "
CMC HV	117 "
CMC LV	98 "
Q Broxin	86 "

Total Cost	$35,448
Cost/metre	$23.50

Table 7 - Chemical Consumption Cost - Volador 1

Interval 2814-4404m
Casing Size 7"

Product	Quantity
Bentonite	2 mt
Barite	168 "
Caustic	133 drums
Soda Ash	4 sacks
Lime	47 "
CMC HV	10 "
CMC LV	110 "
Q Broxin	147 "
Sodium Bicarbonate	-
Durenex	291 "
Surflo W300	4 "
Dextrid	497 "
Celpol	39 "
Al Stearate	1 "

Total Cost $118,726
Cost/Metre $74.7

Interval 4404-4612m
6" hole

Product	Quantity
Barite	72 mt
Caustic	29 drums
Lime	13 sacks
Q Broxin	60 "
Sodium Bicarbonate	20 "
Durenex	110 "
Dextrid	130 "
Celpol	5 "

Total Cost $25,772
Cost/metre $123.9/m

Abandonment phase

Product	Quantity
Bentonite	3 mt
Barite	26.5 "
Caustic	2 sacks
Lime	7 "
$CaCl_2$	3 "
CMC HV	19 "
Celpol	1 "

Total Cost $6,714

Total Mud Chemical Cost $220,635
Cost/Metre $47.8 metre

Table 7 - Chemical Consumption Cost - Volador 1

Production Test Chemicals

Product	Quantity
Rock salt	814 sacks
Barachem C448	4 drums
Total cost $7,147	

Cement/Cement Chemicals

Product	Quantity
Cement G Class	366.5 mt
NF-1	1/2 drum
HR 12	24 sacks
CFR-2	35 sacks
HR-7	12 sacks
Halad 22A	32 sacks
Total Cost $144,782	

Table 8: Time Allocation - Volador-1

		Hours	%
I.	Preparation	-	-
II.	Mobilisation, Moving etc.		
	Rigging up/down	41.25	1.53
			1.53
III.	Making Hole		
	Drilling	783.75	29.14
	Adding Pipe	13.5	0.50
	Surveys	27.75	1.03
	Checktrip	31.5	1.17
	Round Trip - Bit Change	323.0	12.01
	Circulation	69.75	2.59
	Ream/Washing	11.5	0.43
	Fishing	59.0	2.19
	Rig Service	9.5	0.35
	Repairs	0.5	0.02
	Wait Time	9.5	0.35
	Miscellaneous	100.0	3.72
			53.50
IV.	Securing Hole		
	Drilling Cement	18.75	0.70
	Adding Pipe	32.0	1.19
	Surveys	5.75	0.21
	Check trip	32.25	1.20
	Roundtrip - Cement Drilling	12.75	0.47
	- Before Casing	18.75	0.70
	Circulation	22.25	0.83
	Reaming/Washing	1.5	0.06
	Fishing	9.0	0.33
	Rig Service	25.5	0.95
	Wait Time	1.75	0.07
	Miscellaneous	67.5	2.51
	Casing/Liner - Run & Cement	112.5	4.18
	Flanging - up (BOP)	53.25	1.98
			15.39
V.	Formation Evaluation		
	Checktrip	65.5	2.44
	Roundtrip - Logging	18.75	0.70
	Circulation	36.0	1.34
	Reaming/Washing	9.0	0.33
	Formation Strength Test	2.0	0.07
	Rig Service	18.5	0.69
	Miscellaneous	1.25	0.05
	Logging - Open Hole	152.25	5.66
			11.28

Table 8: Time Allocation - Volador-1

		Hours	%
VI.	Completion/Suspension		
	Roundtrip - Bit & Scraper	22.25	0.83
	Circulation	23.5	0.87
	Wait time/Miscellaneous	23.25	0.86
	Testing (& Perforating)	119.0	4.42
	Running - Tubing	64.5	2.40
	- Production Packer	8.0	0.30
	- Wireline	35.25	1.31
	Well Treatment - Stimulation	4.5	0.17
			11.16
VII.	Plug-Back Abandonment		
	Rig Service/Repairs	7.0	0.26
	Miscellaneous	1.5	0.06
	Abandonment	183.5	6.82
			7.14
		2689.5	100.00

Note: An additional 53 hours after abandonment was spent waiting on weather before ending operations at 0625 hours on 19/4/83.

Table 9: Well Cost - Volador-1

Cost Type		$ Million
0	Preparation/Mobilisation	5.50
1	Drilling - Installation	14.11
2	Mud	0.26
3	Bits	0.15
4	Casing and Cement	1.47
5	Evaluation	1.68
6	Production Testing	0.57
7	Abandonment	0.03
8	Transportation	4.98
	TOTAL (above)	28.75

Note: Rig contractor day rates = $12,140,847
Open hole logging cost = $ 1,417,451

4. GEOLOGY

4.1 Regional Setting

The Gippsland Basin and the underlying Strzelecki Basin are the most easterly of the sedimentary basins that border the southern Australian continential margin (Ref. 8).

The Jurassic/Early Cretaceous Strzelecki Basin formed during the initial ('pre-rift') subsidence phase prior to break-up along Australia's southern and eastern margins. The subsequent Gippsland Basin is a 'failed' rift arm (aulacogen) associated with the opening of the Tasman Sea in the Late Cretaceous and Early Tertiary.

Spreading in the Tasman Sea commenced about 78 m.y. BP, at which time the developing Gippsland Rift was landlocked and volcanic activity was common. After break-up, the depositional surface in the rift remained close to sea level until the much later opening of the Southern Ocean in the Tertiary, and the position of the coastline was controlled by the balance between sea level, subsidence and sediment supply. Rift subsidence continued steadily during the Campanian and Maastrichtian, but at the same rate as sedimentation, and the seaward margin of the basin, which includes VIC/P19, remained in a swampy, lower coastal plain environment.

The sea first transgressed the Volador area from the east in the Late Maastrichtian. The Early Tertiary history is broadly transgressive but in detail consists of several cycles of transgression each followed by gradual regression. By Middle Paleocene, Volador was in a dominantly marine setting where there was very little deposition of Latrobe Group sediments.

At the end of the Paleocene, at about the time when spreading stopped in the Tasman Sea (c.55 m.y. BP) and commenced in the Southern Ocean, subsidence in the Gippsland Basin slowed or even ceased, particularly along the seaward margin (roughly over the western flank of VIC/P19). In the Early Eocene there were two minor and one major relative sea level falls, each followed by rises (Ref. 9). The seaward margin of the Gippsland Basin was subjected to the full effect of these changes and was incised by channels.

This complex period of channel cutting and filling in the Late Paleocene and Eocene was critical to the development and sealing of the principal oil and gas fields in the Gippsland Basin and is responsible also for the closure of the upper Volador trap. The most important channel system, with regard to Volador, is the Tuna-Flounder Channel which runs southwards over the Tuna and Flounder oil fields. The channel, which has a relief of up to 650m, was cut in two main phases: the Flounder Channel and the later Tuna Channel.

Over the Flounder Oilfield the Tuna Channel cuts into uppermost Paleocene strata (lower M. diversus zone), but over Volador it cuts into the Maastrichtian. Volador is a surviving island of these sediments in the broad southern reaches of the channel, where the channel base has generally cut to about base Tertiary level. The

Tuna Channel over Volador is filled with fine-grained shallow marine sediments which became trapped in the channel as further subsidence took place about 50 my BP (marked by the W. ornatum dinoflagellate incursion).

After the Early Eocene sedimentation virtually ceased until the deposition of the marine Lakes Entrance mudstone in the Oligocene/Early Miocene. Rapid sedimentation recommenced in VIC/P19 in the Middle Miocene with progradation of the bioclastic Gippsland Limestone, but did not reach the Volador area until the Late Miocene. Relative sea level falls in the Late Miocene created channels in the prograding shelf edge. Further sea level falls in the Pleistocene probably caused the canyon system in the present-day shelf edge and slope, whose tributaries cut back to the Volador area.

Seismic interpretation, based largely on a 0.5 x 0.5 grid acquired in early 1982, led to the definition of the Volador palaeotopographic high at the top of the Latrobe Group, similar in kind to that of the Halibut-Cobia-Fortesque Field immediately to the west, with structural closure deeper in the section.

On regional geological evidence, good reservoirs were predicted in the Maastrichtian section of the erosional high, and in the structurally closed Campanian sequence. Both targets relied upon hydrocarbon migration from source rocks within the Upper Cretaceous section of the Latrobe Group.

Critical factors were the unknown presence of source rocks in the (Campanian and pre-Campanian) mature section of the Latrobe, and the extent of adequate seals.

The well location and total depth were chosen to penetrate the full prospective section in a near crestal position.

4.2 Stratigraphic Table

BIOZONE	AGE	FORMATION	DEPTH BDF, m	DEPTH ss, m
		Sea Level	25	0
		Sea Floor	285	260
A.	Pliocene	GIPPSLAND LIMESTONE	285 - 1435	260 - 1410
				5 my hiatus
D1-B2	Middle and Upper Miocene		1435 - 2563	1410 - 2538
				2 my hiatus
G-E1	Lower and Middle Miocene		2563 - 2840	2538 - 2815
		LAKES ENTRANCE FORMATION		12-14 my hiatus
J2	Lower Oligocene		2840 - 2938	2815 - 2913
				12-14 my hiatus
W. Ornatum	Lower Eocene	Flounder Formation	2938 - 3024	2913 - 2999
		LATROBE GROUP		15 my hiatus
T. Longus	Maastrichtiaan		3024 - 3735	2999 - 3514
T. Lillei	Campanian	Latrobe Coarse Clastics	3735 - 4420	3710 - 4395
	?Santonian		4420 - T.D.	4395 - T.D.
		T.D.	4611	4586

4.3 Well Stratigraphy

The stratigraphic sequence in Volador-1 is summarized in part 4.2 and on Enclosures 1 and 2. The section penetrated agreed fairly closely with that predicted prior to drilling (Fig. 9).

4.3.1 Gippsland Limestone: 285-2563m (2278m)

285-551m. No cuttings were collected in this interval so the lithology has been inferred from seabottom drop cores, drill speed and the gamma ray log. The interval is thought to consist mainly of bioclastic, foraminiferal, greenish grey calcarenite and marl.

551-1790m Light grey to brownish to olive grey bioclastic marlstone, calcisiltite and calcarenite, with angular to rounded fossil fragments (bivalves, corals, echinoderms, sponge spicules, ostracods, gastropods and abundant forams), traces of lithic and carbonaceous detritus, pyrite and glauconite. 10 to 50% calcareous clay matrix.

These are shelf edge and upper slope carbonates, deposited in water depths of between 250 and 400m.

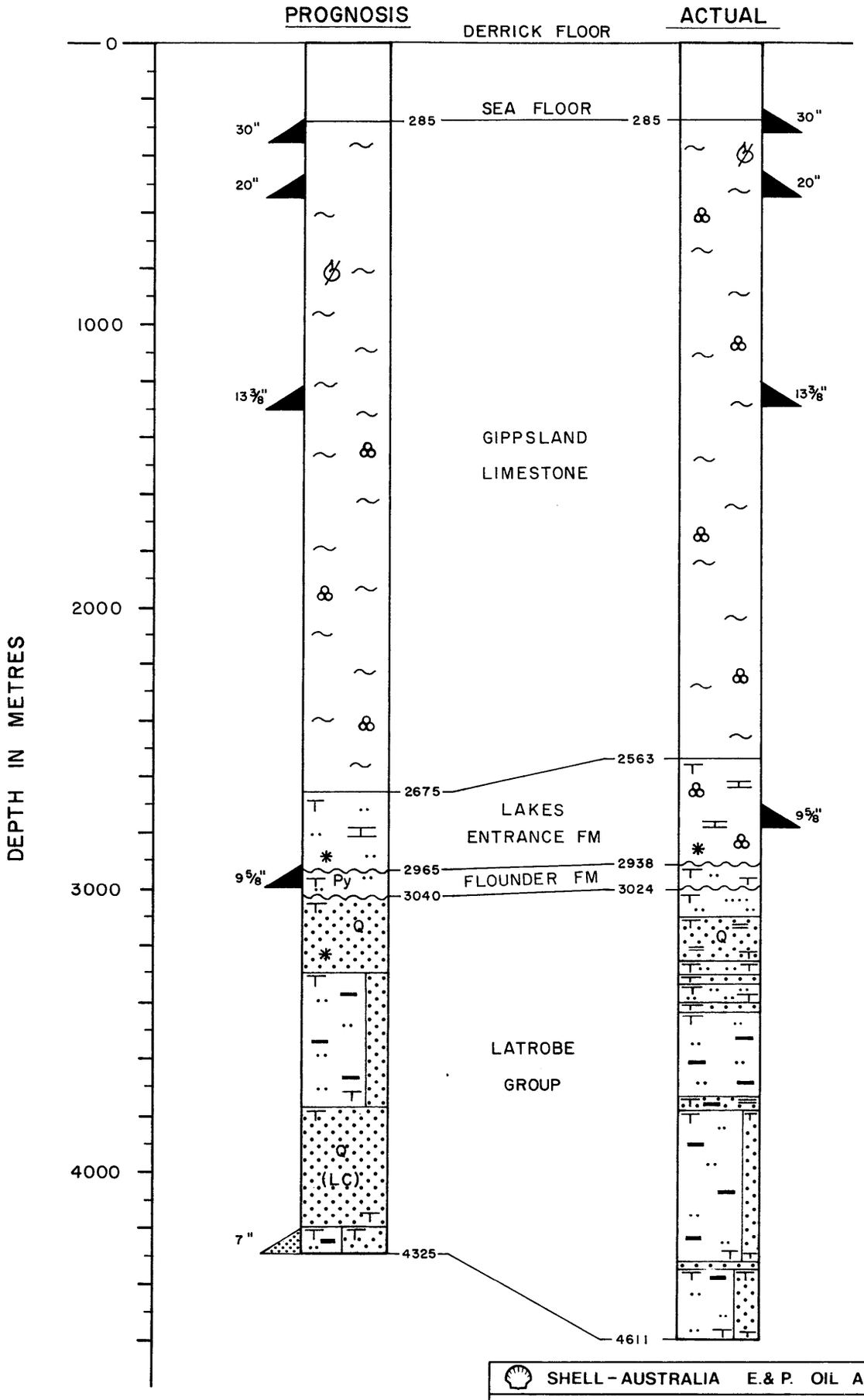
1790-2563m Light to medium brownish grey marl, becoming increasingly argillaceous and grading to calcareous claystone with depth. Subsucrosic and firm where fossiliferous (10 to 50% forams, partly broken, ostracods), soft where argillaceous. Trace carbonaceous flecks and laminae, rare pyrite replacing small forams and rare very fine glauconite.

These upper slope and canyon-fill sediments were deposited in 400 to 1000m water, and show considerable (palaeontological) evidence of slumping (Appendix 6.2).

4.3.2 Lakes Entrance Formation : 2563-2938m (375m)

The Lakes Entrance Formation consists of light to dark grey calcareous claystone and some calcareous siltstone, poorly to moderately calcareous, soft to firm. The fossil content (abundant to common forams, rare ostracods, echinoderms and recycled bryozoa) decreases with depth, and becomes increasingly replaced by pyrite. There are traces to common very fine glauconite, carbonaceous detritus and carbonaceous laminae.

The palaeontological analysis (Appendix 6.2) indicates a hiatus of about 12 to 14 m.y. duration at around 2840m bdf. The older part of the formation was deposited during rapid relative sea level rise in water depths of 40 to 200m. The younger part of the formation above the hiatus was deposited under high-stand and regressive (shallowing) conditions on the continential rise and slope in water of 1000 to 2000m depth. The fossils in the Early Miocene part of this unit show differential dissolution of $CaCO_3$ suggesting deposition close to the calcium compensation depth.



SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

VOLADOR-1
STRATIGRAPHY: PROGNOSIS V. ACTUAL

Author: EXH/4	Date: Sept 1983	Fig. 9
Report No.: SDA 494	Drawing No.: 17363	

4.3.3 Latrobe Group : 2938-4611m (1673m)

Flounder Formation : 2938-3024m (86m)

The Flounder Formation consists of dark grey to brown-grey glauconitic siltstone grading to silty sandstone and mudstone, with a basal glauconitic sandstone unit (3017-3024m). The siltstone is weakly calcareous and moderately firm to hard, and is particularly glauconitic above 2990m. Diatoms, pyrite and faecal pellets are common, and there are also traces of mica and carbonaceous detritus. The basal glauconitic sandstone unit has very fine to fine, occasionally coarse, subangular to rounded grains, and is poorly to moderately sorted, with traces of pyrite.

In general, the Flounder Formation appears to be a good seal over the crest of the Volador structure.

Latrobe Coarse Clastics : 3024-4611m (1587m)

3024-3038m SILTSTONE, argillaceous, carbonaceous, sandy and pyritic. Light to dark brownish grey. Common medium quartz grains and mica, moderately hard. SANDSTONE interbeds at 3033-3033.5.

3038-3092m SANDSTONE, quartzofeldspathic. Coarsening upwards from very fine to fine, dominantly fine, moderately well sorted, subangular to subrounded, to medium to very coarse (bimodal); poorly to moderately sorted, angular to rounded. Occasional pyrite and glauconite. Light grey. Friable to locally hard where carbonate cemented.

3092-3121m SILTSTONE. Slightly sandy, pyritic and micaceous, with some finely disseminated carbonaceous detritus. Trace glauconite. Dark grey to brownish grey. Firm to hard, subfissile.

3121-3126m SILTY GLAUCONITIC SANDSTONE. Very fine to medium, dominantly fine, moderately sorted, angular to subangular quartz. Glauconitic, silty, argillaceous matrix. Moderately hard.

3126-3162m SANDSTONE and MUDSTONE. Massive quartzofeldspathic fine to medium to very coarse, very poorly to poorly sorted, subangular to rounded, fairly porous and permeable. Mudstone, slightly silty, buff to light brown-grey, pyritic, trace carbonaceous detritus.

3162-3251m SANDSTONE, quartzofeldspathic. Medium to very coarse, moderately sorted, subangular to rounded, common pyrite, trace dolomite cement. White to light grey. Moderately consolidated.

3251-3312m SANDY SILTSTONE and SANDSTONE.
SILTSTONE, medium to dark grey, sandy, slightly pyritic and micaceous, trace carbonaceous detritus, weakly calcareous, fissile to subfissile.

SANDSTONE, quartzofeldspathic, fine to coarse, dominantly medium, poorly to moderately sorted, trace dolomite cement, glauconite and pyrite. Light to medium grey.

3312-3356m SANDSTONE, quartzofeldspathic. Fine to coarse, dominantly medium, poorly to moderately sorted, subangular to rounded, light grey, moderate silica cement, trace pyritic cement, rare glauconite. Friable to moderately hard.

3356-3421m SANDY SILTSTONE and SILTY SANDSTONE

SILTSTONE, sandy, slightly pyritic, carbonaceous and micaceous, light to dark grey, slightly calcareous, blocky to subfissile.

SANDSTONE, quartzofeldspathic, silty, very fine to fine, occasionally medium to very coarse, poorly to moderately sorted, subangular to rounded where coarse to very coarse, subrounded to rounded where fine. Trace silt and light grey argillaceous matrix. Common mica, feldspar and carbonaceous detritus. Moderate silica cement, slight porosity. Traces of silt laminae; grades to siltstone.

COAL at 3382-3384m, black, subvitreous, hard.

3421-3451m SILTY SANDSTONE and SANDY SILTSTONE. Lithologies as in interval 3356-3421.

3451-3549m SANDY SILTSTONE and SANDSTONE.

SANDY SILTSTONE as in interval 3356-3421, thin COAL at 3499-3500m.

SANDSTONE, quartzofeldspathic, light grey to brown-grey, very fine to very coarse, dominantly fine to medium, moderately to well sorted, angular to well rounded. Trace mica, carbonaceous flecks, lithics, lithics and pyrite, rarely strongly pyritic, weak to moderate silica and calcareous dolomite cement, fairly porous and permeable.

3549-4538m CARBONACEOUS SILTY MUDSTONE interbedded with QUARTZOFELDSPATHIC SANDSTONE and COAL.

CARBONACEOUS SILTY MUDSTONE (63% overall), light to very dark. dominantly dark grey-brown, carbonaceous to very carbonaceous, common thin (mm) silt laminae (mm) coal streaks, lenses, laminae (plant debris), locally micromicaceous, trace pyrite, locally very pyritic, blocky to subfissile, hard.

COAL (19% overall), bloack, dull to subvitreous, becoming increasingly vitreous with depth, generally vitrinite exinite inertinite, locally traces of amber resinite, traces pyrite and carbonate, locally silty grading to carbonaceous siltstone and shale, blocky to subfissile.

QUARTZOFELDSPATHIC SANDSTONE (18% overall). White to light grey to buff grey, very fine to medium, occasionally coarse, moderately sorted, subangular to subrounded, trace lithic grains, chlorite, mica, trace to common pyrite and carbonaceous detritus. Friable to hard. General increase in silica and ankerite cement and kaolinite (alteration product of feldspar) with depth. Porosity and permeability decrease from moderate at top of section to very poor at the base.

4538-4611m QUARTZOFELDSPATHIC SANDSTONE interbedded with SILTY MUDSTONE.

QUARTZOFELDSPATHIC/SANDSTONE, slightly lihic and argillaceous, light to medium grey to pale brown grey, fine to medium, locally coarse, poorly to moderately sorted, angular to subangular. Trace mica and carbonaceous detritus. Hard.

SILTY MUDSTONE/SHALE. Slightly to moderately carbonaceous, dark brownish grey, very firm to brittle.

The entire post-Campanian Latrobe section, beneath the Tuna-Flounder Channel, is broadly transgressive. A more detailed interpretation of the facies penetrated by the well is as follows:

Coastal barrier/neritic facies above 3126m with gradual transitions to back barrier (3126-3461m), lagoonal with washover (3461-3549m), paludal lower coastal plain (3549-4538m) and below 4538m more continential alluvial facies (upper coastal plain).

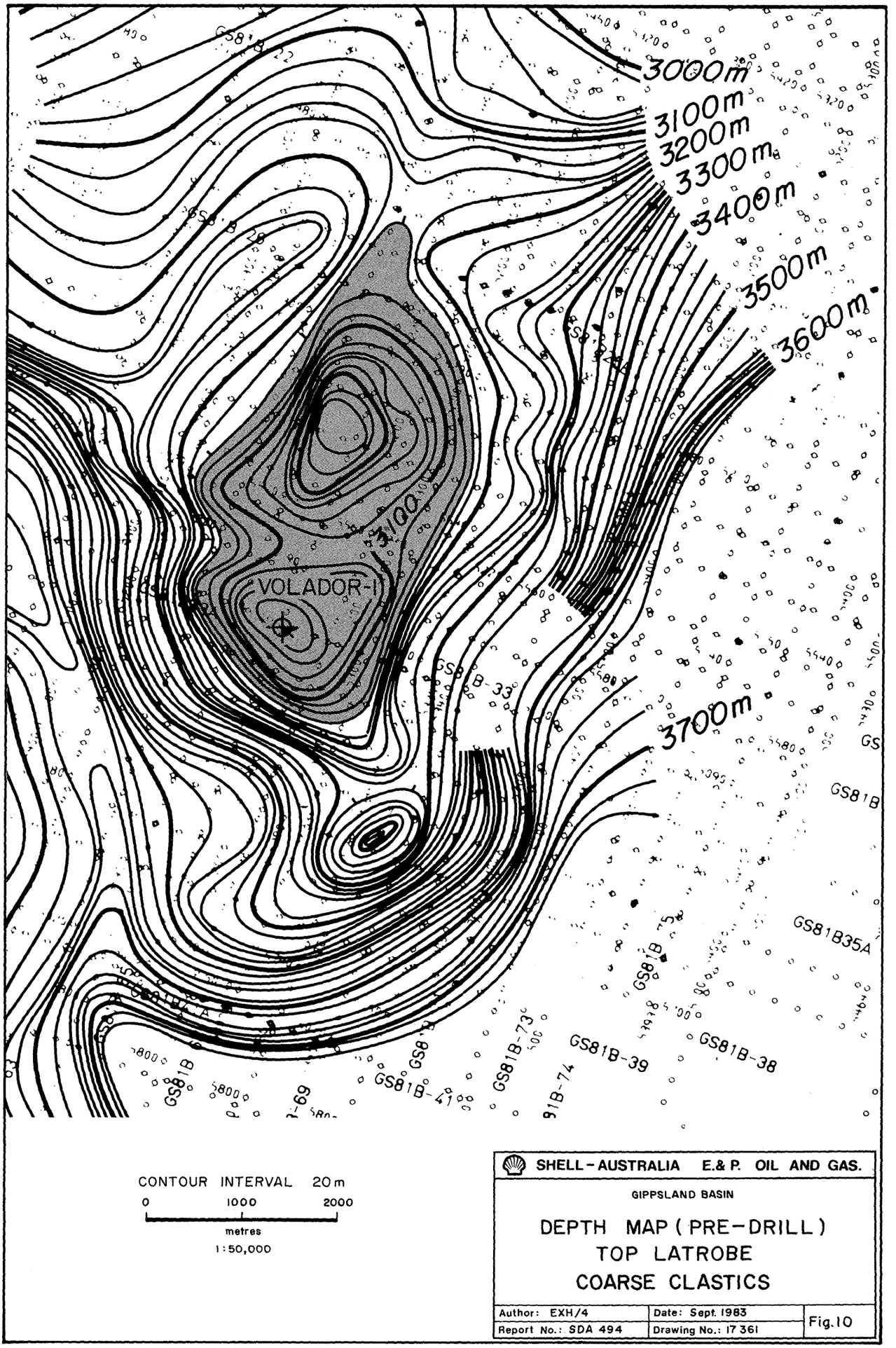
Sedimentary dips in the upper barrier sands are dominantly to the ESE, swinging WNW in the underlying back barrier facies. Fluvial sands deeper in the well have a bimodal azimuthal distribution of sedimentary dips, to the southeast and northwest.

The paludal sequence from 2550-4440m comprises about 60% carbonaceous shale, 20% coal and 20% fluvial sandstone. Rock-eval pyrolysis reveals total organic carbon contents of 15 to 30% and 65 to 80% in the carbonaceous shales and coals respectively, which are rich source rocks.

The maceral analysis shows that these rocks contain an abundance of vitrinite compared to exinite and inertinite, and would conventionally be classified as good source rocks for gas, and moderate source rocks for oil.

4.4 Structure

Pre-drill seismic interpretation showed the Volador prospect to be a pronounced erosional/topographic high at "Top Latrobe Coarse Clastics" level (= "base Tuna-Flounder Channel") with a gentler anticlinal time closure in the underlying Campanian section. Depth conversion, using AIMS modelled velocities, showed the areas of closure to be 9.2 sq.km (210m vertical) and 18 sq.km (70m vertical) respectively (Figs. 10 and 12).



SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

DEPTH MAP (PRE-DRILL) TOP LATROBE COARSE CLASTICS

Author: EXH/4	Date: Sept. 1983	Fig. 10
Report No.: SDA 494	Drawing No.: 17 361	

Well results have been tied directly to seismic information using well shoot data only : previous well/seismic matches (Hammerhead-1, Stonefish-1) had showed good correlation with no apparent time shift. In general, major geological units on electric logs could be visually correlated to reflectors at the Volador-1 location with little ambiguity.

The base of the Tuna Channel was penetrated close to prognosed depth. The dipmeter log shows a clear discontinuity at this level (3024m) but no structural dip elsewhere in the well. Despite this apparent accuracy, two mutually compensating errors are present.

a) AIMS predicted velocities proved approximately 2% faster than well shoot data. This is similar to results established at neighbouring well locations and may be intrinsic to the method.

b) The "base Tuna-Flounder Channel" was incorrectly picked by one loop at the Volador location (Fig. 13) : the well is further downdip than assumed at this level.

A revised post-drill map, depth-converted using Faust functions from well data, has been prepared for the Volador upper objective (Fig. 11). Volador-1 lies well within closure on the revised interpretation but about 2km south-southwest of the crest. Volador-1 is thus considered to be a valid test at this level : updip closure is limited to 2.2 sq km. As the discrepancy between AIMS and well shoot data will change absolute depths but not structural configuration, the test is assumed to be crestal in the Campanian section and revised maps have not been made.

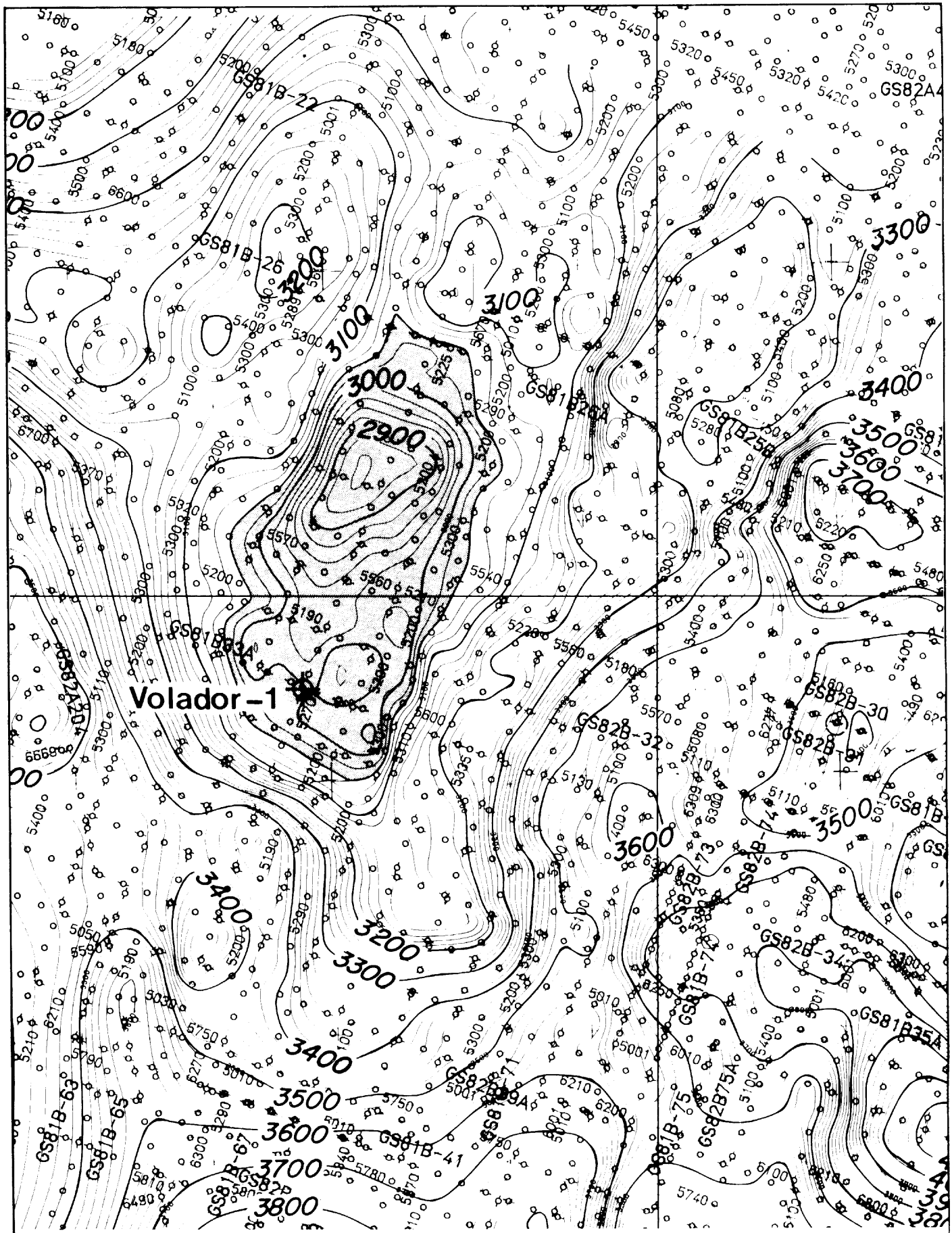
The main phase of growth of the Volador structure was during the depositional hiatus from about 50 to 37 m.y. BP, i.e. after the sealing of the base channel erosional high about 50 m.y. BP.

4.5 Reservoir Potential

The barrier and back-barrier sands down to 3461m consist of medium to coarse-grained clean quartz with little clay or cement. Their porosities range from 15% to 27% and they can be regarded as good potential reservoirs (Fig. 14).

The fluvial (point-bar/crevasse-splay) sandstones down to about 4079m are fine to medium-grained and with significantly greater lithic and clay contents and dolomite/siderite cement than the overlying coastal sands and with pressure solution of the quartz grains. Porosities ranging from 11% to 21%. The fluvial sandstones below this show a further increase in cement and clay; their porosities range from 10% to 15% and their permeabilities are degraded to the point that RFT measurements were not possible.

Below 4500m the sands become more lithic and cemented with porosities in the range 8% to 11%. Much of the clay content in the deeper Latrobe sandstones is secondary, being derived from breakdown of feldspars.



CONTOUR INTERVAL 20m

0 1000 2000

metres

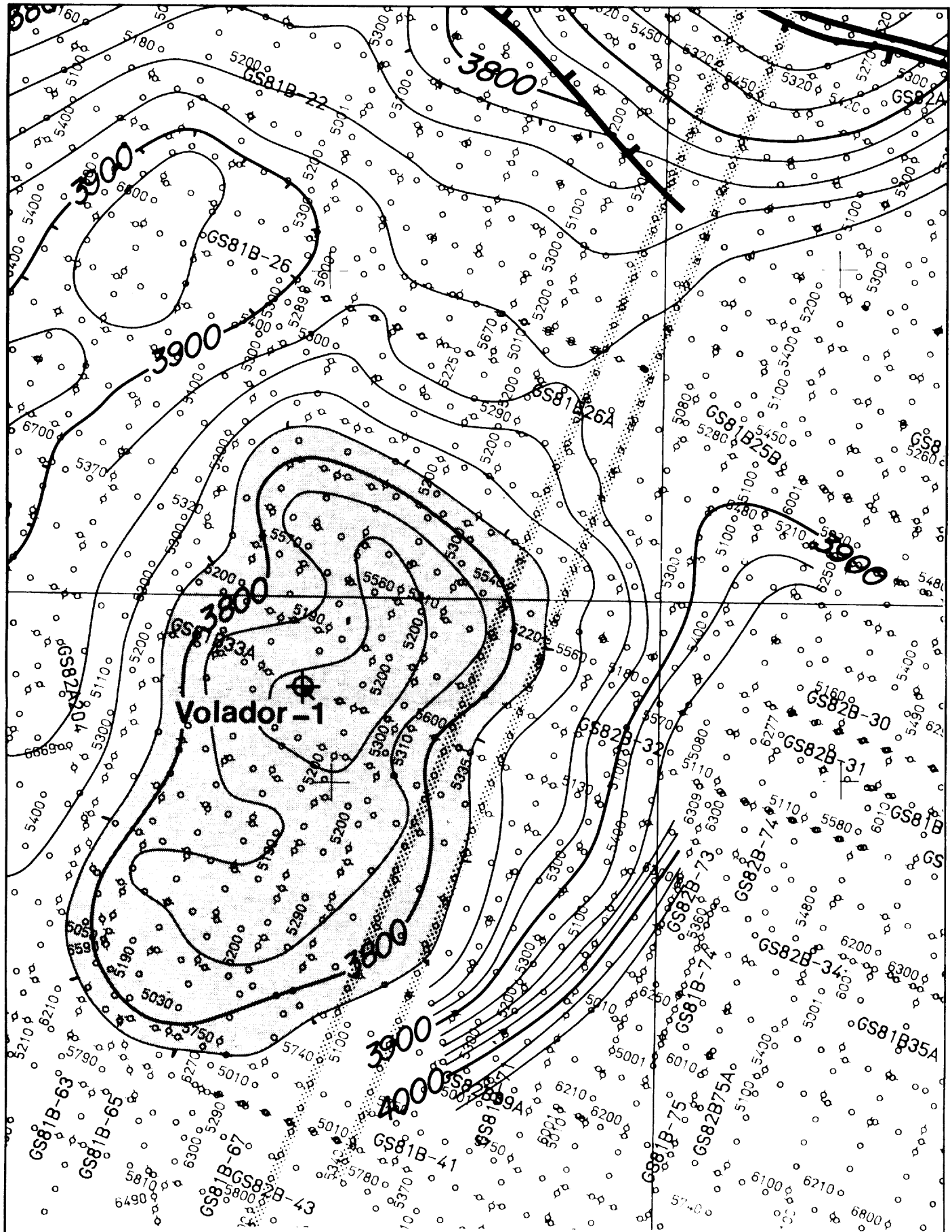
1:50,000

SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

DEPTH MAP (POST-DRILL)
TOP LATROBE
COARSE CLASTICS

Author: EXH/4	Date: Sept 1983	Fig 11
Report No: SDA 494	Drawing No: 17358	



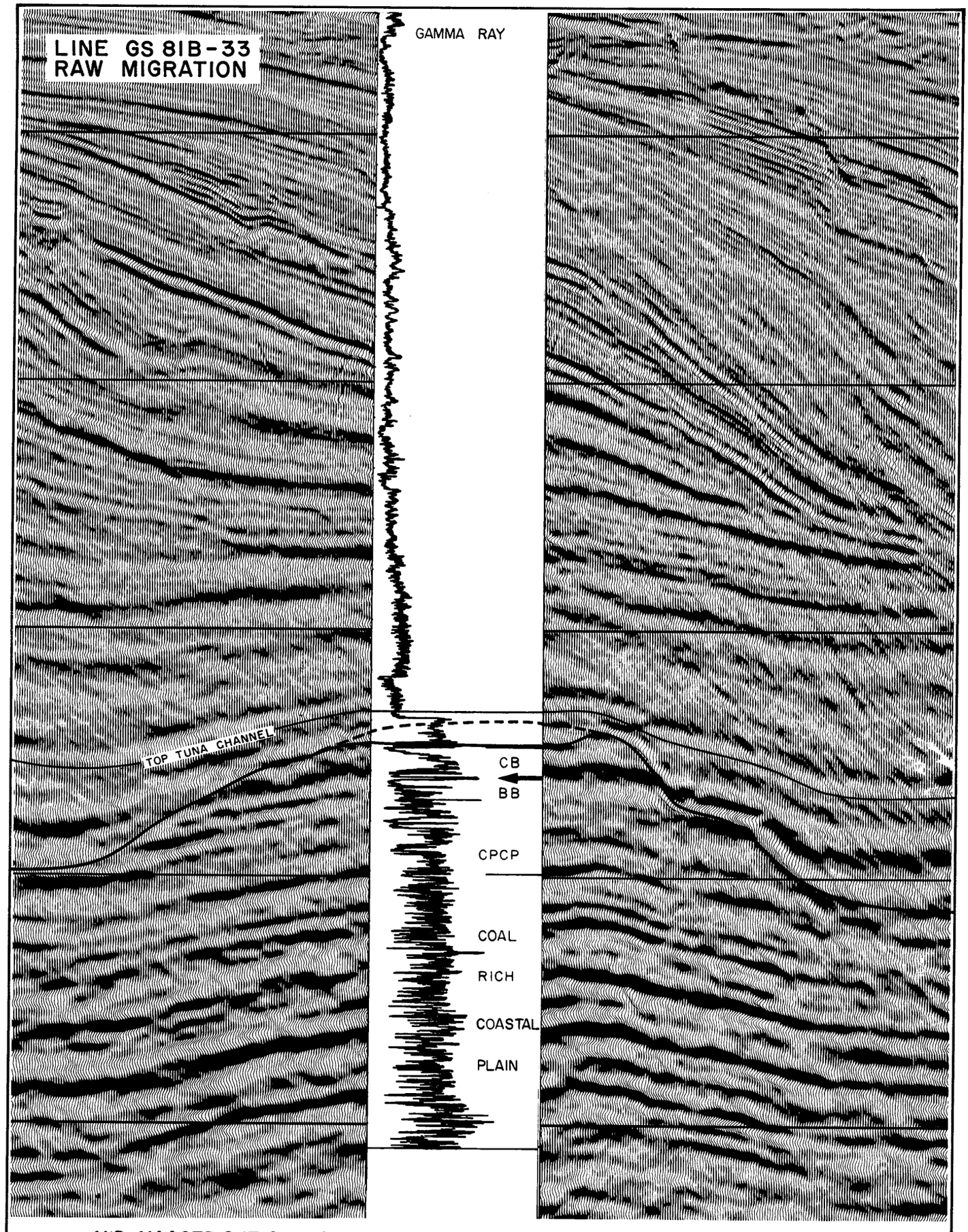
SHELL - AUSTRALIA E.& P. OIL AND GAS

GIPPSLAND BASIN

DEPTH MAP (PRE-DRILL) INTRA-CAMPANIAN MARKER

Author: FXH/4	Date: Sept 1983
Report No: 30A 494	Drawing No: 17359

Fig 12



← MID MAASTRICHTIAN MARKER

CB COASTAL BARRIER SAND

BB BACK BARRIER SAND

CPCP COAL- POOR COASTAL PLAIN

--- PRE-DRILL INTERPN. } TOP LATROBE
—— POST-DRILL INTERPN. } COARSE CLASTICS

SHELL - AUSTRALIA E.& P. OIL AND GAS.

GIPPSLAND BASIN

SEISMIC RESPONSE AT VOLADOR-1

Author: EXH/4	Date: Sept. 1983	Fig. 13
Report No.: SDA 494	Drawing No.: 17362	

PE905493

This is an enclosure indicator page.
The enclosure PE905493 is enclosed within the container PE902608 at this location in this document.

The enclosure PE905493 has the following characteristics:

ITEM_BARCODE	= PE905493
CONTAINER_BARCODE	= PE902608
NAME	= Porosity vs Depth Diagram
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Porosity vs Depth BDF sanstones from WCR for Volador-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

4.6 Hydrocarbon Indications

Hydrocarbon shows in the well were minimal down to about 3500m, except for a very pale crush cut from a silty mudstone in the Tuna-Flounder Channel at 3010m. Around 3500 to 3600m some of the sandstones showed very weak sample and cut fluorescence. At around 3670m the chromatograph recorded significant butane (C4) for the first time, and total ditch gas increased to 0.2% (background), reaching 2% opposite coal beds. These coals gave a bright cut fluorescence.

Below about 3750m the interbedded sandstones showed a spotty yellow fluorescence and moderate slow, streaming cut fluorescence. Background total ditch gas increased to around 1% at 4150m and pentane (C5) became measurable; total gas peaked at around 20% opposite coal beds. Below 4300m the background gas increased to about 2%, but the cut fluorescence in the sandstones diminished, becoming pale below 4400m. The total gas also appeared to diminish slightly in the last 100m of the hole.

The lower part of the hole, below about 3750m, is slightly overpressured. The onset of abnormal pressures approximately coincides with:

(i) the "Intra-Campanian" seismic marker

(ii) the base of a shaly section (lagoonal shales and silts)

(iii) increased separation of the deep and shallow resistivity logs in sands (interpreted to indicate hydrocarbon bearing formation)

(iv) the onset of significant maturity of the coals and carbonaceous shales (measured VR = 0.7% approx.)

(v) the onset of significant oil shows

The onset of overpressures is marked by an inflexion point in the sonic velocity, density and resistivity trends of the shales, and the formation pressure gradient in the sandstones derived from RFT results.

Production Test Nos. 1 and 2 produced mixtures of CO_2 rich gas, waxy crude, condensate and formation water from the tested reservoirs. The presence of continuous phase hydrocarbons has not been convincingly established suggesting that only limited short range migration has taken place. This is supported by the presence of CO_2 rich gas, an early generation product which has not been able to escape. Permeabilities in the tested intervals are low probably due to diagenetic clay reactions.

4.7 Conclusions and Contributions to Geology

1. Volador-1 was a valid test of an Upper Maastrichtian erosional/truncation closure and a Campanian anticlinal trap. AIMS modelling velocities and seismostratigraphic predictions corresponded closely to well data.

2. The Latrobe facies are broadly transgressive, passing upwards from an (?Campanian-Santonian) alluvial sequence, through a thick Campanian sequence of coal-rich coastal plain deposits, into Maastrichtian lagoonal, back-barrier, barrier face and neritic deposits, sealed at the Tuna channel erosion surface by overlying Lower Eocene neritic shales.

3. Reservoir quality is excellent in the coastal barrier sands of the upper Latrobe, but rapidly deteriorates downwards, partly as a result of progressive kaolinitisation of the feldspars.

4. The Flounder Formation and the shales within the paludal Campanian/early Maastrichtian section (3549-4538m) particularly those in the immature section above 3750m, form effective seals to vertical migration.

5. The paludal section is a very rich source rock sequence for gas and oil (Reference 10). It is mature for significant oil generation beneath about 3750m (the onset of significant oil shows).

6. Hydrocarbon shows (ditch gas and cut fluorescence) were ubiquitious beneath about 3670m, but saturations were insufficient to provide commercial accumulation. Significant quantities of continuous phase hydrocarbons have not been proven indicating that only localised (primary) migration has occurred. Production tests on fluvial sands beneath 3750m recovered CO_2-rich gas, water and minor amounts of waxy crude.

7. Volador-1 was a very useful deep test of the poorly known Upper Cretaceous section of the Latrobe Group near the seaward margin of the Gippsland Basin. The well data has greatly increased the knowledge of the stratigraphy and hydrocarbon habitat in this setting.

5. REFERENCES

Ref. 1	R4252	Data Evaluation of a Geophysical Evaluation at Site GSS-3 VIC/P19 Gippsland Basin. E.G.& G. Int. 1982.
Ref. 2	SDA 466	Rig Location Report of Nymphea over Volador-1. Mason, G.M., 1982.
Ref. 3	SDA 464	Report on Syledis Chain Calibration for Seismic and Rig Positioning VIC/P19 Permit Area. Mason, G.M., 1982.
Ref. 4	SDA 514	Volador-1 Basic Data Package, 1983.
Ref. 5	R4692	Volador-1 Well Velocity Survey and Calibrated Velocity Log S.S.L. 1983.
Ref. 6	SDA 501	Volador Production Test Results and Pressure Analysis. Soylemezoglu, M.I., 1983.
Ref. 7	R4784	Volador-1 Final Well Report. Exlog, 1983.
Ref. 8	SDA 289	A hydrocarbon habitat study of the Gippsland Basin, Australia, with an appraisal of acreage recently gazetted for exploration. Thomas B.M., Prudence T.J.C., Nelson A.W., Spence K., Blackburn G.J., Parker D.K. and Brown S.A., 1981.
Ref. 9	APEA J. 16(1)	Partridge A.D., 1976. The geological expression of eustacy in the Early Tertiary of the Gippsland Basin.
Ref. 10	R4753	Hydrocarbon source rock characterisation study, Volador-1 well. ANALABS, June 1983.

APPENDIX 6.1
PALYNOLOGICAL ANALYSIS OF VOLADOR-1
(GIPPSLAND BASIN, PERMIT VIC/P19)

By
JAN VAN NIEL

SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

I. SUMMARY

Depth	Dinoflagellate Zones	Spore-pollen Zones	Age
2941-2970m	W. ORNATUM or W. "THOMPSONAE"	Upper M. DIVERSUS	Early Eocene
2990m	W. ORNATUM	"	"
3000-3019.5m	A. HYPERACANTHUM to W. ORNATUM, probably W. ORNATUM	"	"
3030-3116m	(no dinoflagellates)	T. LONGUS	Maastrichtian
3122-3125m	I. DRUGGII	"	"
3133-3735m	(no dinoflagellates)	"	"
3896-4253m	(" ")	T. LONGUS or T. LILLIEI	Maastrichtian or Campanian
4265-4442m	(" ")	T. LILLIEI	Campanian
4526m	(" ")	No older than N. SENECTUS, probably T. LILLIEI	Probably Campanian

Sporomorph-colour, Organic Maturity and Source Rock Qualities

Transmitted (white) light : From pale yellow (2941m) to yellow/orange-brown (4526m)

Incident ultraviolet light : From bright yellow to yellowish brown

Organic Maturity : Immature at 2941m to Early Mature for oil generation at 4526m

Source Rock Qualitities : Sediments are moderate to very rich in organic matter, especially below 3300m, indicating good source rock qualities. Type of palynomacerals suggests that they are gas-prone.

Environment of Deposition (palynofacies)

2941-3019.5m	:	Marine - near shore
3030-3133m	:	Shore face, marine incursions
3283-4526m	:	Non-marine, low energy fluvial/swamp environment

II. INTRODUCTION AND METHODS

The interval examined palynologically ranged from 2941m down to 4526m (TD is at 4611m, bdf). A total of 49 sidewall cores and 8 cutting samples were selected on the basis of lithology. Grey to black mudstones and shales are generally richer in palynomorphs than silts and sands deposited in higher-energy environments. Where mudstones or shale samples were not available, siltstone samples were prepared. The quality of the sidewall cores was poor to fair.

Samples were prepared in Perth by Exploration Consultants Ltd (ECL) using the "standard" technique for siliciclastic sediments, i.e. hydrochloric and hydrofluoric acid treatment followed by heavy-liquid separation to remove mineral matter; controlled oxidation with nitric acid to reduce unwanted organic constituents and thus concentrate the palynomorphs; and finally washing with sodium hydroxide to remove humic acids. The resulting acid-insoluble residue was mounted in Elvacite to produce permanent microscope preparations. A slide of the non-oxidised residue was used for palynomaceral studies.

All samples yielded an organic fraction and almost all were productive, although from about 3800m down preservation deteriorated rapidly while assemblages were often poor in palynomorphs and lacked diversity. Consequently specific determination became almost impossible and this affected the picking of the T. LONGUS/T. LILLIEI zonal boundary.

The palynomorphs were recorded semi-quantitatively. To provide continuity with the work of Harris, 1983, the stratigraphic interpretation of assemblages follows the zonal characteristics given in his "Biostratigraphic Summary" (Harris, undated). The range charts in this "Summary" are largely based on published and unpublished work of Stover and Evans (1974), Stover and Partridge (1973), Partridge (1975) and Partridge (1976).

Reworked palynomorphs were found throughout the interval studied, but in very low percentages only. They ranged in ages from ?Devonian-Carboniferous and Permo-Triassic to Jurassic and Early Cretaceous. Contamination from the mud was present in many samples. Although all samples were carefully cleaned before preparation, a fractured or broken-up sidewall sample cannot always be fully trusted as some contamination with palynomorphs from the mud is unavoidable.

III. ANALYSIS OF ZONES

A. Dinoflagellate Zones:

2941-2970m (3 samples): "W. THOMPSONAE" or W. ORNATUM Zone (Early Eocene)

Based on the presence of *Apectodinium hyperacanthum* and *Muratodinium fimbriatum* which have their top-occurrence in the "W. THOMPSONAE" Zone. Other dinoflagellates present: *Apectodinium homomorphum* (common), *Ceratiopsis obliquipes* (single), *Renidinium* spp., *Cordosphaeridium* ssp., *Hystrichokolpoma* spp., *Adnatosphaeridium* spp. and *Deflandrea* spp. (all common).

2990m (1 sample): W. ORNATUM Zone (Early Eocene).

Although the nominate species was absent several specimens of *Wetzeliella articulata*, which has the same vertical restricted range, were found. The types mentioned from the overlying interval were present in this sample as well.

3000-3019.5 (4 samples): Probably W. ORNATUM Zone, but may be as old as the A. HYPERACANTHUM Zone (Early Eocene).

W. ornatum was absent and *W. articulata* occurred only as a doubtful specimen. The interpretation is therefore largely based on the presence of *A. hyperacanthum* and single specimens of *Deflandrea truncata* and *M. fimbriatum*. *A. homomorphum* and *Achomosphaera* spp. were common. A few specimens of *Palaeocystodinium australinum* and fragmented (indet.) *Deflandrea* ssp. were present also. A sample at 3010m was quite rich in dinoflagellates including a number of unknown generic affinity.

3030-3116m (7 samples): Non-diagnostic; only a few long-ranging types are present.

3122-3125m (2 samples): I. DRUGGII Zone (late Maastrichtian). Both Isabelidinium druggii and Eurydinium conoratum were present. In addition a single specimen of I. acuminatum, several of Nummus cf. N. monoculatus and fragmented (indet.) Deflandrea spp. were found.

3129-4526m (40 samples): No dinoflagellates found.

B. Spore-pollen zones: 2941-3019.5m (8 samples): Upper M. DIVERSUS Zone (Early Eocene). Well preserved, diverse and fairly rich assemblages. Amongst the many species present were: Ischyosporites gremius, Proteacidites pachypolus, P. grandis, P. beddoesii, Kuylisporites waterbolki, Cupanieidites orthoteichus, Tiliaepollenites notabilis, Verrucosisporites kopukuensis, Gephyrapollenites cranwellae, and Triporopollenites ambiguus.

The boundary between the upper M. DIVERSUS Zone and the overlying P. ASPEROPOLUS zone is apparently not easily definable (see Harris, undated, Figure 2). In Volador-1 evidence from dinoflagellates has been taken into account to restrict the interval under discussion to the upper M. DIVERSUS Zone.

3030-3735m (22 samples): T. LONGUS Zone (Maastrichtian). Both Tricolporites lilliei and Triporopollenites sectilis were present in the highest sample indicating that at this level the section is no younger than the T. LONGUS Zone. The nominate species was present as well but not in the highest samples. Proteacidites spp were common to abundant while Nothofagidites spp were not, at least down to 3288m. From this level down to the deepest sample examined (4526m) both groups of pollen are present in roughly equal proportions. While most samples yielded pollen and spores their concentration was generally low in respect to the abundant organic material (mostly plant tissues and inertinite) and preservation starts to deteriorate in the lower part of the zone.

In addition to Proteacidites spp. and Nothofagidites spp., Gambierina rudata, Tricolpites gillii, T. waiparaensis, Triporopollenites sectilis, Tricolporites lilliei, T. waiparaensis, Dacrydium spp., N. endurus, P. angulatus, are all present in varying amounts but types such as Gephyrapollenites wahooensis, Dilwynites granulatus, Tetracolpites verrucosus, Stereisporites regium and Camarozonosporites ohaiensis occur singly only. In general, the assemblages lacked diversity.

3896-4253m (15 samples): T. LONGUS or T. LILLIEI Zone (Maastrichtian or Campanian)

Most samples were very poor in pollen, only 2 out of 15 samples gave a workable assemblage. Furthermore, preservation deteriorated to the point that specific determination in many cases is impossible.

A sample at 4253m still contained Proteacidites angulatus, which has its base-occurrence at the boundary of the T. LONGUS and T. LILLIEI Zones. As this is regarded as insufficient evidence (none of the other zonal markers could be found) it seems better to leave the question of which zone is represented open.

4265-4442m (11 samples): T. LILLIEI Zone (Campanian). Again, assemblages are very poor, badly preserved and lack diversity. Only 2 samples yielded a reasonable number of specimens. Markers for the T. LONGUS Zone are absent but T. lilliei and T. sectilis are both present. Smallish proteaceous pollen and Nothofagidites spp are fairly regularly present but too badly worn for identification at species level.

4526m (1 sample): Probably T. LILLIEI Zone (probably Campanian). Deepest sidewall core available. Nothofagidites was still present, indicating that the base of the examined section is no older than the N. SENECTUS Zone (Senonian). However, a single specimen of T. lilliei (admittedly badly preserved) suggests that the T. LILLIEI Zone extends down to (at least) this level.

IV. SPOROMORPH COLOUR, DEGREE OF ORGANIC METAMORPHISM (D.O.M.) AND SOURCE ROCK POTENTIAL

The colour of palynomorphs changes when subjected to the increasing or prolonged temperatures such as occur during burial. These changes in colour are irreversible and therefore indicate the maximum level of maturity reached. The different stages, yellow to golden-yellow through orange and brown to black can be correlated with changes in chemical composition as hydrocarbons are generated from the organic matter (see Fuchs, 1969; Shell Standard Legend, Section 23.51.10). The sporomorph colour scale is more subjective than the vitrinite reflectance scale. Ideally, a long-ranging sporomorph type should be selected as different types of sporomorphs within the same sedimentary section show variations in colour. The change in colour from light yellow to golden-yellow or orange when observed in transmitted white light corresponds to the onset of oil generation, whereas the onset of gas generation is associated with a change in colour from orange to brown. Post-mature source rocks contain black sporomorphs and organic fragments only.

In incident ultraviolet light palynomorphs (and some palynomacerals) exhibit fluorescence colours that not only help in their identification but also increase and decrease according to rank. Fluorescence is maximal at the threshold of the "oil window", decreases with increasing rank and disappears at the end of the "oil window" (1-1.3% Ro, see Robert, 1981).

In Volador-1 sporomorph-colour in transmitted light ranged from pale-yellow at 2941m to yellow and yellow-orange to light brown at 4526m. Over the same interval fluorescence colours of sporomorphs ranged from golden yellow to yellowish-brown. Both estimates seem to indicate immature conditions at 2941m., changing into early mature towards 4526m.

Palynomaceral determination was carried out on a sieved, non-oxidised preparation. The sieving (with a 10 micrometer mesh sieve) was necessary to concentrate the large palynomacerals that otherwise would be diluted by fine, amorphous organic matter. This fine fraction is

undoubtedly important for source rock characterisation but its nature and origin cannot be determined by ordinary means.

In Volador-1 the total organic content after sieving in the interval 2941-3019.5m contained on average 30-40% Liptinite (spores, pollen, dinoflagellates, cutinite, alginite, all hydrogen-rich precursors of oil and gas), 50-60% Vitrinite (relatively hydrogen-poor) and 10% Inertinite (hydrogen-poor, no precursor of either oil or gas).
From 3030-3133m: a much higher percentage of Inertinite was present (50-80%), Vitrinite 10-40% and less than 10% Liptinite.
From 3288-4526m: 60-70% Vitrinite, 10-20% Liptinite and 10-30% Inertinite was found.

Although no accurate figures are available, a rough estimate during preparation showed that especially below about 3300-3500m the sediments were very rich in organic matter (1.0-3.0 millilitre per 10 grams of sample); between 2941 and 3288m sediments were less rich, averaging 0.25-1.0 millilitre per 10 grams.

V. ENVIRONMENT OF DEPOSITION AND PALYNOFACIES

The relationship between organic matter and grainsize of the sediments has been well-documented and is used to deduce depositional environment (palynofacies) from the type of palynomorphs and palynomacerals present.

The palynomorphs can be divided into marine organisms such as dinoflagellates and Tasmanites and foraminiferal test linings; fresh and brackish water organisms such as Botryococcus and Acritarchs; and land-derived pollen and spores (Sporomorphs).

Breakdown products of plants (woody fragments, epidermal tissues, cork cells, resin), algal and bacterial remains, animal tissue and many indeterminate organic fragments are collectively known as palynomacerals.

Although wind transport is an important aspect of the initial dispersal of sporomorphs, water transport then carries the sporomorphs and palynomacerals until they settle out of the water column. A continuous process of mechanical abrasion, biological degradation and wave and current action sorts and grades the particles during this transportation phase. Less buoyant, heavy or larger organic particles tend to characterise environments close to source while lighter, more buoyant and smaller particles are carried further afield. Very low sporomorph diversity indicates authochthonous environments (marsh, swamps); allochthonous environments are characterised by more diverse assemblages. Marine microplankton diversity increases in an offshore direction (Whitaker, 1979).

In Volador-1 interval 2941-3019.5m is clearly marine: dinoflagellates are common and fairly diverse. Sporomorphs are common as well and so is landplant material (small to medium sized). This suggests a near source, near shore, environment.

Between 3030-3133m a marked increase in Inertinite is evident and sporomorphs and plant fragments are common. The latter are occasionally large to very large, indicating limited water transport. Dinoflagellates are present between 3122 and 3125m. A shore face environment is most likely.

No marine or brackish water indicators were present between 3288-4526m. Plant tissues predominate, varying in size from small to very large. Sporomorphs were found in all samples but often in low percentage in respect to the abundant organic matter. Inertinite was present as a "background" in all samples. A low to intermediate-energy, fluvial/swamp environment is suggested.

REFERENCES

HARRIS, W.K. (undated) : Gippsland Basin Early Tertiary and Late Cretaceous Palynology: Biostratigraphic Summary
(Internal Report)

HARRIS, W.K. (1983) : Gippsland Basin Early Tertiary and Late Cretaceous Palynology: Summary of Results from 22 Selected Wells
(Internal Report)

FUCHS, H.P. (1969) : D.O.M. Determination by Geologists and Palynologists
(Shell Proprietary Report - Confidential)

ROBERT, Paul (1981) : Classification of Organic Matter by Means of Fluorescence: Application to Hydrocarbon Source Rocks
(Internat. Journal of Coal Geology, Vol. 1, pp. 101-137)

PARTRIDGE, A.D. (1975) : Palynological Zonal Scheme for the Tertiary of the Bass Strait Basins
(Handout: Symposium on Bass Strait Geology, Melbourne 1975)

PARTRIDGE, A.D. (1976) : The Geological Expression of Eustacy in the Early Tertiary of the Gippsland Basin
(J. AUST. Petrol. Expl. Assoc., 16: pp. 73-79)

STANDARD LEGEND (1976) : (Shell Proprietary Report)

STOVER, L.E. and EVANS, P.R. (1974) : Upper Cretaceous - Eocene Spore Pollen Zonation, Offshore Gippsland Basin, Australia
(Spec. Publ. Geol. Soc. Aust., 4, pp. 55-72)

STOVER, L.E. and PARTRIDGE, A.D. (1973) : Tertiary and Late Cretaceous spores and Pollen from the Gippsland Basin, Southeastern Australia (Proc. R. Soc. Vic., 85, pp. 237-256)

WHITAKER, M.F. (1979) : Palynofacies Catalogue (Shell Proprietary Report - Confidential)

APPENDIX 6.2

THE FORAMINIFERAL SEQUENCE IN VOLADOR-1

BY
DAVID TAYLOR

FOR: SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

R 4688

VOLADOR # 1.

SUMMARY OF FORAMINIFERAL SEQUENCE

†Sample Depth (m)	ZONE*	AGE*	PALEOENVIRONMENT¶	E-Log Pick
1325	A-4	Early Pliocene	Shelf Edge (≈250m)	
1475 to 1785	B-2 to C	Late to Mid Miocene	Upper Slope carbonates (400-250m)	
1925 to 2555	D-1	Mid Miocene	Slumping of carbonate down slope with canyon fills	
~~ (2 m.y.) ~~~~				2563
2564 to 2650	E-1 to E-2	Mid to Early Miocene	Carbonates at base of continental slope (≈1000m)	2659
2671 to 2828	F to G	Early Miocene	Deep oceanic basin carbonate with sporadic corrosion due to proximity of C.C.D. (2000-1000m).	
~~ (12-14 m.y.) ~~~~				2840
2850 to 2935	J-2	Early Oligocene	Carbonates from rapid transgression & eustatic sea level rise onto shelf platform (40m-<200m).	
2941	J/K	Eo/Oligocene Boundary	Commencement of early Oligocene Transgression coincidental with tectonic adjustment (<40m)	2938
?	?	?	? ? ? ?	?—2945
2949 to 3010	No planktonics	"Early Tertiary" arenaceous forams.	Barrier barred estuary/ lagoonal system; anoxic & polyhaline (<10m).	
?	?	?	? ? ? ?	?
2947 to 3030	? No microfauna found	?	? ?	

† Summary of results of examination of fiftyfive sidewall cores as tabulated on Tables 2, 3 & 4.

* Based solely on planktonic foraminifera. Detailed planktonic foraminiferal distributions on Table 2, with reliability of zonal boundary picks given on Table 1.

¶ Interpretations based on benthonic foraminifera (see Table 3); total microfauna and other sediment grains (see Table 4). Paleo-depth estimates given in parentheses.

—?—?— Unable to interpret contact relationship

~~~(2 m.y.)~~~ Hiatus with time span in parentheses.
~~~

BIOSTRATIGRAPHY.

This discussion is based on the distribution of Tertiary planktonic foraminifera in the Gippsland sector of the Tasman Sea Provence. The biostratigraphic letter scheme is in accordance with those for other sectors of the Provence, as outlined by Jenkins (1974), and Srinivasan & Kennett (1981).

EARLY TERTIARY - 3010 to 2949: No planktonic foraminifera found, but the arenaceous benthonic foraminiferal assemblages were similar to arenaceous assemblages, which were common in early Tertiary sediments in all three Bass Strait Basins (Taylor, 1965).

EO/OLIGOCENE BOUNDARY - 2841m: Only planktonic foraminifera present were two specimens of *Globigerina angiporoides angiporoides* which ranged from latest Eocene into the basal Oligocene.

BASAL OLIGOCENE - ZONE J-2 - 2935 to 2850m: Contains planktonic assemblages typical of the basal Oligocene (Zone J-2) of the Tasman Sea region; especially *Globigerina brevis* and *Globorotalia gemma* (? syn. or ≡ *G. postcretacea*).

EARLY MIOCENE - ZONES G at 2828m and the OLIGO/MIOCENE HIATUS at 2840m (E-log): At 2828m, the presence of *Globigerinoides trilobus* with the Tasman Sea early/mid Miocene *Globorotalia* suite of *G. miozea miozea, G. praescitula* and *G. zealandica* indicates a biostratigraphic position some distance above the base of the Miocene; that is Zone G, rather than the basal Miocene Zone H-1. Such a biostratigraphic placement of the sidewall core at 2828m automatically implies a hiatus existed between the early Oligocene at 2850m and the early Miocene. The E-log pick for this event in Volador # 1 is at 2840m. This event was an ubiquitous one in deep water Oligo/Miocene sequences in the Gippsland Basin as well as in the whole Tasman Sea Provence (refer Loutit & Kennett, 1981a). In Volador, the time span of the Hiatus was some 12 to 14 million years in length, compared with a maxima of 20 million years recorded in Hapuku # 1. However, in marginal, shallow water, Gippsland sequences, sedimentation was accumulating during this interval (e.g. at Lakes Entrance - refer Jenkins, 1974, Table 3). The causes of this hiatus will be discussed in the Paleoenvironment section of this report.

EARLY/MID MIOCENE - ZONES G,F.E-2 & E-1 - 2828m to 2564m: A deep water sequence of early Miocene carbonate extends from Zone G, through Zone F (with *Globigerinoides bisphericus* ≡ *G. sicanus*), to Zone E-2 at the top of the early Miocene with members of the *Praeorbulina glomerosa* Group. Sediment accumulation was also evident at the very base of the mid Miocene (Zone E-1 with *Orbulina suturalis*); before the sequence was abruptly truncated by mid Miocene slumping and submarine canyon cutting.

MID MIOCENE - BASE of CANYON FILL SEQUENCE - ZONE D-1 at 2555m: Probably all the mid Miocene Zone D-2 sediment was removed by slope slumping and/or the initiation of canyon cutting. A hiatus, with a time span of some 2 million years was evident in the Volador sequence, with an E-log pick at 2563m.

MID MIOCENE - ZONE D-1 - CANYON FILL SEQUENCE 2555 to 1925m: A thick sequence of Zone D-1 assemblages, which fluctuate in the quality of preservation. The degree of diagenesis was proportional to the ability to specifically identify specimens and thus positively identify a Zone D-1 assemblage in each sample. This is demonstrated by the tabulation below and in several columns on Table 4.

Depth (m)	Sidewall Core	ZONE	Reliability Rating (refer Table 1) & Preservation Quality	
1925	# 43	indeterminate		poor
2001	# 42	D-1	(1)	moderate
2144	# 40	indeterminate		poor
2300	# 37	indeterminate		poor
2350	# 36	D-1	(2)	poor
2426	# 34	D-1	(1)	moderate
2452	# 33	indeterminate		poor
2500	# 31	D-1	(0)	moderate
2525	# 30	D-1	(0)	moderate
2555	# 29	D-1	(1)	moderate

Samples with a high confidence rating of zero (0), contained the *Globorotalia peripheroacuta* morphotype of the *G.foshi* Group; whilst those with a moderate rating of one (1) contained members of the Tasman Sea Provence *Globorotalia* suite, including the highest appearance of *G. conica* at 1925m.

MID to LATE MIOCENE to EARLY PLIOCENE - ZONES C.B-2 and A-4 - 1785 to 1325m:

Because of poor sidewall core recovery, the upper part of the Gippsland sequence was poorly represented in Volador # 1. Zone B-1 was not designated but was probably present in the unsampled interval between 1475 and 1325m. The sample at 1325m contained an almost complete list of species for a Zone A-4 planktonic assemblage, bearing witness of the early Pliocene transgression onto the southern Australian Margin.

PALEOENVIRONMENT.

These interpretations are based on the analysis of the benthonic foraminiferal faunas, as well as all faunal elements (including planktonic foraminifera) and other sediment grains in the prepared residues (size >.075mm). Paleo-depths and other physico-chemical parameters are deduced from the benthonic assemblage by a combination of both comparison with faunal distribution in sediments of similar age and by using present day distribution of species analogues.

3010 to 2949m "EARLY TERTIARY" ESTUARINE: These arenaceous benthonic foraminiferal assemblages were, as elsewhere in the Bass Strait region, indicative of poorly oxygenated water with severe salinity fluctuations (Taylor, 1965). Distinctly biogenic pyrite and indications of sediment bioturbation were associated with these faunas, as were pyritized discs and spheres which could be attributed to diatoms. Such fossil features are characteristics of the carbon-rich, mudstones and micaceous quartz sandy siltstones of the Flounder Formation of the Gippsland, the Demons Bluff Formation of the Bass Basin and the Johanna River Sand and Dilwyn Formation of the Otway Basin. The facies similarities suggest the development of a series of barrier-barred estuarine/lagoonal systems. However, the facies was extremely diachronous, ranging in age from latest Paleocene to Eocene across the three Bass Strait Basins.

By this comparative reasoning, I regard the Flounder Formation to fill a series of estuarine scours rather than deeply incised channels.

2941 to 2850m - EO/OLIGOCENE - RAPID TRANSGRESSION: The four assemblages within this interval demonstrate rapid environmental change; from the

initiation of the marine transgression onto an exposed surface at 2941m to total inundation by shelfal seas and establishment of a biogenic carbonate, sedimentary regime. Both the planktonic and benthonic foraminiferal assemblages indicate that this transgression was isochronous with and resulted in similar environmental responses as the Whaingaroan Stage in New Zealand (Loutit & Kennett, 1981b).

The *"Vail Coastal On-lap Curve"* (e.g. Loutit & Kennett, l.c., p.1596) expresses this Whaingaroan transgressive event in terms of eustatic sea level rise. However, the increase in paleo-water depth in the Gippsland Basin Deep was too exaggerated in vertical scale, to have resulted purely from eustatic sea level rise. Vulcanism and tectonic uplift occurred in the East Gippsland Highlands in latest Eocene Times (Wellman, 1974), so that compensatory subsidence could explain the rapidity of basin deepening (refer below for further discussion).

OLIGOCENE/EARLY MIOCENE HIATUS - 2840m (E-log): The sidewall cores above this hiatus contained an extremely deep water benthonic foraminiferal assemblage associated with Zones G & F (early Miocene) planktonic faunas. The benthonic faunas were often dominated by morphologically primitive agglutinated foraminifera; especially the branching tubed form *Rhabdammina abyssorum*. These benthonic assemblages closely resemble those recorded in sediments of the same age from DSDP Site 206 in the Tasman Sea by Hayward & Buzas (1979). By analogy, these Volador faunas are typical of modern assemblages inhabiting the continental rise between 2000-4000m. This depth is confirmed by comparative methods, in that the interpreted depths are "consistent with inferred little change in water depth (3000m) at DSDP 206 between the early Miocene and now" (Hayward & Buzas, l.c., p.24). A higher depth estimation of between 2000 and 1000m is given for the Volador # 1 early Miocene as faunal modification may have occurred due to upwelling of carbonate deplete water, thus raising the C.C.D. at the base of the continental rise.

Effects of the corrosion due to differential dissolution of $CaCO_3$ are noted in the Volador early Miocene with the degree of corrosion fluctuating sporadically (see Table 4). Thus carbonate sedimentation was in the proximity of the C.C.D. throughout the early Miocene.

However, Loutit & Kennett (1981a, fig. 1-4) show that the C.C.D. was deeper during the late Oligocene to early Miocene than it was during the early Oligocene and Eocene, or during the mid to late Miocene. Loutit & Kennett (1981a & b and Kennett references therein) account for the hiatus in terms of paleoceanographic changes associated with the opening of the Southern Ocean, causing northern movement of high velocity deep currents to penetrate into the Tasman Sea. The non-accumulation of sediment was thus explained for in terms of non-deposition or erosion. But the time span of the hiatus is by no means uniform throughout the Gippsland Basin. This inconsistency is even apparent in wells within the same structure. Instances of the time span variation are:-

Zero along Basin Margins (e.g. Lakes Entrance)
8-10 million years in Kingfish, Fortesque, Cobia Wells
12-14 million years in Volador # 1
17 million years in Flounder # 1
and 20 million years in Hapuku # 1.

This data supports the contention that upwelling of the C.C.D. was responsible for the absence of some if not all Oligo/Miocene carbonate sedimentation. The extent of the upwelling would have been a function of the submarine topography in the proximity of any one site.

2828 to 2564m - EARLY to MID MIOCENE BASIN DEEP CARBONATES: The deep water environmental interpretation for the Zone G & F interval (2828 to 2671m) is discussed above. Gradual shallowing of the depositional surface occurred and is most marked at and above 2650m, during the early/mid Miocene transition of Zones E-2 and E-1. A situation at the base of the continental slope (≈1000m) is envisaged.

2555 to 1925m - MID MIOCENE CANYON FILL CARBONATES: High energy sedimentation is evident at and above 2555m, compared with generally low energy regimes of the continental rise below 2564m. Recycling of shallow shelf benthonics and size and shape sorting of planktonics are features of assemblages at and above 2555m. This 2555m sample was just above the truncation of the biostratigraphic sequence during the mid Miocene (at 2563m on E-log). All these features are typical of submarine cutting and subsequent carbonate filling in Gippsland offshore sequences. The time span for this Zone D-1 fill with a thickness of at least 600m was less than 1.5 million years. This accumulation rate was remarkably high. No doubt much of the accumulation was slumped material from an unstable shelf edge and upper slope.

REFERENCES.

HAYWARD, B.W. & BUZAS, M.A., 1979 - Taxonomy and Paleoecology of Early Miocene Benthic Foraminifera of Northern New Zealand and the North Tasman Sea. *Smithsonian Conts. to Paleobiology, 36;* 1-154.

JENKINS, D.G., 1974 - Paleogene Planktonic Foraminifera of New Zealand and the Austral Region. *J. Foram. Res., 4(4);* 155-170.

LOUTIT, T.S. & KENNETT, J.P., 1981a - Australasian Cenozoic Sedimentary Cycles, Global Sea Level Changes and the Deep Sea Sedimentary Record. *Oceanologica Acta, No. SP:* 45-63.

LOUTIT, T.S. & KENNETT, J.P., 1981b - New Zealand and Australian Cenozoic Sedimentary Cycles and Global Sea-Level Changes. *AAPG Bull. 65(9);* 1586-1601.

SRINIVASAN, M.S. & KENNETT, J.P., 1981 - Neogene Planktonic Foraminiferal Biostratigraphy and Evolution: Equatorial to Subantarctic, South Pacific. *Marine Microp. 6;* 499-533.

TAYLOR, D.J., 1965 - Preservation, Composition and Significance of Victorian Lower Tertiary "*Cyclammina* faunas". *Proc. Roy. Soc. Vict., 87;* 143-160.

WELLMAN, P., 1974 - Potassium-Argon Ages on the Cainozoic Volcanic Rocks of Eastern Victoria, Australia. *J. Geol. Soc. Aust., 21;* 359-376.

Table 1

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: +25.3 GL: -260

WELL NAME: VOLADOR # 1 TOTAL DEPTH:

AGE		FORAM. ZONULES	HIGHEST DATA					LOWEST DATA				
			Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Tim
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4	1325	0				1325	0			
MIOCENE	LATE	B_1										
		B_2	1475	2				1475	2			
	MIDDLE	C	1700	0				1785	1			
		D_1	2001	1				2555	1	2525	0	
		D_2										
		E_1	2570	0				2570	0			
		E_2	2590	0				2650	0			
	EARLY	F	2671	1				2750	1			
		G	2760	1				2828	0			
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1										
		J_2	2850	1				2941	2	2935	0	
EOCENE		K	2941	2				2941	2			
		Pre-K	2947	2				3010	2			

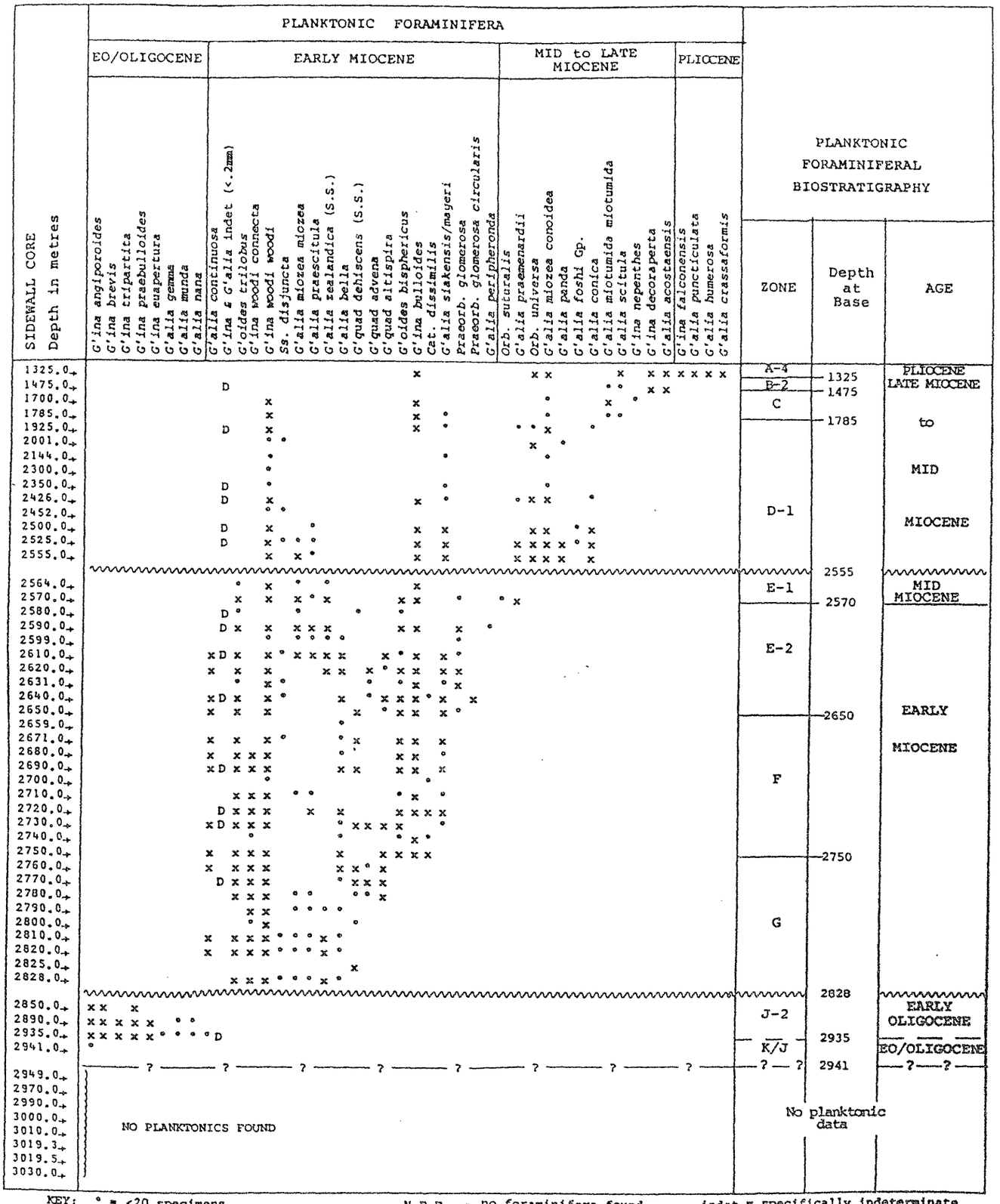
COMMENTS: Pre-K interval does not contain planktonic foraminiferal; but arenaceous fauna & diatoms were present and together with lithofacies suggest Flounder Formation.

N.B. Hiatus between J-2 & G (time span ≈12-14m.y.) and between E-1 & D-1 (time span ≈2 m.y.). Absence of B-1 was probably an artifact of sampling.

CONFIDENCE RATING:

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

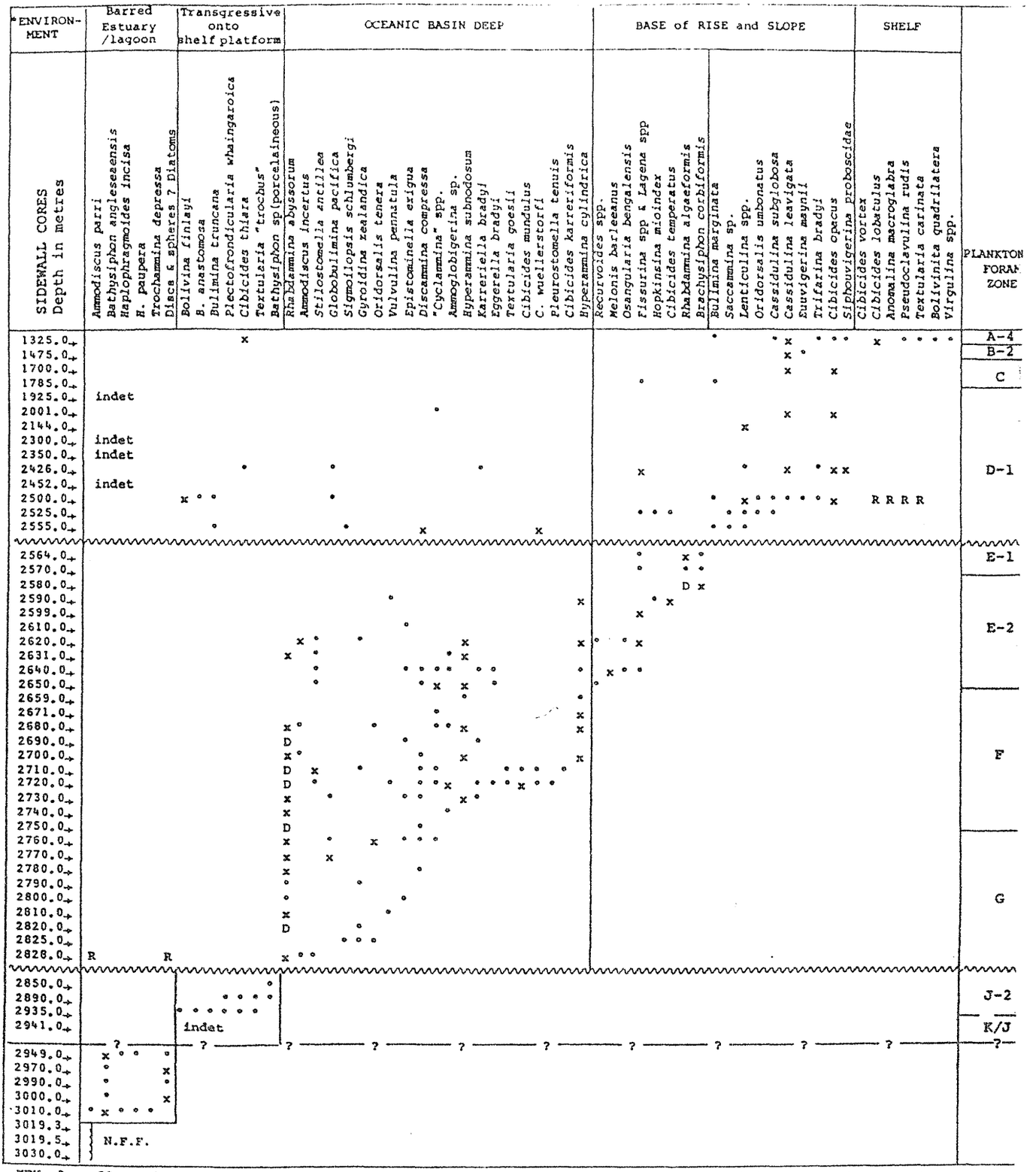
NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear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



KEY: ° = <20 specimens
× = >20 specimens
D = Dominant >60% specimens
? = determination queried
N.F.F. = no foraminifera found
≈≈≈ = definite hiatus
—— ? —— ? — hiatus - uncertain
indet = specifically indeterminate because of poor preservation due to solution effects and/or diagenesis.

TABLE 2:- EO/OLIGOCENE to PLIOCENE PLANKTONIC FORAMINIFERAL DISTRIBUTION - VOLADOR # 1
refer Table 3 for Benthonic Distribution.

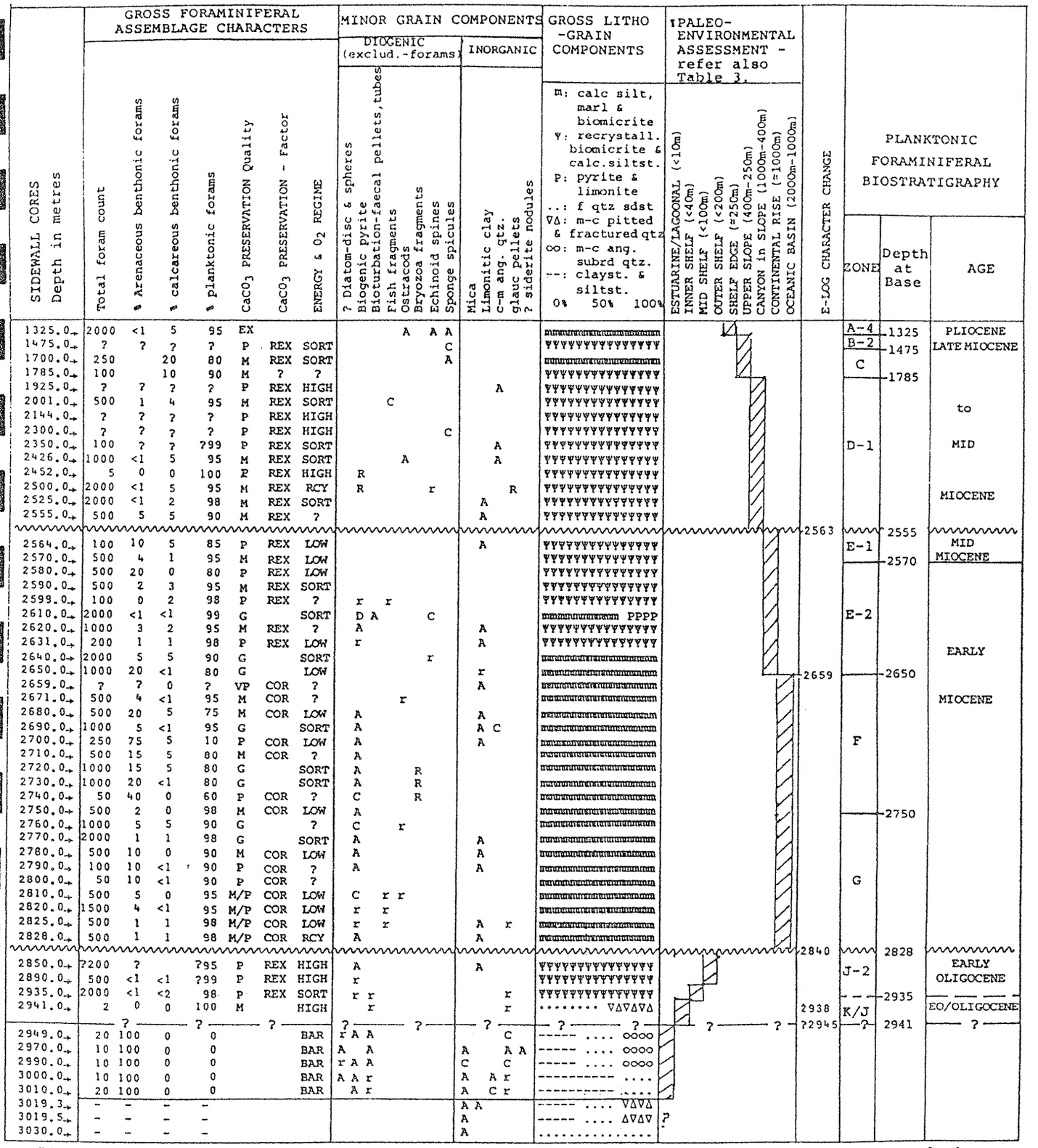
David Taylor, 29/3/1983.



KEY: * = <20 specimens
x = >20 specimens
D = Dominant >60% specimens
? = determination queried
R = Recycled specimens
N.F.F. = no foraminifera found
~~~ = definite hiatus
—?—? = hiatus - uncertain
indet = specifically indeterminate because of poor preservation due to solution effects and/or diagenesis.

TABLE 3: DISTRIBUTION of BENTHONIC FORAMINIFERA in Valador - 1
(with environmental assessment based on both analogy & comparison; refer Table 4).

David Taylor, April 12, 1983.
~~~



EX= Excellent
G= Good Texture & Shape
M= Moderate Texture & Shape
P= Poor-texture obliterated
VP= Very Poor-only "Ghosts"
M/P= planktonics moderate but benthonics poor.

REX= diagenetic recrystallisation
COR= corrosion at or near C.C.D.
HIGH = energy, seafloor currents
SORT= size & shape sorted
RCY= recycled shallow water forms
LOW= energy, seafloor currents, poor oxygenation

BAR= to ocean - low energy oxygenation & salinity.

A= 1-5% of grains
C= >20 grains
r= <20 grains
R= Recycled

¶Paleowater depth in parentheses

TABLE 4: PALEOENVIRONMENTAL ANALYSIS - VOLADOR # 1.

David Taylor, April 19, 1983.

APPENDIX 6.3

PETROPHYSICAL DATA

APPENDIX 6.3

DECK CARD STRUCTURE USED IN PARASOL PETROPHYSICAL EVALUATION

1. Interval 3700-4400m

   - Correction of Gamma Ray for bore hole
   - Correction of Laterolog deep for borehole
   - Correction of Laterolog shallow
   - Correction of Mircospherical focused log for borehole
   - Calculation of R_t (True Resistivity) and d_i (diameter of invasion)
   - Calculation of V_{sh} (fraction of shale) by means of Gamma Ray
   - Calculation of Porosity and Hydrocarbon saturations by means of Simandoux technique (using the density curve as input for porosity determination)
   - SUMS and averages listing

2. Interval 4400-4608m

   - Correction of Gamma Ray for borehole
   - Correction of Laterolog deep for borehole
   - Correction of Laterolog shallow for borehole
   - Correction of Microspherical Focused Log for borehole
   - Calculation of R_t (True Resistivity) and d_i (diameter of invasion)
   - Calculation of V_{sh} (fraction of shale) by means of Gamma Ray
   - * Calculation of Porosity/Lithology using Neutron/Sonic cross plot technique
   - * Calculation of Hydrocarbon saturations using Simandoux equation
   - SUMS and Averages listing

   * These steps are different from the interval 3000-4400m due to the unreliability of the density curve readings (excessive washouts)

APPENDIX 6.3

PETROPHYSICAL PARAMETERS

	3000-3300m	3300-3420m	3420-3540m	3540-3700m	3700-3750m	3750-3850m	3850-4400m	4400-4600m
GR maximum	135	135	135	135	135	135	135	135
GR minimum	33	33	33	33	33	33	33	33
ma	2.67	2.67	2.67	2.67	2.67	2.67	2.68	-
f	1	1	1	1	1	1	1	-
w	1	1	1	1	1	1	1	-
w	0.07	.08	.09	0.1	0.097	0.097	0.102	0.102
R_{Sh}	8.5	8.5	13	22	45	45	45	45
m,n	2	2	2	2	2	2	2	2
A	1	1	1	1	1	1	1	1

PE903587

This is an enclosure indicator page.
The enclosure PE903587 is enclosed within the container PE902608 at this location in this document.

The enclosure PE903587 has the following characteristics:

ITEM_BARCODE	= PE903587
CONTAINER_BARCODE	= PE902608
NAME	= Well Summary Sheet
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= MONTAGE
DESCRIPTION	= Well Summary Sheet for Volador-1
REMARKS	=
DATE_CREATED	= 19/04/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE602482

This is an enclosure indicator page.
The enclosure PE602482 is enclosed within the container PE902608 at this location in this document.

The enclosure PE602482 has the following characteristics:

ITEM_BARCODE	= PE602482
CONTAINER_BARCODE	= PE902608
NAME	= Composite Well Log
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Well Composite Log for Volador-1
REMARKS	=
DATE_CREATED	= 31/07/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE903588

This is an enclosure indicator page.
The enclosure PE903588 is enclosed within the container PE902608 at this location in this document.

The enclosure PE903588 has the following characteristics:

ITEM_BARCODE	= PE903588
CONTAINER_BARCODE	= PE902608
NAME	= Well Correlation
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= CROSS_ SECTION
DESCRIPTION	= Well Correlation for Tuna-1, Batfish-1, Stonefish-1, Flounder-1, Volador-1, Hapuku-1
REMARKS	=
DATE_CREATED	= 31/08/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE603884

This is an enclosure indicator page.
The enclosure PE603884 is enclosed within the container PE902608 at this location in this document.

The enclosure PE603884 has the following characteristics:

ITEM_BARCODE	= PE603884
CONTAINER_BARCODE	= PE902608
NAME	= Petrophysical Evaluation
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Petrophysical Evaluation for Volador-1
REMARKS	=
DATE_CREATED	= 31/07/83
DATE_RECEIVED	= 9/11/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE602468

This is an enclosure indicator page.
The enclosure PE602468 is enclosed within the container PE902608 at this location in this document.

The enclosure PE602468 has the following characteristics:

ITEM_BARCODE	= PE602468
CONTAINER_BARCODE	= PE902608
NAME	= Formation Evaluation Log
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Formation Evaluation Log for Volador-1
REMARKS	=
DATE_CREATED	= 23/03/83
DATE_RECEIVED	= 2/07/83
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	= EXLOG
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

(vi) Pressure Evaluation Log

PE602471

This is an enclosure indicator page.
The enclosure PE602471 is enclosed within the container PE902608 at this location in this document.

The enclosure PE602471 has the following characteristics:

ITEM_BARCODE	= PE602471
CONTAINER_BARCODE	= PE902608
NAME	= Pressure Evaluation Log
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Pressure Evaluation Log for Volador-1
REMARKS	=
DATE_CREATED	= 23/03/83
DATE_RECEIVED	=
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	= EXLOG
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE602469

This is an enclosure indicator page.
The enclosure PE602469 is enclosed within the container PE902608 at this location in this document.

The enclosure PE602469 has the following characteristics:

ITEM_BARCODE	= PE602469
CONTAINER_BARCODE	= PE902608
NAME	= Temperature Data Log
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Temperature Data Log for Volador-1
REMARKS	=
DATE_CREATED	= 23/03/83
DATE_RECEIVED	=
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	= EXLOG
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

(v) Wireline Data Pressure Log

PE602470

This is an enclosure indicator page.
The enclosure PE602470 is enclosed within the container PE902608 at this location in this document.

The enclosure PE602470 has the following characteristics:

ITEM_BARCODE	= PE602470
CONTAINER_BARCODE	= PE902608
NAME	= Wireline Data Pressure Log
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Wireline Data Pressure Log for Volador-1
REMARKS	=
DATE_CREATED	= 23/03/83
DATE_RECEIVED	=
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	= EXLOG
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE903639

This is an enclosure indicator page.
The enclosure PE903639 is enclosed within the container PE902608 at this location in this document.

The enclosure PE903639 has the following characteristics:

ITEM_BARCODE	= PE903639
CONTAINER_BARCODE	= PE902608
NAME	= Time/Depth Curve
BASIN	= GIPPSLAND
PERMIT	= VIC/P19
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Time /Depth Curve for Volador-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W794
WELL_NAME	= VOLADOR-1
CONTRACTOR	=
CLIENT_OP_CO	=

(Inserted by DNRE - Vic Govt Mines Dept)