Data Repository

Australian Government

Geoscience Australia

Well Completion Report Scanned Image File

Well Name	Ashmore Reef 1
Operator	B.O.C. of Australia Limited
Contractor	Zapata O.D.E. Pty. Ltd
Date of Report	16th October 1967 – 23rd March 1968
State	AC
Comment	

This file contains scanned images of a Well Completion Report submitted under the Petroleum (Submerged Lands) Act of the Australian Government. The data in this file are made available to assist future explorers for petroleum and may be distributed freely.

Please refer any queries to

Geoscience Australia
Data Repository
Cnr Jerrabomberra Avenue & Hindmarsh Drive,
Symonston ACT 2609
GPO Box 378, Canberra,
ACT, 2601, Australia

Phone: +61 2 6249 9222
Fax: +61 2 6249 9903
E-mail: ausgeodata@ga.gov.au
Web Page: http://www.ga.gov.au

ADMINISTRATOR,
DARWIN, N.T.

PERTH
16 APR 1968

29 APR 1968

Senior Petroleum Engineer,
B.O.C. of Australia Limited,
184 Adelaide Terrace,
PERTH. W.A. 6000

Dear Sir,

I refer to my teleprinter message of 19th March, 1968 concurring the abandonment of Ashmore No.1 Well.

Would you please let me have the details of the marker buoy as soon as possible, as the Port Authority desires to include them in the next issue of the notices to mariners.

Yours faithfully,

James H R Coleman
(R.L. DEAN)
Administrator

[illegible] refer [illegible] [illegible] to N.T.
Admin of 15 3 68

AUSTRALIA - NORTH WEST COAST

ASHMORE REEF

OBSERVATION RESULTS

BY: AUSTRALIAN HYDROGRAPHIC SERVICES PTY. LTD.
FOR: BURMAH OIL AUSTRALIA LTD.

October, 1967

SHORE CONTROL.

The following results have been computed from information contained in field books supplied by M.A. Nicholas and Associates and field observations by the Australian Hydrographic Services Pty. Ltd., representative.

PLANE RECTANGULAR CO-ORDINATES

These co-ordinates are based on a false origin "A Base" situated on the North-eastern shore of West Island.
Shoran Station West Island:- This is marked by concrete with "Shoran 1967" written on the surface.
S Middle Island:- This mark is a sign on the South-western corner of Middle Island. The sign gives the Latitude and Longitude of the group and information about potable water.
Palm East Island:- This mark is a palm tree about 25 feet high and is situated slightly to the North-west from the centre of the Island.

Most other marks with the exception of the Shed on West Island could not be located as Indonesian fishermen have taken the steel pickets etc., which marked the stations.

	(yards)	(yards)
A Base West Island	00.0	00.0
B Base West Island	347.3 S.	159.6 W.
Shoran West Island	28.2 S.	0.2 E.
South-east corner Shed West Island	37.5 S.	177.5 W.
S Middle Island	2 808.8 S.	7 423.5 E.
P East Island	2 115.1 S.	15 030.1 E.
J East Island	2 414.3 S.	15 023.3 E.
Z East Island	2 143.0 S.	14 881.9 E.
Shoran East Island	2 144.9 S.	14 873.2 E.
Palm East Island	2 202.2 S.	15 051.9 E.
"Investigator"	7 611.9 N.	14 338.9 E.

Plane bearings and distances:-

Rig to Palm	=	175° 50' 41"	9 840.0 yards
Rig to Shoran (West Island)	=	241° 57' 00"	16 247.1 yards
Palm to S	=	265° 27' 12"	7 652.5 yards
Shoran (West Island) to S	=	110° 32' 05"	7 927.0 yards

AUSTRALIAN TRANSVERSE MERCATOR CO-ORDINATES

These results have been computed from the plane rectangular co-ordinates shown above, then converted to Australian Transverse Mercator Co-ordinates using the values supplied by M.A. Nicholas and Associates, of Astro Station Z.

Astro Station Z	648 830.0	East
	3 432 025.5	North
"Investigator"	648 362.1	East
	3 441 790.6	North
Shoran Station West Island	633 956.2	East
	3 434 257.0	North
S Middle Island	641 362.0	East
	3 431 417.2	North
Palm East Island	648 999.6	East
	3 431 964.9	North

Geographic Co-ordinates:-

"Investigator"	12° 10' 49".7	South
	123° 05' 10".6	East
Astro Stration Z	12° 15' 40".0	South
	123° 05' 27".0	East
Palm East Island	12° 15' 41".8	South
	123° 05' 32".1	East
S Middle Island	12° 15' 59".8	South
	123° 01' 41".3	East
Shoran Station West Island	12° 14' 37".0	South
	122° 57' 56".8	East

G.H. Little

(G.H. Little)
Registered Surveyor

PLAN SHOWING POSITION OF "INVESTIGATOR" AT ASHMORE REEF

Compiled from Burmah Oil Australia Ltd. Plan Nº 531 (B.T.498) by Australian Hydrographic Services Pty. Ltd.

Australian Transverse Mercator Co-ordinates (Zone 2)

SCALE: 1" = 500 feet

OCTOBER 1967

PLAN SHOWING POSITION OF "INVESTIGATOR" AT ASHMORE REEF

Co-ordinates on Australian Transverse Mercator System (Zone 2)

Surveyed by Australian Hydrographic Services Pty. Ltd. Sydney.

OCTOBER 1967

Burmah

LOCATION OF STRUCTURE SECTIONS & ASHMORE REEF No. 1

(on hydrographic map base)

Copy 2
67/4264

I. SUMMARY

Ashmore Reef is situated on the outer portion of the Sahul Shelf, immediately south of the Timor Trough. Ashmore Reef No.1 was drilled with Zapata-O.D.E.'s drilling barge "Investigator" to a total depth of 12,843 feet.

The well penetrated ~~893 feet of~~ Quaternary carbonates before entering a ~~6903 feet thick~~ palaeontologically paraconformable sequence of early Middle Miocene through Upper Cretaceous predominantly carbonate beds. Although palaeontologically paraconformable, seismic evidence suggests that the sequence contains two unconformities; one intra-Lower Miocene, and one at the base of Oligocene. Three stratigraphic units are defined from this succession.

Unconformably beneath the Upper Cretaceous beds are a thin (146 feet) sequence of uppermost Jurassic sediments which rest conformably on 1041 feet of Upper Jurassic volcanics.

The Jurassic volcanics rest unconformably on a penetrated 3700 feet of Upper Triassic predominantly clastic beds to total depth.

The only hydrocarbon indications in the well were very minor amounts of gas of mainly less than 1% on the gas analyser and apparently originating from amygdaloidal basalts at the top of the Upper Jurassic volcanics. They were not significant enough to warrant testing.

Eocene calcarenites and Upper Triassic clastics are good potential hydrocarbon reservoirs. Tertiary marls and shales and Upper Triassic shales are possibly hydrocarbon source rocks. The Ashmore Reef structure was formed in the late Middle Miocene - the age of uplift is young relative to sediment deposition, thus possibly accounting for the lack of hydrocarbon shows. This might not be true for other Sahul Shelf structures with an earlier history of uplift.

II. INTRODUCTION

Ashmore Reef is located on the outer portion of the Sahul Shelf immediately east of the Timor Trough. The wellsite lies in the newly-created Australian Territory of Ashmore and Cartier Islands. Geographically, Ashmore Reef is 400 miles north-northeast of the shorebase of operations at Broome, W.A., and 260 miles northwest of the marine radio navigation station on Troughton Island off the northern tip of the Kimberley Block.

The well was subsidized as a 12,500 foot stratigraphic test to sample the sedimentary section in the remote Sahul Shelf region of the Australian Continental Shelf.

RECEIVED
19 AUG 1968
BMR G&G
CANBERRA
A.C.T.

Punch Card
Prepared By I. Powell
29/8/68.

III. WELL HISTORY - Compiled by D. Langton

(1) GENERAL DATA -

(a)	Well name and number	Ashmore Reef No.1
(b)	Name and address of operator	B.O.C. of Australia Limited, 8-12 Bridge Street, SYDNEY N.S.W. 2000.
(c)	Name and address of tenement holder	(i) Tenement Holders Shell Development (Australia) Pty. Ltd. (33 1/3%) B.O.C. of Australia Limited (33 1/3%) Woodside (Lakes Entrance) Oil Co. N.L. (25%) Mid-Eastern Oil N.L. (8 1/3%) (ii) Address B.O.C. of Australia Limited, 8-12 Bridge Street, SYDNEY N.S.W. 2000.
(d)	Petroleum tenement	Oil Permit No.141, Northern Territory. Tenable over an area of 314 square miles.
(e)	District	Ashmore Reef and its associated islands became a Territory administrated by the Commonwealth of Australia in 1933. In 1938 it was annexed to the Northern Territory of Australia for administrative and other purposes.
(f)	Location	Latitude 12°10'49.7"S. Longitude 123°05'10.6"E.
(g)	Rotary table elevation	160 feet above sea bed at zero tide datum (Mean Low Spring Tide). 33 feet above mean sea level.
(h)	Datum	All depths in report refer to rotary table.
(i)	Total depth	12843' from permanent R.T.
(j)	Date drilling commenced	16th October, 1967
(k)	Date drilling completed	23rd March, 1968
(l)	Date well capped	27th March, 1968
(m)	Date barge moved off location	2nd April, 1968 (1115 hours)
(n)	Drilling time from spud to total depth	160 days (this includes four days lost due to bad weather).
(o)	Status	Plugged and capped.

(2) DRILLING DATA

(a) Drilling Contractor — Zapata-O.D.E. Pty. Ltd., 39-41 York Street, SYDNEY N.S.W. 2000

(b) Draw-works

Make	IDECO
Type	H2500
Rated Capacity	20,000 ft. with 4½" D.P.
Motors	2 x 1000 H.P. Caterpillar D.398

(c) Derrick — Lee C. Moore 140' x 30' x 14' 1,100,000 lb. hookload capacity.

(d) Pumps (2)

Make	IDECO
Type	1450
Size	18" stroke
Motors	3 x 1000 H.P. Caterpillar D.398

(e) B.O.P. equipment

Make	Hydril 20"	Hydril 13-5/8"	Cameron 13-5/8"
Size	2000 psi	5000 psi	5000 psi

(f) Hole sizes and depths (Below Permanent Datum)

36"	to	337 ft.
26"	to	1015 ft.
17½"	to	3650 ft.
12¼"	to	8175 ft.
8½"	to	12,843 ft.

(g) Casing and Cementing Details

Size	30"	20"	13-3/8"	9-5/8"
Weight	319	94	68	43.5-47
Grade		H40	J55	N80-P110
Range			2	2
Setting Depth	332	985	3589	8140
Cement (sacks)	1700	1400	1800	1250
Type	Const.	Const.	Class H	Class H
Cemented to	Seabed	Inside 30"	Sea Bed	Inside 13-5/8"
Method used	- - - - - Displacement - - - - -			

(h) Drilling Mud

36" hole to 337'

The hole was drilled and opened using salt water. Prior to running casing the hole was filled with low weight (8.7 lb./gal.) and high viscosity 60 sec. slugs containing lost circulation material.

WEEK ENDING	WEIGHT (lb/gal)	VISCOSITY (Sec.)	GEL	WATER LOSS (c.c.)	FILTER CAKE	pH	SAND (%)	OIL (%)
12.1.1968	9.7	48	0/6	4.5	1.5	10.5	Tr.	6.0-7.0
19.1.1968	9.5-10.0	44-47	1/5	4.5-4.8	1.5	10.0	0.75	6.5-8.5
26.1.1968	9.7-10.0	44-48	0/6	4.0-4.6	1.5	9.3-10.0	0.50	7.0-8.5
2.2.1968	9.7	55	2/10	2.8-4.5	1.5	9.2	0.50	8.0-12.0
9.2.1968	9.7	49-55	2/6	3.7-4.0	1.5	9.6-9.8	0.25-0.75	9.0-10.0
16.2.1968	9.7-9.8	56	2/8	3.9	1.5	9.7	0.50-1.00	9.0-10.0
23.2.1968	9.7-9.8	53-57	2/8	3.9-4.0	1.5	9.7-10.0	0.50-1.00	9.0-10.0
1.3.1968	9.5-9.7	53-62	2/7	4.0	1.5	9.8	0.75	10.0
8.3.1968	9.6	54	2/6	4.0	1.5	9.8	0.50	8.0-11.0
15.3.1968	9.5-9.8	55-60	2/8	3.9	1.5	9.7-10	0.50	9.0-11.0
22.3.1968	9.7-9.8	54-60	2/8	3.7-4.0	1.5	9.7-9.8	0.50-0.75	9.0-10.0

For total consumption of all mud materials see forms headed "Drilling Mud Record".

(i) Water

Consumption — Both fresh and salt water was used in the drilling mud with most of the fresh water transported by service boats from Broome. Minor amounts of water for drinking purposes only were made on board with the "Aquachem" equipment.

(j) Perforation Record — Nil.

(k) Cement Plugs

	Depth	Cement & Type	Tested
(i) Overcoming lost circulation	414- 498	175 construction	Yes
	338- 414	100 construction	Yes
	845-1015	500 construction	Yes
(ii) Abandonment Plugs	7840-8300	300 Class H 0.5% HR4	Yes
	350-1050	230 Class H 0.5% HR4	

Corrosion cap with attached buoy placed over wellhead.

(l) Fishing

(i) At 10,166 feet an 8½" H.T.C. XIG bit was pulled with two cones missing. While reaming down to bottom a W7R-J became wedged in the undergauge hole. The pipe was worked for 3½ hours. 47 bl. diesel and 55 gal. pipelax were spotted at the bit and moved in 5 bl. slugs. Worked pipe without success.

Spotted 56 bl. diesel/drilling detergent mix around drill collars. Backed off string at Shaeffer Wagner safety joint leaving a fish in hole consisting of bit and junk subs, 15 drill collars, two stabilizers, bumper sub and one joint of drill pipe.

Ran in jars and made up to string but jars failed to operate. Unlatched, pulled out and serviced jars. Ran back in, made up to string, jarred and freed fish. Pulled out fish and found that the gauge teeth of the bit were broken ~~the~~ and the cones crimped.

(2) DRILLING DATA (cont'd.)

26" hole to 1015'

Drilling was commenced with a low weight high viscosity fresh water mud treated with up to 10 lb./bbl. lost circulation material. A complete loss of circulation occurred. Drilling was continued without returns but as the loss continued, cement plugs were placed. Continued lack of returns necessitated drilling with sea water without returns. Prior to logging and running casing, the sea water was displaced with viscous fresh water mud treated with L.C.M.

17½" hole to 3650'

Drilling was continued with mud containing a high concentration of lost circulation material. However, almost continuous losses occurred, at times up to 120 bls. per hour.

WEEK ENDING	WEIGHT (lb/gal.)	VISCOSITY (Sec.)	GEL	WATER LOSS (c.c.)	FILTER CAKE (mm.)	pH	SAND
10.11.1967	9.2	43-60	1/6	10.6-38	1.5-2.0	10.5	1.0
17.11.1967	9.1-9.4	34-80	1/6	12-45	1.5-2.2	9.0-10.5	½-1%
24.11.1967	9.7-9.9	43-76	3/12	7.6-9.2	1.5	9.5-10.5	1%

As from the 18th November and when opening the 12¼" hole to 17½", diesel was added to the mud. The oil content ranged between 7-10%.

12¼" hole to 8175'

Sporadic mud losses up to 150 bl/day while drilling occurred and particularly while tripping. Addition of lost circulation material was sufficient to reduce the loss to an acceptable amount. Periodically, the hole required resting for up to six hours after which the loss stopped.

Lost circulation material had to be removed by the shale shaker screens prior to coring to prevent plugging of the core barrel.

WEEK ENDING	WEIGHT (lb/gal)	VISCOSITY (Sec.)	GEL	WATER LOSS (c.c.)	FILTER CAKE	pH	SAND (%)	OIL (%)
1.12.1967	9.5-10	44	1/8	4.8-12.0	1.5	10.5	0.75	4.0-8.5
8.12.1967	9.5-10	45	0/6	4.2-6.2	1.5	9.0	1.00	6.0-8.0
15.12.1967	9.7-10	45	1/6	4.0	1.5	10.0	1.25	7.0
22.12.1967	9.6-10.1	44-52	0/4	4.0-7.5	1.5	9.3-9.7	0.25-1.25	4.0-7.0
29.12.1967	9.6-9.8	44-90	3/9	3.4-5.6	1.5	9.0-9.5	Tr.	6.0-8.0
5.1.1968	9.7	57-74	3/9	4.5	1.5	9.2-9.5	Tr.	6.0-8.0

8½" hole to 12843'

No lost circulation problems occurred during the drilling of the 8½" hole. An oil emulsion mud was used throughout and the following properties maintained.

Opened hole to 10,166 feet, ran Bowen reverse circulation junk basket and hole deepened nine inches, recovered one cone. Drilled ahead. Total time lost 73½ hours.

(ii) At 11,850' and 8½" H.T.C. XDR held up 220 feet from bottom. While reaming the bit was jammed by large shale fragments.

Worked pipe for three hours. Spotted 30 bls. of diesel/ pipelax mix across drill collars and continued working pipe.

Backed off at Shaeffer-Wagner safety joint leaving fish in hole consisting of bit and junk subs, 21 drill collars, one stabilizer, one joint of drill pipe. Ran in Bowen hydraulic jars and made up to string.

Commenced jarring without success. Spotted 20 bls. of diesel around bit. Continued jarring and fish became free. Gauge teeth broken, bit slightly crimped.

Total time lost 20¼ hours.

(iii) At 12,843' while pulling out, prior to running Schlumberger logs, the collars were backed off and the fish dropped to bottom.

Ran into hole with Bowen over-shot and hydraulic jars but these held up on bridge at 11,320 feet. Cleaned out hole and on second run with overshot latched onto fish. Fish jarred free and recovered. Left three cones in hole at T.D. Total time lost 41½ hours.

(3) LOGGING AND TESTING

(a) Flush Samples

Samples were taken from a vibrating screen at 10 ft. intervals while drilling and 5 ft. intervals while coring. All samples were logged and caught by the mud logging personnel under the supervision of B.O.C. Geologists and are representative of the labelled depth.

Representative suites of samples are stored with the Core and Cutting Laboratory of the Bureau of Mineral Resources, Canberra, the Northern Territory Administration, Darwin, Shell Development, Melbourne and B.O.C. Australia Limited, Perth.

(b) Coring

Cores were taken in accordance with the B.M.R. subsidy regulations for a stratigraphic hole:

No.	Interval	Recovery Feet	Recovery Percent
1	1125- 1152	-3/4'	2.8
2	2286- 2310	14½'	60.0
3	2619- 2644	13'	52.0
4	2901- 2928	22'	81.0
5	3212- 3240	Nil	
6	3245- 3270	Nil	

No.	Interval	Recovery Feet	Recovery Percent
7	3622- 3645	16'	70.0
8	4036- 4063	26'	97.0
9	4540- 4566	25½'	98.0
10	5020- 5035	15'	100.0
11	5535- 5553	14'	78.0
12	6022- 6042	20'	100.0
13	6520- 6533	10'	77.0
14	6730- 6748	18'	100.0
15	7252- 7267	13½'	90.0
16	7575- 7590	15'	100.0
17	8016- 8023	4'	57.0
18	8281- 8290	9'	100.0
19	8835- 8844	7½'	83.0
20	9295- 9314	19'	100.0
21	9741- 9755	22'	100.0
22	10048-10063	15'	100.0
23	10575-10583	8'	100.0
24	11024-11035	11'	100.0
25	11716-11724	8'	100.0
26	12060-12070	10'	100.0
27	12423-12433	10'	100.0

Description and analyses for the above cores are contained in the Appendices on "Cores" and on "Analyses".

(c) Side Wall Sampling:

	No. Rec.	No. Attempted	Interval
Run No.1	29	30	2638-3455
No.2	30	30	3895-8160
No.3	17	30	9400-10160
No.4	22	30	12813-12835
No.5	22	30	8900-12795
No.6	1	30	12826

Most of the losses were due to malfunctioning of the CST equipment. For complete details including depth, recovery and lithology see the Appendix on Cores.

All side wall cores are located at the Core and Cuttings Laboratory, Canberra.

(4) LOGGING AND SURVEYS

(a) Electrical and other logging

All the wireline logs itemised in the Appendix on logs were run by Schlumberger Seaco Inc. The following logs were run over the entire length of the hole.

Induction Electrical Log
Borehole Compensated Sonic Log
Borehole Compensated Formation Density Log
Gamma Ray Log
Continuous Dipmeter.

The following logs were run only when necessary.

Microlog/Microlaterolog/Caliper,
Neutron Log,
Temperature Log.

A wave and tide compensating device was used on all runs.

(b) Penetration rate log

Included as part of the Composite Log.

(c) Gas log

The variations in the amount of gas in the drilling mud was continuously recorded by two gas detectors using the following principles:-

(i) By variation in conductivity of the gas.
(ii) By variation in resistivity of a hot wire in contact with the gas.

The latter was used also to determine the type of gasses present and is presented on the composite log.

(d) Deviation Record

All readings were taken using a Lane Wells Sure Shot single reading inclinometer, recording a maximum of 8 degrees.

Deviation (degrees)	Depth (ft.)	Deviation (degrees)	Depth (ft.)
3/4	337	5-3/4	10166
1/2	980	4-3/4	10197
1	1600	4-3/4	10249
1	2619	4-3/4	10354
1	2901	5	10514
1	3212	5	10574
1-1/2	4036	3-3/4	10640
1-1/4	4337	4-1/4	10720
1/2	4540	4-1/4	10803
1/2	4880	4	10907
1/2	5505	3-3/4	10950
1/2	5840	4-1/2	11024
3/4	6230	2-3/4	11079
1/2	6400	3-1/2	11183
3/4	6609	4	11260
1	6903	3-3/4	11312
1/4	7570	3-1/4	11406
1-1/4	8470	1	11542
1-3/4	8830	2	11606
1	9290	2-1/2	11828
3	9670	3-1/2	11906
4-1/2	9740	2-3/4	12007
4-3/4	9820	2-1/4	12188
4-1/2	9924	1-1/2	12423
5	10048	1	12743

(e) Temperature Survey

The following surveys were run:-

Run No.	Interval	
Run No.1	200- 840	Top of cement located within 30"-20" casing annulus
Run No.2	3000-8082	Top of cement located behind 9-5/8 casing at 7020 ft.

(f) Velocity Survey

A velocity survey was run on the 23rd and 24th March 1968 by Western Geophysical Co. For details see Appendix No.6.

(g) Formation Tester

One formation interval tester was run by Schlumberger.

Run No.	Interval	
Run No.1	9230	10250 c.c. mud filtrate. 2225 c.c. mud filtrate with 10% formation water.

(5) TESTING

No testing was carried out.

B.O.C. OF AUSTRALIA L'

PLUG-BACK AND ABANDONME... ..EPORT

Form B - 6

Well ASHMORE REEF No. 1

Location

K.B. Elevation 160' above seabed.

F.T.D.

Fluid in Hole Drilling mud.

Plug Back String 4½" Drill pipe, open ended

Service Company Halliburton

Cons. Bd. Approval

Cons. Bd. Witness

Hole Size	8½
Depth	12843

Casing in Hole	Size	Set At	Top of Cement
Surface Casing	9-5/8	8140(Sch)	7000
Prod. String	-	-	

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5
Date	25-3-1968	27-3-1968			
Interval - Top	7600	350			
Bottom	8300	1050			
Felt Plug Depth	7840	-			
Formation - Name	VOLCANICS				
Depth		CASING			
Caliper Hole Size (Avg.)	12½	9-5/8			
Type of Mud	LIGNOSULPHONATE				
No. of Sacks	300	230			
Additives	HR4 0.5%	HR4 0.5%			
Bbls. of Water Ahead	10	5			
Displacement - Bbls. Water	3				
Bbls. Mud	103				
Slurry Weight	15.2	15.3			
Mixing Times - Start	04.00				
Finish	04.12				
Displacing Times - Start	04.14				
Finish	04.30				
Felt Plug Time	14.00				

Surf. Csg. Cut - Ft. Below Grd. Surf. Plug 230 Sacks. Plate Welded ~~Yes~~/No

(350 - 1050 ft.)

Casing Salvage: Shot off at - No. of Jts. Recovered -

Remarks: CORROSION CAP PLACED OVER WELLHEAD.

Operator's Representative C. TYNER

DRILLING RECORD

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL NO. 1.

Report No. 1. for week ending ~~[illegible]~~ 0600 hrs to Friday. 20th Oct. 1967.

I. WELL STATUS (All depths relate to ~~[illegible]~~) rotary table : 160 ft above seabed.

26 inch hole to 332 ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; _____ inch casing to _____ ft.

36 inch hole to 202 ft.; Operation OPENING 26" hole to 36".

II. DRILLING SUMMARY

Progress 172 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		~~Logging~~	~~Testing~~
			Mechanical	~~Weather~~		
& opening hole 76½	-	13½	1¼	under tow 15	ANCHORING 52½	Miscellaneous 9¼

No. of bits used during week 2 ; Total 2

Weight on bit 5 - 10,000 ; R.P.M. 75 - 100.

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7½	65 x 2	1150 - 1200	1300.

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
WATER (with slugs of mud)						

Coring

nil

Drill Stem Testing

nil

Electrical Logging

Remarks

Ashmore reef No. 1. was spudded at 0530 hrs. on 16th October 1967. Severe sloughing resulted in rough drilling conditions and finally a cutter was broken off the 36" hole opener.

The barge was moved 50 ft on a bearing of 70° and a new hole was started.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	-	-	2700	8000
Bentonite	(do)	270	270	530	3785
Spersene	Sks (x50 lb.)	-	-	293	1344
XP20	(do)	-	-	209	630
C.M.C.	(do)	3	3	50	-
L.C.M.	(do)	-	-	310	640
H.S.D.	bls	-	-	-	-
Caustic Soda	Drums (x100lb)	7	7	18	200
Soda ash	Sks (x92lb)	1	1	23	-
Sodium Bi-carb	(do)	-	-	16	24
Cement	Sks (x94 lb.)	-	-	4900	10,000
Fuel	bls barge	130	130	1119	-
Water	bls service boats	151	151	1226	-
	barge.			3106	

Active Mud Volumes

Circulation	hole		bls
	tank	305	bls
Stock	tank	305	bls
Total		610	bls

Made during week	900	bls
Total last week	0	bls
Consumption/[redacted]	290	bls

Remarks

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 2 for week ending ~~2400 hours~~ 0600 hours Friday, 27th October, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

17½ inch hole to 980 ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; _____ inch casing to _____ ft.

26 inch hole to 800 ft.; Operation OPENING 17½" HOLE TO 26"

II. DRILLING SUMMARY

Progress 648 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Testing~~
			~~Mechanical~~	~~Weather~~		Misc.
Opening Hole 35¼	4	30-3/4	0	0	4	94

No. of bits used during week 1 ; Total 3

Weight on bit 5-15,000 R.P.M. 60 - 150

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7½	40 - 65 x 2	750 - 1500	1000 - 1250

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
Sea water with pills of mud						

Coring

Nil

Drill Stem Testing

Nil

Electrical Logging

Induction Electrical	330 - 982 ft.
Sonic	330 - 972 ft.
Gamma Ray	160 - 945 ft.
Caliper	330 - 979 ft.

Remarks

36" hole was drilled to 337 feet and 30" casing was cemented to 332 feet. The 20" BOP stack and 24" riser were installed and 12¼" hole was started with mud in circulation. A complete loss of circulation occured at 437 feet and drilling was continued to 980 feet with sea water. Schlumberger surveys were taken and the hole was opened to 17½ " to 980 feet. At the end of the week the 17½" hole was being opened to 26" at 800 feet.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	0	0	2700	8000
Bentonite	(do)	473	743	33	3785
Spersene	Sks (x50 lb.)	0	0	293	1344
XP20	(do)	0	0	163	630
C.M.C.	(do)	3	6	47	0
L.C.M.	(do)	310	310	0	640
H.S.D.	bls	-	-	-	-
Caustic soda	Drums(x100LB)	20	27	0	198
Soda ash	Sks (x92 lb)	3	4	15	-
Sod bicarb	(do)	16	16	0	24
Cement	Sks (x94 lb.)	1975	1975	2925	10,000
Fuel	bls barge				-
	service boats				-
Water	bls barge			986	-

Active Mud Volumes

Circulation hole _____ bls

tank _____ bls

Stock tank _____ bls

Total _____ bls

Made during week _____ bls

Total last week _____ bls

Consumption/losses _____ bls

Remarks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 3 for week ending ~~XXXX

Remarks

During the week 12¼" hole was drilled from 1015 to 3030 ft. Losses of circulation were cured by circulating LCM in the mud and by periodically "resting" the well.

Deviation :

1 degree at 1600 ft.
1 degree at 2619 ft.
1 degree at 2901 ft.

Time Analysis :

Breakdown of miscellaneous hours	
Preparing to drill out of 20" casing	39
Coring	8½
"Resting" well	8
	53½

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	0	0	3700	7000
Bentonite	(do)		3369	76	1140
Spersene	Sks (x50 lb.)	108	188	525	924
XP20	(do)	42	82	293	418
C.M.C.	(do)	15	30	23	NIL
L.C.M.	(do)	879	1322	1042	426
H.S.D.	bls	NIL	NIL	-	-
Caustic Soda Drums (100 bl)		37	91	56	78
Soda Ash Sx (94 lb.)	NIL	12	5		NIL
Soda Bicarb. (94 lb.)		NIL	14	62	60
Cement	Sks (x94 lb.)	NIL	3875	2900	7000
Fuel	bls (barge)	115	617	962	-
	(service boats	93	407	936	-
Water	bls				
Zeogel Sx (50 lb.)		421	421	438	NIL
Lime Sx (94 lb.)		29	45	NIL	400

Active Mud Volumes

Circulation	hole 740 bls	Made during week	7500 bls
	tank 505 bls	Total last week	440 bls
Stock	tank NIL bls	Consumption/losses	6655 bls
Total	1245 bls		

Remarks

Continuous losses of 15 - 180 bl./hr. occurred while drilling from 20 inch casing shoe to approximately 2550 ft. A number of zones within this interval claimed up to 90% of the circulation volume and could only be sealed by high viscosity slugs with LCM. Below 2250 ft. losses have been considerably less although minor heavy losses have occurred. At the week-end the losses had stopped.

Mud chemical consumption and stocks have been corrected following physical check of all stocks.

Remarks

26 inch hole was drilled to 1015 ft. An attempt was made to run 20 inch casing but it held up to 921 ft. The casing was pulled out, and rerun after conditioning the hole. It was cemented with 1400 sacks construction cement with the shoe at 985 ft.
A temperature survey indicated top of cement above the 30 inch casing shoe.
At the end of the week preparations were in hand for drilling ahead.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	0	0	2700	8000
Bentonite	(do)	901	1644	0	
Spersene	Sks (x50 lb.)	80	80	423	
XP20	(do)	40	40	207	
C.M.C.	(do)	9	15	38	
L.C.M.	(do)	133	443	1015	
H.S.D.	bls	0	0	-	-
Caustic Drums (100 bl.)		27		13	-
Soda Ash Sx (94 lb)		10	12	5	
Soda Bicarb. (94 lb.)		0	16	13	
Cement	Sks (x94 lb.)	1900	3875	2700	
Fuel	bls Barge			1089	
Water	bls Barge			2843	
Lime (x 94 lb.)		16	16	29	

Active Mud Volumes

Circulation	hole	400	bls
	tank	40	bls
Stock	tank	0	bls
Total		440	bls

Made during week	1400	bls
Total last week	400	bls
Consumption/losses	1360	bls

Remarks

Mud chemical en route to barge

Bentonite	400 sacks
Salt Gel	75 sacks
Caustic	30 drums
Lime	42 sacks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 4 for week ending ~~XXXX

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 5 for week ending ~~2400 xxxx Saturday~~ 0600 Friday, 17th November, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.: 30 inch casing to 332 ft.

26 inch hole to 015 ft.: 20 inch casing to 985 ft.

___ inch hole to ___ ft.: ___ inch casing to ___ ft.

___ inch hole to ___ ft.: ___ inch casing to ___ ft.

12¼ inch hole to 3650 ft.: Operation 12¼" HOLE OPENED TO 17½" DOWN TO 3560 FT.

II. DRILLING SUMMARY

Progress 620 ft. in 12¼ hole; 2575 ft. of hole opened to 17½ inches.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	Testing
			Mechanical	Weather		
86-1/2	11-1/2	48-1/2	1	-	20-1/2	-

No. of bits used during week 3 ; Total 14

Weight on bit 5,000 - 20,000 ; R.P.M. 45 - 150

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7½	45 - 88	1000 - 2250	500 - 760

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.1 - 9.4	34 - 80	1/6	12 - 45	1.5 - 2.2	9.0 - 10.5	½ to 1

Coring

No. 5 3212 - 3240 Recovery Nil
No. 6 3258 - 3270 Recovery Nil
No. 7 3622 - 3645 Recovery 16 feet 69%

30 sidewall cores attempted by Schlumberger - recovered 29.

Drill Stem Testing

Electrical Logging

Continuous dipmeter run No. 1 983 - 3630
BCH formation density log run No.1 983 - 3644
Induction Electric run No. 2 983 - 3644

Electrical Logging (Cont'd.)

Proximity Log/Microlog Run No. 1	983 - 3644
BHC Sonic Log Run No. 2	983 - 3634

Remarks

The 12¼ inch hole was deepend to 3650 ft. without further losses of circulation. After running Schlumberger logs the hole was opened to 17½ inches. Despite heavy losses of mud, the hole opening progressed satisfactorily and losses stopped by the end of the week.

Deviation :
1 degree at 3212 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	-	-	3700	7000
Bentonite	(do)	626	3995	590	1710
Spersene	Sks (x50 lb.)	244	432	281	420
XP20	(do)	100	182	193	212
C.M.C.	(do)	9	39	14	NIL
L.C.M.	(do)	209	1531	1259	NIL
H.S.D.	bls	-	-	842	-
Caustic (x 100 lb.)		63	154	43	20
Soda Bicarb x 94 lb.		-	14	62	19
Soda Ash x 94 lb.		-	12	5	49
Cement	Sks (x94 lb.)	-	3875	2900	7000
Fuel	bls (barge)	120	737	842	-
	(service boats)	56	463	910	-
Water	bls	1134	1154	2066	NIL
Zeogel x 50 lb.	444	865	NIL		NIL
Lime x 94 lb.		NIL	45	NIL	-

Active Mud Volumes

Circulation	hole	1140 bls	Made during week	3300 bls
	tank	400 bls	Total last week	1245 bls
Stock	tank	NIL bls	Consumption/losses	3005 bls
Total		1540 bls		

Remarks

Salt Gel	19 sx added to base stock
Soda Ash	49 sx. added to base stock
Soda Bicarbonate	19 sx. added to base stock
Bentonite	1710 sx. added to base stock
LCM	589 sx. added to base stock
Caustic Soda	72 drums x 140 lb. added to base stock
Spersene	504 sx. on route to rig via Kabbarli
XP.20	206 sx. en route to rig via Kabbarli
CMC	84 sx. en route to rig via Kabbarli
LCM	589 sx. en route to rig via Kabbarli
Caustic	72 drums x 140 lb. en route to rig via Kabbarli
	28 drums x 100 lb. en route to rig via Kabbarli
Gel	1000 sx. en route to rig via Kabbarli

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 6 for week ending 0600 hours Friday, 24th November, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

inch hole to ft.; inch casing to ft.

12¼ inch hole to 3650 ft.; Operation RUNNING 13-5/8 B.O.P. STACK; WELL STANDING CEMENTED

II. DRILLING SUMMARY

Progress Nil ft. 12¼ INCH HOLE OPENED TO 17½ INCH, FROM 3560 FT.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	misc.
			Mechanical	Weather		
36-3/4	23½	20½	0	0	0	87¼

No. of bits used during week 1 ; Total 15

Weight on bit REAMING ; R.P.M. 100

Pump Performance

Liner Size	Strokes	Pressure	Volume (Gals/min)
7½	one pump @ 35 two pumps @ 34 - 42	one pump p.s.i. 700 two pumps 1000 - 2200	two pumps 700 - 1000

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7 - 9.9	43 - 76	3/12	7.6 - 9.2	1.5	9.5 - 10.5	1

Oil 9 - 10% Salinity 18 - 19,000 p.p.m.

Coring

Nil

Drill Stem Testing

Nil

Electrical Logging

Nil

Remarks

The hole was opened to 3560 feet and the mud was conditioned prior to running casing. On the first run the casing held up at 1300 feet and was pulled. The hole was reamed but during the second run the casing held up at 1375 feet. The hole was reamed again and the mud viscosity raised. At the third attempt the 13-5/8" casing was run, landed at 3589 feet and cemented using 1400 sacks Class H. Cement with 6% gel followed by 400 sacks neat cement. Returns of 12 lb./gal cement contaminated mud were obtained at surface but circulation was lost during the last 50 bl. of displacement.
After flushing out kill and choke lines, the 20" riser was removed and the 20" B.O.P. stack was pulled. At the end of the week the 13-5/8 inch B.O.P. stack was being run.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	0	0	3700	7000
Bentonite	(do)	316	4311	1774*	1974
Spersene	Sks (x50 lb.)	196	628	589	420
XP20	(do)	50	232	363	192
C.M.C.	(do)	10	49	88	0
L.C.M.	(do)	0	1531	1869	0
H.S.D.	bls	184	184	1223	-
Caustic	(x 100 lb.)	47	201	4	20
	(x 140 lb.)	0	0	72	20
Soda Bi-carb. Sx		0	14	20	38
Cement	Sks (x94 lb.)	1800	5575	800	7000
Salinex	(x 55 gals)	6	6	14	0
Fuel	bls Barge	241	978	1223	-
	Service boats	89	552	2213	-
Water	bls	1270	12924	1219	-
Soda Ash Sx	(x 94lb.)	0	12	57	68
Zeogel	(50 lb.)	0	865	19	0
	Lime (94 lb.)		45	50	350

Active Mud Volumes

Circulation	hole 504 bls	Made during week	650 bls
	tank 432 bls	Total last week	1540 bls
Stock	tank 396 bls	Consumption/losses	bls
Total	1332 bls		

Remarks

During the repeated reaming operations mud losses between slight and 10 lb./hr. were recorded following removal of L.C.M. from the mud. A complete loss of circulation occurred 50 bls. before completion of displacement of 13-5/8 inch casing cementation.

* Bentonite stock on vessel includes 500 sacks en route to barge on the Missouri.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 7 for week ending 2400 hours Saturday 1st. December, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

inch hole to ft.; inch casing to ft.

12¼ inch hole to 4512 ft.; Operation CIRCULATING

II. DRILLING SUMMARY

Progress 862 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		~~XXXXX~~	Testing
			Mechanical	Weather	Misc.	
39-3/4	7-1/2	46-1/4	0	0	74½	0

No. of bits used during week 3 ; Total 13

Weight on bit 10 - 35,000 ; R.P.M. 74 - 150

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7½	28 - 65	400 - 2300	290 - 650

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.5 - 10	44		4.8 - 12.0	1.5	10.5	0.75

Coring

No. 8 4036 - 4063 Recovery 26 feet 97%

Drill Stem Testing

Nil

Electrical Logging

Nil

Remarks

The 13-5/8" stack, 16" riser and kill and choke lines were installed and tested. Drilling of 12¼" hole proceeded to 4063 feet, when a leak developed in the Koomey control system. Repairs were carried out and at the end of the week 12¼" hole had been drilled to 4512 feet.

Deviation :

1½ degrees at 4036 ft,
1¼ degrees at 4337 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	300	300	3400	7000
HR.4 (x 50 lb.)		0	16	0	41
Bentonite	(do)	208	4519	1566	1894
Spersene	Sks (x50 lb.)	337	965	252	298
XP20	(do)	160	392	203	248
C.M.C.	(do)	8	57	80	0
L.C.M.	(do)	50	1581	1819	110
H.S.D.	bls	78	262	-	-
Caustic (x 140 lb.)		8	163	70	0
Soda Bicarb (x 94 lb)		10	24	10	60
Soda Ash (x 94 lb.)		0	12	57	72
Cement	Sks (x94 lb.)	50	5625	450	-
Lime (x 94 lb.)		0	45	50	350
Fuel	bls Barge	150	1128	992	-
Water	bls Service Boats	69	621	812	-
		1250	14174	1153	-
Salinex (x 55 gal.)		3	9	11	0
Zeogel (x 50 lb.)		0	865	19	0

Active Mud Volumes

Circulation	hole 672 bls	Made during week	850 bls
	tank 576 bls	Total last week	1332 bls
Stock	tank 288 bls	Consumption/losses	646 bls
Total	1536 bls		

Remarks

Of 646 bl. mud loss, 350 bl. , were dumped into the sea. The remaining 296 bl. were lost to formation. Loss commenced at 4330 ft. and continued at up to 25 bl./hr. However, at both 4337 and 4378 ft. approximately 70 bl. mud were lost.

Materials en route to Barge on Missouri :-

Spersene	168 (x 50 lb.)
Caustic	14.3(x140 lb.)
Soda Bicarb	20 (x 94 lb.)
Cement	1400 sacks
HR4	14 sacks
Bentonite	80 sacks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 8 for week ending ~~2400 hours Saturday~~ 0600 hours Friday, 8th December, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

inch hole to ft.; inch casing to ft.

12¼ inch hole to 5553 ft.; Operation DRILLING

II. DRILLING SUMMARY

Progress 1041 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		~~Logging~~ Misc.	Testing
			Mechanical	Weather		
73	10-3/4	73-1/4	0	0	11	0

No. of bits used during week 5 ; Total 18

Weight on bit 10 - 30,000 ; R.P.M. 60 - 140

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7	40 - 80	500 - 1900	400 - 800

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.5 - 10.0	45		4.2 - 6.2	1.5	9.0	1

Coring

No. 9 4540 - 4566 Recovery 25½ feet 98%
No. 10 5020 - 5035 Recovery 15 feet 100%
No. 11 5535 - 5553 Recovery 14 feet 78%

Drill Stem Testing

Nil

Electrical Logging

Nil

Remarks

Drilling of 12¼" hole was continued from 4512 to 5553 feet.

Deviation
½ degree at 4540 ft.
½ degree at 4880 ft.
½ degree at 5505 ft.

Omitted from Weekly Report No. 7 :-

1½ degrees at 4036 ft.
1¼ degrees at 4337 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	0	300	3400	7000
Bentonite	(do)	1546	6065	100*	1093
Spersene	Sks (x50 lb.)	295	1260	125	126
XP20	(do)	111	503	92	0
C.M.C.	(do)	26	83	54	0
L.C.M.	(do)	1119	2700	700	510
Zeogel (x 50 lb)		0	865	19	0
H.S.D.	bls	127	389	-	-
Caustic (x 140 lb)		20	183	50	0
Soda Bicarb (x 93 lb)		0	24	30	60
Soda Ash (x 93 lb)		0	12	57	85
Cement	Sks (x94 lb.)	0	5625	1850	
HR.4 (x 50 lb)		370	1316	14*	41
Fuel	bls Barge	375	1503	776	-
Water	bls Serviceboats	-	-	-	-
		1435	15609	757	-
D.D. (x 55 gal.)		1	1	9	0
Salinex (x 55 gal)		8	17	3	0

Active Mud Volumes

Circulation	hole 825 bls	Made during week	3148 bls
	tank 275 bls	Total last week	1536 bls
Stock	tank 288 bls	Consumption/losses	3000 bls
Total	1388 bls		

Remarks

Mud losses to the formation at up to 30 bls./hr. while drilling 4512 - 5424 ft.

Mud chemicals en route to Investigator on m.v. "Porpoise".

Bentonite 801 sacks
Spersene 172 sacks
XP 20 248 sacks

* 80 sacks Bentonite)
14 sacks HR4) blended in cement

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 9 for week ending 2400 hours Saturday 15th December, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 6515 ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; Operation DRILLING

II. DRILLING SUMMARY

Progress 962 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	Testing
			Mechanical	Weather		
102-3/4	5	52	0	0	8¼	0

No. of bits used during week 4 ; Total 22 (corrected)

Weight on bit 10 - 40,000 ; R.P.M. 50 - 100

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7	40 - 70	1250 - 2000	400 - 700

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7 - 10.0	45	1/6	4.0	1.5	10	1¼

Coring

No. 12 6022 - 6042 Recovery 20 feet, 100%

Drill Stem Testing

Nil

Electrical Logging

IES Run No. 3 3644 - 6400

BHC Sonic Run No.3 3634 - 6398

Remarks

Drilling of 12¼ inch hole was continued from 5553 - 6515 feet.
Schlumberger consolidation logging was carried out at 6404 feet.

Deviation :

½ degree at 5840 ft.
3/4 degree at 6230 ft.
½ degree at 6400 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	160	460	3240	7000
SaltGel Sx (x 50 lb.)		14	879	221	284
Bentonite	(do)	541	6606	1160*	293
Q. Broxin Sx (x 50 lb)		240	1500	568	0
Spersene	Sks (x50 lb.)				
XP20	(do)	165	668	415	36
C.M.C.	(do)	1	84	53	0
L.C.M.	(do)	162	2857	1048	0
H.S.D.	bls	75	464	-	-
Caustic Sode (x 140 lb)		24	207	47	0
Soda Bicarb (x 93 lb)		0	24	30	60
Soda Ash (x 95 lb)		16	28	41	85
Cement	Sks (x94 lb.)	0	5625	1850	-
HR.4		0	16	14*	41
Fuel	bls Barge	295	1798	809	-
Water	bls Service boats	-	-	-	-
		1891	17500	994	-
Salinex (x 55 gal)		0	17	3	0
D.D (x 55 gls)		3	4	6	0

Active Mud Volumes

Circulation	hole	910 bls	Made during week	1000 bls
	tank	550 bls	Total last week	1388 bls
Stock	tank	350 bls	Consumption/losses	578 bls
Total		1810 bls		

Remarks

80 sack Bentonite and 14 sacks HR4 blended in cement.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 10 for week ending 2400 hours Saturday 22nd. December, 19 67

I. WELL STATUS (All depths relate to ~~sub sea guide base.~~ rotary table at zero tide).

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 7236 ft.; _____ inch casing to _____ ft.

_____ inch hole to ____ ft.; Operation DRILLING

II. DRILLING SUMMARY

Progress 721 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Testing~~ Misc.
			Mechanical	Weather		
104-3/4	6¼	48-3/4	-	-	-	8¼

No. of bits used during week 7 ; Total 29

Weight on bit 30 - 50,000 ; R.P.M. 60 - 90

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7	45 - 60	2000 - 2250	450 - 760

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.6 - 10.1	44 - 52	0 - 4	4.0 - 7.5	1.5	9.3 - 9.7	0.25 - 1.2

Coring

No. 13 6520 - 6533 Recovery 13 ft. (100%)
No. 14 6730 - 6748 Recovery 18 ft. (100%)

Drill Stem Testing

Nil

Electrical Logging

Nil

Remarks

Drilling in 12¼ inch hole was continued from 6515 to 7236 feet.

Deviation :

3/4° at 6609 feet
1° at 6903 feet

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	425	885	2850	7000
Bentonite	(do)	182	6788	1321	0
Spersene	Sks (x50 lb.)	50	1250	518	127
XP20	(do)	25	693	426	0
C.M.C.	(do)	2	86	51	0
L.C.M.	(do)	64	2921	984	300
D.D.		0	4	6	0
H.S.D.	bls	50	514	-	-
Caustic		21	228	26	110
Soda Ash		17	41	55	54
Soda Bicarb		0	24	30	60
Cement	Sks (x94 lb.)	0	5625	1850	4850
Salinex		0	17	3	0
Fuel	bls Barge	160	1958	886	-
Lime	bls	0	45	50	350
Water		1741	19241	633	-
Q. Broxin		20	20	369	0
Zeogel		0	879	505	500

Active Mud Volumes

Circulation	hole 1010 bls	Made during week	570 bls
	tank 560 bls	Total last week	1810 bls
Stock	tank 350 bls	Consumption/losses	460 bls
Total	1920 bls		

Remarks

Consumption of mud includes 110 bl. dumped because of full tanks.
40 bl. lost during testing, 310 bl. lost to formation (at up to 10 bl./hr)

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 11 for week ending ~~2400 hours Sunday~~ 0600 hours Friday, 29th December, 19 67

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

____ inch hole to ____ ft.; ____ inch casing to ____ ft.

12¼ inch hole to 7902 ft.; Operation DRILLING

II. DRILLING SUMMARY

Progress 666 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Misc.~~
			Mechanical	Weather		
98-3/4	9-3/4	57½	-	-		2

No. of bits used during week 7 ; Total 36

Weight on bit 40 - 50,000 ; R.P.M. 60 - 80

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7	45 - 55	1100 - 1750	450 - 550

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.6 - 9.8	44 - 90	3/9	3.4 - 5.6	1.5	9.0 - 9.5	TRACE

Coring

No. 15 7252 - 7267 ft. Recovery 13-1/2 ft. (90%)
No. 16 7575 - 7590 ft. Recovery 15 ft. (100%)

Drill Stem Testing

Nil

Electrical Logging

Nil

Remarks

Drilling continued in 12¼" hole from 7236 to 7902 ft. at average speeds of 7.5 - 8.5 feet/hr. Continuous mud losses occurred while drilling.

Daviation ¼ degree at 7570 feet.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	840	1725	1975	7000
Bentonite	(do)	835	7623	1045	-
Spersene	Sks (x50 lb.)	150	1700	455	40
HR.4	(50 lb.)	-	16	14	-
XP20	(do)	101	794	255	-
C.M.C.	(do)	5	91	46	-
L.C.M.	(do)	544	3465	685	-
H.S.D.	bls	170	684	-	-
Q. Broxin	(x 50 lb.)	58	78	381	-
Caustic	(x 140 lb)	29	257	59	48
D.D.	(55 gals)	1½	5½	4½	-
Cement	Sks (x94 lb.)	-	6350	1850	6700
Salinex	(55 gals)	3	20	-	-
Fuel	bls	221	-	905	-
Water	bls	1860	-	1975	-
Saltgel	(x 50 lb.)	450	1329	595	-
Soda Bicarb	(93 lb)	0	24	30	60

Active Mud Volumes

Circulation	hole	1160 bls		Made during week	910 bls
	tank	490 bls		Total last week	1920 bls
Stock	tank	280 bls		Consumption/losses	900 bls
Total		1930 bls			

Remarks

State ship "Delamere" arriving Broome January 6th carrying 2000 sx Aquagel, 1000 Zeogel, 1000 LCM,200 drums Caustic.
Whilst drilling mud was lost at up to 25 bl./hr., after adding LCM the loss dropped to 5 - 10 bl/hr. which was considered manageable. The LCM was removed for coring and considerable volumes of mud were lost during trips. Jets were taken out at the beginning of the week but were replaced by 3/4 inch jets at the end of the week. After raising the viscosity to 90 seconds, the losses decreased to nil on the last day of the week.

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 12 for week ending ~~2400 hours Saturday~~ 0600 hours Friday, 5th January, 19 68

I. WELL STATUS (All depths relate to ~~sea level~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8135 ft.

inch hole to ___ ft.; Operation WELL STANDING CEMENTED

II. DRILLING SUMMARY

Progress 273 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Xxxxx~~ Casing
			Mechanical	Weather		
39-3/4	7-1/4	50	24	-	27	20

No. of bits used during week 2 ; Total 38

Weight on bit 35 - 45,000 ; R.P.M. 60 - 80

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
7	31 x 2	2000	600 - 640

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7	57 - 74	3/9	4.5	1.5	9.2 - 9.5	Trace

Coring

Core No. 17 8016 - 8023 Recovered 4 feet (57%)

Drill Stem Testing

Nil

Electrical Logging

I.E.S. 8178 - 6250 feet C.D.M. 3589 - 8174 feet
Sonic Caliper 8171 - 6250 feet, F.D.C. 8178 - 3589 feet,
Gamma 980 - 8164 feet

Sidewall Cores 8160 - 3589 (30 taken, 30 recovered). Run No. 2

Remarks

Ran 9-5/8" casing and landed at 8135 feet. Cemented using 1000 sx Class H cement with 6% gel followed by 250 sx neat cement; slurry weights 13.4 lb./gal and 15.0 lb./gal. respectively.

Displaced cement with 10 bl. water and 588 bl. mud, bumped plug at 1700 psi. Mud losses during cementing and displacing 300 bl. and after the job the mud level in the annulus dropped from site.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	0	1725	1975	7000
Bentonite	(do)	135	7758	910	0
Salinex		0	20	0	0
Spersene	Sks (x50 lb.)	20	1720	435	40
D.D.		½	6	4	0
XP20	(do)	10	804	315*	41
HR 4		14	30	0	0
C.M.C.	(do)	2	93	44	0
L.C.M.	(do)	0	3465	685	0
H.S.D.	bls	36	720	0	0
Caustic 140 lbs.		6	263	53	48
Soda Bicarb 93 lbs.		0	26	30	60
Soda Ash 93 lbs.		0	62	38	54
Cement	Sks (x94 lb.)	1250	7600	0	4850
Fuel	bls			1201	
Water	bls			3043	
Q-Broxin 50 lbs.		90	168	221*	0
Zeogel 50 lbs.		0	1329	595	0

Active Mud Volumes

Circulation	hole	598 bls	Made during week	120 bls
	tank	350 bls	Total last week	1930 bls
Stock	tank	330 bls	Consumption/losses	772 bls
Total		1278 bls		

Remarks

There were no losses while drilling during the week. However, losses to formation before and during cementing totalled 480 bl. 210 bl. were lost behind 9-5/8" casing and 80 bl. lost during removal of cuttings.

* Note : 70 sacks of XP-20 were stacked with Q-Broxin. Stock has been corrected accordingly.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL NO. 1

Report No. 13 for week ending 2400 hours Saturday 12th January, 19 68

I. WELL STATUS (All depths relate to ~~xxxxxxxxxxxx~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.
26 inch hole to 1015 ft.; 20 inch casing to 985 ft.
17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.
12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8135 ft.

8½ inch hole to 8700 ft.; Operation DRILLING

II. DRILLING SUMMARY

Progress 525 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~xxxxx~~ Wellhead
			Mechanical	Weather		
50½	2	32	0	0	3	80½

No. of bits used during week 3 ; Total 41

Weight on bit 25 - 35,000 ; R.P.M. 55 - 80

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	50 - 65	400 - 480	1800 - 2250

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7	48		4.5	1.5	10.5	Trace

Coring

Core No. 18 8281-8290 Recovered 9 ft. (100%)

Drill Stem Testing

Nil

Electrical Logging

Temperature survey 3000 - 8082 ft.

Remarks

A temperature survey indicated top of cement at 7020 feet in the 9-5/8" casing x 12¼" hole annulus. Drilling was continued in 8½" hole and a depth of 8700 feet was reached at the end of the week.

Deviation :

1¼ degrees at 8470 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	340	2065	3635	5000
Saltgel		0	1329	595	0
Bentonite	(do)	75	7833	1810	2000
Spersene	Sks (x50 lb.)	36	1756	399	40
Salinex (x 55 gal)		0	20	0	0
XP20	(do)	14	818	301	0
D - D		0	6	4	0
C.M.C.	(do)	5	98	39	0
L.C.M.	(do)	0	3465	1724	1200
H.R.4		0	30	8	33
H.S.D.	bls	24	744	-	-
Caustic (x 140 lb)		0	263	53	238
Soda Ash (x 93 lb.)		0	62	38	54
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	156	2505	1000	-
Water	bls	597	2505	1000	-
Soda Bicarb (x 93 lb.)		8	34	22	60
Q-Broxin (x 50 lb)		0	168	221	1000

Active Mud Volumes

Circulation	hole 600 bls	Made during week	180 bls
	tank 560 bls	Total last week	1388 bls
Stock	tank 315 bls	Consumption/losses	93 bls
Total	1475 bls		

Losses due to pulling plugged core barrel and bit.

Remarks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 14 for week ending ~~xxxxxxxxxxxx~~ 0600 hours Friday, 19th January, 19 68

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8135 ft.

8½ inch hole to 9690 ft.; Operation DRILLING

II. DRILLING SUMMARY

Progress 990 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Testing~~ MISC.
			Mechanical	Weather		
101	5	56-3/4				5-1/4

No. of bits used during week 5 ; Total 46

Weight on bit 25 - 40,000 ; R.P.M. 65

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	50	2300	400 - 420

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.5 - 10.0	44 - 47	1/5	4.5 - 4.8	1.5	10.0	-3/4%

Coring

Core No. 19 8835 - 8844 (Recovered 7½ feet - 83%)

Core No. 20 9295 - 9317 (Recovered 22 feet. 100%)

Drill Stem Testing

NIL

Electrical Logging

Remarks

Drilling continued in 8½ inch hole from 8700 ft. to 9690 ft. without incident.

Deviation

1-3/4° at 8830 ft.
1° at 9290 ft.
3° at 9670 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	NIL	2065	3635	5000
Salinex (x 55 Gal.)		0	20	0	0
Bentonite	(do)	70	7903	765	2945
D.D.		0	6	4	0
Spersene	Sks (x50 lb.)	102	1858	297	40
H.R.4		0	30	8	33
XP20	(do)	47	865	254	NIL
Soda Ash (x 93 lb.)		0	62	38	54
C.M.C.	(do)	NIL	98	39	NIL
Soda Bicarb (x 93 lb.)		8	34	22	60
L.C.M.	(do)	NIL	3465	674	2250
Q Broxin (x 50 lb)		0	168	221	1000
H.S.D.	bls	124	868	NIL	NIL
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls			620	
Water	bls			2320	

Active Mud Volumes

Circulation	hole	660	bls
	tank	600	bls
Stock	tank	310	bls
Total		1570	bls

Made during week	95	bls
Total last week	1475	bls
Consumption/losses	NIL	bls

Remarks

There were no losses of circulation during week.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 15 for week ending 0600hrs Friday, 26th Jan. 1968

I. WELL STATUS (All depths relate to rotary table at zero tide 0).

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8135 ft.

8½ inch hole to 9924 ft.; Operation REAMING AT 9550 FT.

II. DRILLING SUMMARY

Progress 234 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	Testing
			Mechanical	Weather		Misc.
37½	3	33½	-	83	-	11

No. of bits used during week 3 ; Total 49

Weight on bit 15 - 30,000 ; R.P.M. 65 - 100

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	50 - 55	2100 - 2300	400 - 430

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7 - 10.0	44 - 48	0/6	4.0 - 4.6	1.5	9.3 - 10.0	½

Coring

Core No. 21 9741 - 9755 (Recovered 14 feet - 100%).

Drill Stem Testing

NIL

Electrical Logging

NIL

DEVIATION

4½ degrees at 9740 ft.
4-3/4 degrees at 9820 ft.
4½ degrees at 9924 ft.

The rapid build up of deviation is thought to be result of the heave and pitch of the investigator. By cutting back drilling weight and experimenting with various stabilizer arrangements, the deviation is being contained but as yet not significantly reduced.

Remarks

The rig was made secure during heavy swell associated with tropical cyclone Bertha.

Drilling was suspended at 1900 hrs. on 20-1-1968 on receipt of a warning that tropical depression, Bertha, at that time south of Kalumburu, would intensify into a cyclone when it moved offshore. The barge was then experiencing 3 ft. seas in 20 - 30 knot westerly winds with the barometer falling.

The storm moved offshore on the evening of 21-1-1968 about 200 miles SSE of the barge, the closest it came, and continued towards the WSW. The seas at the barge gradually increased to a maximum of 8 - 10 ft. from north west and north on the 22-1-1968. Maximum heave, pitch and roll were 3 ft., 4 degrees and 6 degrees respectively.

Conditions then slowly moderated and operations were re-started at 0600 hours on 24-1-1968. Drilling was resumed at 1600 hours.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	155	2225	3480	5000
Bentonite	(do)	234	8137	531	2945
Spersene	Sks (x50 lb.)	20	1878	277	40
XP20	(do)	10	875	244	0
C.M.C.	(do)	0	98	39	0
L.C.M.	(do)	0	3465	674	2250
HR.4		0	30	8	33
H.S.D.	bls	29	897	-	-
Caustic (140 lb.)		9	290	28	238
Soda Ash		10	72	28	54
salinex		0	20	0	0
Soda Bicarb.		0	34	22	60
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	230	2991	825	-
Water	bls	309	25732	2362	-
D.D.		0	6	4	0
Q. Broxin		0	1329	195	400

Active Mud Volumes

Circulation	hole 680 bls	Made during week	150 bls
	tank 580 bls	Total last week	1570 bls
Stock	tank 295 bls	Consumption/losses	165 bls
Total	1555 bls		

Remarks

165 barrels were lost during cleaning up operations and while making secure. Condition of the mud after shut down period was excellent.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 16 for week ending ~~2400 Xxxxx Saxxxx~~ 0600 hrs. Friday 2nd. February, 19 68

I. WELL STATUS (All depths relate to ~~sub sea guide base~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8135 ft.

8½ inch hole to 10166 ft.; Operation RUNNING IN BIT

II. DRILLING SUMMARY

Progress 242 ft.

Time Analysis (hrs.)

Drilling / Reaming	Circulating	Tripping	Shut Down		Logging	~~Xxxxx~~ Fishing
			Mechanical	Weather		
33	2½	26	0	0	31½	75

No. of bits used during week 5 ; Total 54

Weight on bit 15 - 30,000 ; R.P.M. 100 - 120

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	50	2250	400

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7	55	0/10 - 2/6	4.5 - 2.8	1.5	9.2 Oil ~~Cl~~	0.5 8 -12% ~~5100~~

Coring

Core No. 22 10048 - 10063 Recovery 15 ft. (100%)

Drill Stem Testing

NIL

Electrical Logging

Induction Electrical 8140 - 10170
Sonic/Gamma Ray/Caliper 8140 - 10161
Continuous Dipmeter 8140 - 10160
Formation density 8140 - 10170
Sidewall cores Run No. 3

Remarks

Drilling was continued to 10166 feet, at which depth two cones of a bit were left in the hole. The hole was then found to be undergauge below 10125 feet and, while reaming, the bit became wedged at 10150 feet.
Working pipe and spotting diesel with pipe lax failed to free the bit. The pipe was backed off at the safety joint and hydraulic jars were run. On the second run of the jars the bit was worked free.
Schlumberger surveys were taken and at the end of the week a bit was being run prior to drilling ahead.

DEVIATION

5 degrees at 10048 ft.
5-3/4 degrees at 10166 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	155	2380	3325	5000
Salinex (55 gals.)		0	20	0	0
Bentonite	(do)	16	8153	865	2595
D.D. (55 gals.)		1	7	3	0
Spersene	Sks (x50 lb.)	80	1958	197	40
Pipe Lax (55 gals.)		2	2	1	0
XP20	(do)	40	915	204	0
HR4 (50 lb.)		0	30	8	33
C.M.C.	(do)	0	98	39	0
L.C.M.	(do)	0	3465	885	2039
H.S.D.	bls	131	1028	-	-
Caustic (140 lbs.)		7	297	39	220
Soda Ash (93 lbs.)		9	81	19	54
Sodiaum Bicarb (93 lbs.)		0	34	22	60
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	265	3256	1020	-
Water	bls	930	26662	2584	-
Q Broxin (50 lbs.)		0	168	221	1000
Salt Gel (50 lbs.)		0	1329	135	400

Active Mud Volumes

Circulation	hole	745 bls	Made during week	130 bls
	tank	486 bls	Total last week	1555 bls
Stock	tank	288 bls	Consumption/losses	166 bls
Total		1519 bls		

Losses due to dumping of sand traps.

Remarks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 17 for week ending ~~XXXXXXXXXXXX~~ 0600 hours Friday, 9th February, 19 68

I. WELL STATUS (All depths relate to ~~XXXXXXXXXXXX~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.
26 inch hole to 1015 ft.; 20 inch casing to 985 ft.
17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.
12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 10728 ft.; Operation PULLING OUT TO CHANGE BIT.

II. DRILLING SUMMARY

Progress 562 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	Testing
			Mechanical	Weather		
82	6-3/4	74-1/4	-	-	-	5

No. of bits used during week 9 ; Total 63

Weight on bit 15 - 30,000 ; R.P.M. 60 - 100

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	40 - 45	1700 - 2000	360

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7	49 - 55	2/6	3.7 - 4.0	1.5	9.6 - 9.8	-1/4 to -3/4

Coring

Core No. 23 10575 - 10583 (Recovery 8 ft. - 100%)

Drill Stem Testing

NIL

Electrical Logging

NIL

Remarks

Drilling continued in 8½ inch hole from 10166 ft. to 10728 ft. without incident. The deviation has gradually been cut back to acceptable limits.

Deviation

4-3/4 degrees at 10197 ft.
4-3/4 degrees at 10249 ft.
4-3/4 degrees at 10354 ft.
5 degrees at 10514 ft.
5 degrees at 10574 ft.
3-3/4 degrees at 10640 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	380	2760	2945	5000
Bentonite	(do)	151	8304	714	2595
Saltgel		0	1329	135	400
Spersene	Sks (x50 lb.)	70	2028	127	40
XP20	(do)	15	930	189	0
Salinex		0	20		
C.M.C.	(do)	0	98	39	0
L.C.M.	(do)	0	3465	885	1039
H.S.D.	bls	57	1085	–	–
D.D.		½	7½	2½	0
Caustic	140 lbs.	9	306	28	220
	100 lbs.				3
HR4		0	30	8	33
Cement	Sks (x94 lb.)	0	7600	810	4040
Q Broxin		0	168	221	1000
Fuel	bls	414	3670	992	–
Water	bls	927	27589	2257	
Soda Ash		0	81	19	54
Sodium Bicarbonate		0	34	22	60

Active Mud Volumes

Circulation	hole	770	bls
	tank	560	bls
Stock	tank	180	bls
Total		1510	bls

Made during week	150	bls
Total last week	1519	bls
Consumption/losses	159	bls

Remarks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF No. 1

Report No. 18 for week ending 2400 hours ~~Saturday~~ Friday 16th Feb. 1968

I. WELL STATUS (All depths relate to ~~XXXXXXXXXXXXXX~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 11135 ft.; Operation Drilling

II. DRILLING SUMMARY

Progress 407 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		~~Logging~~	~~Testing~~
			Mechanical	Weather		
72-3/4	4	65-3/4	3-3/4	0	Fishing 20¼	Wellhead 1½

No. of bits used during week 8 ; Total 71

Weight on bit 25-45,000 ; R.P.M. 45 - 70

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	40 - 65	2200	290 - 460

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7 - 9.8	56	2/8	3.9	1.5	9.7	

Coring

Core No. 24 11024 - 11035 (Recovery 11 ft.: 100%)

Drill Stem Testing

Nil

Electrical Logging

Remarks

The bearings and one cone of a bit were left in the hole at 10860 feet. The range 10826 - 10860 was reamed and most of the junk was recovered in a junk sub above the bit. The remainder of the junk was recovered during the next bit run.
A diamond bit was run at 11079 feet in an attempt to improve the daily footage. At the end of the week 8½" hole had been drilled to 11135 feet.

Deviation - 10720 4¼
10803 4¼
10907 4
10950 3-3/4
11024 4½
11079 2-3/4

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Salinex		0	20	0	20
Barytes	Sks (x100 lb.)	225	2985	2720	4289
HR4		0	30	8	33
Bentonite	(do)	213	8517	501	2595
Q-Broxin		1	169	220	1000
Spersene	Sks (x50 lb.)	68	2096	59	0
XP20	(do)	30	960	159	0
C.M.C.	(do)	2	100	37	0
L.C.M.	(do)	0	3465	885	1039
H.S.D.	bls	29	1114	-	-
Soda Bicarb		0	34	22	60
Soda Ash		10	81	19	59
Caustic Soda	(140 lbs)	13	319	15	202
	(100 lbs)	-	-	-	3
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	138	3808	830	-
Water	bls	1317	28906	2190	-
Zeogel		0	1329	135	400
D.D.		1½	9	1	0

Active Mud Volumes

Circulation	hole 808 bls	Made during week	200 bls
	tank 605 bls	Total last week	1510 bls
Stock	tank 252 bls	Consumption/losses	45 bls
Total	1665 bls		

Remarks

Materials en route to Barge on M/V Missouri:

Barytes 711 sacks
Spersene 28 "
Salinex 10 drums
Caustic 18 "

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 19 for week ending ~~2400 hours Saturday~~ 0600 hrs. Friday, 23rd. February, 68

I. WELL STATUS (All depths relate to ~~sea level~~ rotary table at zero tide).

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17-1/2 inch hole to 3650 ft.; 13-1/8 inch casing to 3589 ft.

12-1/4 inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8-1/2 inch hole to 1542 ft.; Operation RUNNING IN HOLE

II. DRILLING SUMMARY

Progress 407 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Xxxxx~~ Misc.
			Mechanical	Weather		
96½	½	66¼	-	-	-	4-3/4

No. of bits used during week 8 ; Total 78

Weight on bit 25 - 35,000 ; R.P.M. 60 - 80

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6"	40 - 45	2200	290 - 320

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7 - 9.8	53 - 57	2/8	3.9 - 4.0	1.5	9.7 - 10.0	0.5 - 1.0

Coring

NIL

Drill Stem Testing

NIL

Electrical Logging

NIL

Remarks

The diamond bit was pulled after drilling 109 feet in 37 hours. The formation penetrated was entirely unsuitable for this type of bit.

The pipe was held up at 10302 feet for 1-3/4 hours, but after reaming the hole no further trouble experienced.

Deviation

3½	degrees	at 11183 feet
4	"	at 11260 feet
3-3/4	"	at 11312 feet
3¼	"	at 11406 feet
1	"	at 11542 feet

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	300	3285	3131	20
Bentonite	(do)	108	8625	569	4113
Q Broxin		0	169	220	1000
Spersene	Sks (x50 lb.)	85	2181	12	33
XP20	(do)	38	998	121	0
C.M.C.	(do)	3	103	34	0
L.C.M.	(do)	0	3465	885	1039
H.S.D.	bls	58	1172	-	-
Caustic	(140 lbs.)	15	334	36	184
Salinex		0	20	10	20
Soda Bicarbonate		0	34	22	60
Cement	Sks (x94 lb.)	0	7600	810	4040
Soda Ash		0	81	19	59
Fuel	bls	292	4100	880	-
Water	bls	855	29761	2435	-
Zeogel		0	1329	135	400
D.D.		1½	9	1	0

Active Mud Volumes

Circulation	hole	830	bls
	tank	400	bls
Stock	tank	200	bls
Total		1430	bls

Made during week	100	bls
Total last week	1570	bls
Consumption/losses	240	bls

Remarks

Nil

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF No. 1

Report No. 20 for week ending ~~2400 hours Saturday~~ 0600 hrs. Friday, 1st. March, 19 68

I. WELL STATUS (All depths relate to ~~XXXXXXXXXXXX~~ rotary table at zero tide).

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-1/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 11906 ft.; Operation RUNNING NEW BIT

II. DRILLING SUMMARY

Progress 364 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Testing~~ Fishing
			Mechanical	Weather		
63-3/4	5	79¼	½	7	10½	2

No. of bits used during week 7 ; Total 85

Weight on bit 25 - 40,000; R.P.M. 60 - 80

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	40	2200	290

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.5 - 9.7	53 - 62	2/7	4.0	1.5	9.8	-3/4

Coring

Core No. 25 11716 - 11724 Recovery 8 ft. (100%)

Drill Stem Testing

Nil

Electrical Logging

I.E.S. Run 6 11,618 - 10,000

Sonic/Gamma Ray/Caliper Run 6 11,609 - 10,000

Remarks

When the depth was 11724' a stabilizer stuck at 11589' while running in. The stabilizer was freed after two hours and the hole reamed. Drilling continued without further incident.

Deviation :-

2 degrees at 11606 ft.
2½ degrees at 11828 ft.
3½ degrees at 11906 ft.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	220	3505	2911	4289
Zeogel		0	1329	135	400
Bentonite	(do)	105	8730	464	2419
HR4		0	30	8	33
Spersene	Sks (x50 lb.)	12	2193	0	0
XP20	(do)	23	1021	98	0
Sodium Bicarb.		0	34	22	60
C.M.C.	(do)	10	113	24	0
L.C.M.	(do)	-	3465	885	1039
H.S.D.	bls	34	1206	-	-
Caustic Soda		5	341	31	184
Salinex		1	21	9	20
Q. Broxin		69	238	151	1000
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	253	4353	1163	-
Water	bls	1043	39804	2192	-
D.D.		1	10	0	0
Soda Ash		0	81	19	59

Active Mud Volumes

Circulation	hole	850	bls
	tank	470	bls
Stock	tank	-	bls
Total		1320	bls

Made during week	150	bls
Total last week	1430	bls
Consumption/losses	~~260~~	bls

Remarks

30 bls. were lost to the formation while drilling 11770 - 11780

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 21 for week ending ~~XXXXXXXXXXXX~~ 0600 hours Friday, 8th March, 19 68

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 12070 ft.; Operation RUNNING IN HOLE.

II. DRILLING SUMMARY

Progress 164 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Testing~~
			Mechanical	Weather		
61½	4½	68½	11			Miscell. 22½

No. of bits used during week 7 ; Total 92

Weight on bit 20 - 40 ; R.P.M. 35 - 60

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6"	30 - 60	2250	290

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.6	54	2/6	4	1.5	9.8	½

Coring

Core No. 26 12060 - 12070 Recovery 10 ft. (100%)

Drill Stem Testing

Nil

Electrical Logging

Nil

Remarks

Drilling continued at a slow rate in 8½ inch hole to 12070 feet, where the bit became stuck. The string was backed off at the safety joint. Bowen hydraulic jars were run and the fish was recovered. Some time was lost repairing failure of a bearing on the dynamatic brake, and trip times have risen considerably.

Deviation
2-3/4 degrees at 12007 feet.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	110	3615	2801	4289
Salinex		0	21	9	20
Bentonite	(do)	43	8773	526	2314
Soda Bicarb.		0	34	22	60
Spersene	Sks (x50 lb.)	-	2193	-	-
Zeogel		0	1329	135	400
XP20	(do)	35	1056	63	-
HR.4		0	30	8	33
C.M.C.	(do)	19	132	5	-
L.C.M.	(do)	-	3465	885	1039
H.S.D.	bls	79	1285	-	-
Caustic		8	349	23	184
Q. Broxin		70	308	297	784
Soda Ash		7	88	12	59
Cement	Sks (x94 lb.)	-	7600	810	4040
Fuel	bls	141	4494	972	-
Water	bls	692	40496	2400	-
Pipelax		1	3	-	-
D.D.		0	10	0	0

Active Mud Volumes

Circulation hole 870 bls
tank 430 bls
Stock tank _____ bls
Total 1300 bls

Made during week 250 bls
Total last week - bls
Consumption/losses 270 bls

Remarks

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 22 for week ending ~~2400 hours Saturday~~ 0600 hours Friday, 15th March, 1968

I. WELL STATUS (All depths relate to ~~sub-sea guide base~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 12680 ft.; Operation TRIPPING

II. DRILLING SUMMARY

Progress 610 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Xxxxxx~~ Misc.
			Mechanical	Weather		
104-3/4	3½	47½	9¼	-	-	3

No. of bits used during week 7 ; Total 99

Weight on bit 40,000 ; R.P.M. 70

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6	40	2200	290

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.5 - 9.8	55 - 60	2/8	3.9	1.5	9.7 to 10.0	½

Coring

Core No. 27 12423 - 12433 Recovery 10 feet (100%)

Drill Stem Testing

NIL

Electrical Logging

NIL

Remarks

The 8½" hole was conditioned and drilled ahead without incident to 12680 feet. 9¼ hours were lost repairing the hydromatic break.

Deviation

2¼ degrees at 12188 feet
1½ degrees at 12423 feet

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	70	3685	2731	4289
Bentonite	(do)	164	8937	117	2314
Spersene	Sks (x50 lb.)	0	2193	0	-
XP20	(do)	10	1066	0	-
C.M.C.	(do)	0	132	5	-
L.C.M.	(do)	0	3465	815	1039
H.S.D.	bls	53	1338	NIL	-
Caustic		9	358	8	184
Soda Ash		7	95	5	59
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	153	4647	987	-
Water	bls	900	41396	2757	-

Active Mud Volumes

Circulation	hole	900 bls	Made during week	200 bls
	tank	300 bls	Total last week	1300 bls
Stock	tank	NIL bls	Consumption/losses	100 bls
Total		1200 bls		

~~Remarks~~
Materials (Cont'd.)

Q. Broxin	55	363	122	784
Zeogel	-	1329	135	400
Pipelax	0	2½	½	-
HR4	-	30	8	33
Salinex	0	21	1	20
D.D.	-	10	0	0
Soda Bicarb.	-	34	22	60

Stock en route to Broome

Bentonite	245
XP20	53
L.C.M.	70
Q. Broxin	120
Caustic (drums)	6
Salinex (drums)	8

Remarks
Approximately 120 barrels lost dumping sand, through desander over shale shaker and when testing B.O.P. No loss to formation during drilling.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 23 for week ending ~~XXXXXXXXXXXXXXX~~ 0600 hours Friday, 22nd. March, 19 68

I. WELL STATUS (All depths relate to sub sea guide base.)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 12843 ft.; Operation LOGGING

II. DRILLING SUMMARY

Progress 163 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~Testing~~ Fishing
			Mechanical	~~XXXXXXXX~~ Miscellaneous		
44-3/4	6½	51-1/4		2	21½	42

No. of bits used during week 4 ; Total 103

Weight on bit 35 - 40,000 ; R.P.M. 30 - 80

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
6"	40	2200	290

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
9.7 - 9.8	54 - 63	3/11	3.7 - 4.0	1.5	9.6 to 9.8	½ - 3/4 9 - 10% Oil

Coring

Nil

Drill Stem Testing

Schlumberger formation interval tester Run No. 1 9230 ft.

Electrical Logging

I.E.S. Run No. 7 11,000 - 12842

Sonic/Gamma Ray/Caliper Run No. 7 11,400 - 12832.

Remarks

With drilling rates exceeding 100 ft. per day, drilling was continued beyond the original programmed total depth. However, with the change in lithology at 12690 ft. the daily footage dropped below 50 ft. and preparations to run the final logs were made. While conditioning the hole the collars below the bumper sub were backed off at 8842 ft. and dropped to the bottom of the hole. These were recovered with an overshot with the only equipment damaged being the bit and the junk sub.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	100	3785	2631	4289
Bentonite	(do)	79	9016	108	2314
Spersene	Sks (x50 lb.)	0	2193	0	0
XP20	(do)	0	1066	0	0
C.M.C.	(do)	5	137	0	0
L.C.M.	(do)	0	3465	450	1039
H.S.D.	bls	78	1416	0	0
Caustic	140 lbs.	9	367	8	181
Soda Ash	93 lbs.	3	98	0	59
Soda Bicarb	93 lb.	0	34	0	60
Cement	Sks (x94 lb.)	0	7600	810	4040
Fuel	bls	209	4856	1090	0
Water	bls	857	42253	2200	0
Q. Broxin	50 lb.	56	419	126	784
Zeogel	50 lb.	0	1329	0	400

Active Mud Volumes

Circulation	hole	1000 bls	Made during week	300 bls
	tank	200 bls	Total last week	1200 bls
Stock	tank	0 bls	Consumption/losses	300 bls
Total		1200 bls		

MATERIALS (Cont'd.)

~~Remarks~~

Pipelax	55 gal.	0	2½	½	0
Salinex	55 gal.	0	21	1	20
D.D.	55 gal.	0	10	0	0
HR.4	50 lb.	0	30	8	33

REMARKS The mud stocks en route to Broome last week were returned to the "Investigator". The following materials are now en route to Broome :-

Bentonite	175 sacks
XP.20	53 sacks
Q. Broxin	60 sacks
L.C.M.	435 sacks
Salinex	8 drums
Zeogel	109 sacks
Sodium Bicarb.	14 sacks
Soda Ash	10 sacks.

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 24 for week ending ~~XXXXXXXXXXXX~~ 0600 hours Friday, 29th March, 19 68

I. WELL STATUS (All depths relate to ~~XXXXXXXXXXXXXX~~ rotary table at zero tide).

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; _____ inch casing to _____ ft.

8½ inch hole to 12843 ft.; Operation Cement plugs 7840 - 8300 and 350 - 1050 feet. Well capped and temporarily abandoned.

II. DRILLING SUMMARY

Progress 0 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		Logging	~~XXXXXX~~
			Mechanical	Weather		
0	5½	7½	0	0	52	Abandonment & Demobilization ~~103~~

No. of bits used during week 0 ; Total 103

Weight on bit - ; R.P.M. -

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
-	-	-	-

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
-	-	-	-	-	-	-

Coring

46 sidewall cores were recovered from the intervals 8900 - 9485 and 11910 - 12835 ft.

Drill Stem Testing

Nil

Electrical Logging

~~Remarks~~

Electrical Logging

Epithermal Neutron	Run No. 1	9000 - 12838
Continuous Dipmeter	Run No. 4	10000 - 12840
Formation Density/Gamma Ray	Run No. 4	10000 - 12837
Velocity Survey	-	1400 - 12750

Remarks

The well was logged, plugged and capped. A buoy was attached to the corrosion cap at 1130 hours on 27th March, 1968.

At the end of the week all B.O.C. equipment was being removed from the barge.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)	31	3816	2600	4289
Bentonite	(do)	0	9016	0	2597
Spersene	Sks (x50 lb.)	0	2193	0	0
XP20	(do)	0	1066	0	53
C.M.C.	(do)	0	137	0	0
L.C.M.	(do)	0	3465	0	1724
H.S.D.	bls	0	1416	0	-
Caustic (140 lbs.)		2	369	0	187
Q. Broxin (50 lbs.)		20	439	0	950
Cement	Sks (x94 lb.)	530	8130	280	4040
Fuel	bls	-	4856 *	-	-
Water	bls	-	42253 *	-	-
Soda Ash (93 lb.)		0	98	0	69
Sodium Bicarb (93 lb.)		0	34	0	74

Active Mud Volumes

Circulation hole _____ bls

tank _____ bls

Stock tank _____ bls

Total _____ bls

Made during week _____ bls

Total last week _____ bls

Consumption/losses _____ bls

~~Remarks~~

Materials (Cont'd.)

Zeogel (50 lb.)	0	1329	0	509
Pipelax (55 gls)	0	2½	0	½
Salinex (55 gls)	0	21	0	29
D.D. (55 gls)	0	10	0	0
HR4 (50 lbs.)	6	36	2	33

* as at 22nd. March, 1968

Form A-3

B.O.C. OF AUSTRALIA LIMITED

WEEKLY PROGRESS REPORT

Well ASHMORE REEF WELL No. 1

Report No. 25 & FINAL for week ending ~~xxxxxxxxxxxx~~ 0600 hours Friday, 5th April, 19 68

I. WELL STATUS (All depths relate to ~~xxxxxxxxxxxx~~ rotary table at zero tide)

36 inch hole to 337 ft.; 30 inch casing to 332 ft.

26 inch hole to 1015 ft.; 20 inch casing to 985 ft.

17½ inch hole to 3650 ft.; 13-3/8 inch casing to 3589 ft.

12¼ inch hole to 8175 ft.; 9-5/8 inch casing to 8140 ft.

8½ inch hole to 12843 ft.; Operation -

II. DRILLING SUMMARY

Progress 0 ft.

Time Analysis (hrs.)

Drilling	Circulating	Tripping	Shut Down		~~Logging~~	~~Testing~~
			Mechanical	Weather		
-	-	-	8	-	Unloading and preparing for tow 52	Lifting Anchors 41¼

No. of bits used during week - ; Total

Weight on bit - ; R.P.M. -

Pump Performance

Liner Size	Strokes	Pressure (p.s.i.)	Volume (Gals/min)
-	-	-	-

Mud Properties

Weight (lb/gal)	Viscosity (ccs)	Gel	Water loss (ccs)	Filter Cake (mm)	P.H.	Sand %
-	-	-	-	-	-	-

Coring

NIL

Drill Stem Testing

NIL

Electrical Logging

NIL

Remarks

All Burmah material removed from "Investigator". During anchor lifting 8 hours were lost due to clutch failure on the "Rig Service". "Investigator" released for tow 1115 hours on 2nd. April 1968.

Status of well - temporarily abandoned. Cement plugs 7840 feet to 8300 feet and 360 feet to 1060 feet. Well head fitted with corrosion cap.

III. MATERIALS

Item	Unit	Consumption Weekly	Consumption Cumulative	Stocks on Vessel	Stocks on Shorebase
Barytes	Sks (x100 lb.)			2600	
Bentonite	(do)				
Spersene	Sks (x50 lb.)				
XP20	(do)				
C.M.C.	(do)				
L.C.M.	(do)				
H.S.D.	bls				
Cement	Sks (x94 lb.)				
Fuel	bls				
Water	bls				

Active Mud Volumes

Circulation	hole - bls	Made during week - bls	
	tank - bls	Total last week - bls	
Stock	tank - bls	Consumption/losses - bls	
Total	- bls		

Remarks

2600 sacks of bulk Barytes left on "Investigator".

BIT RECORD

B.O.C. OF AUSTRALIA LTD. Form C-1

BIT RECORD

Well ASHMORE REEF NO. 1 Field

Bit No.	Depth From	Depth To	Size	Make and Type	Footage	Hours Run	Remarks
1	SURFACE	364	17½"	SEC. S4TJ	212	28-3/4	
			26"	HOLE OPENER			
	SURFACE	364			212	28-3/4	
	SURFACE	332			172	15	
	332	1015			683	12	
	DRILLING CEMENT				170	3	
			36"	HOLE OPENER			
	SURFACE	310			158	24½	
	SURFACE	337			177	35-3/4	
2	SURFACE	332	17½"	SEC. ST4J	172	15	
3	337	980	12¼"	SEC. S4J	643	8	
	DRILLED CEMENT				155	1½	
			17½"	HOLE OPENER			
(i)	317	980			643	2½	
	3253	3560			307	18½	
(ii)	1068	3253			2185	35	
	3560	3650			90	3-3/4	
4	1015	1125	12¼	SEC. S6GJ	110	4	
	1125	1152	8-7/16	CHRIS. DIA.	27	1½	CORE NO.1
5	1125	1842	12¼	SEC. S6GJ	717	18	T4B1
6	1842	2895	12¼	SEC. S6GJ	1053	16	T3B4
7	2895	3245	12¼	SEC. S6GJ	350	9½	T1B1
	2286	2310	8-7/16	CHRIS. DIA. C8	24	1	CORE NO.2
	2619	2644			25	1½	NO.3
	2901	2928			27	3	NO.4
	3212	3240			28	3	NO.5
	3245	3270			25	3	NO.6
8	3245	3650	12¼	SEC. S6GJ	405	16½	T2B2
	3622	3645	8-7/16	CHRIS. DIA. C31	23	4¼	CORE NO.7
9	DRILLING CEMENT		12¼	SEC. S6GJ		7½	
	3650	4036			386	12½	T4B3
4RR	4036	4336	12¼	SEC. S6GJ	300(410)	10 (14)	

B.O.C. OF AUSTRALIA LTD.

Form C-1

BIT RECORD

Well ASHMORE REEF WELL No. 1 Field

Bit No.	Depth From	Depth To	Size	Make and Type	Footage	Hours Run	Remarks
	4036	4063	8-7/16"	CHRIS. DIA.C8	27	1-3/4	CORE NO. 8
10	4336	4540	12-1/4	SEC. M4NGJ	204	13	T4B1
	4540	4566	8-7/16"	CHRIS.DIA. C8	26	5½	CORE NO. 9
11	4540	4657	12-1/4	SEC.M4NGJ	117	13	
12	4657	4886	12-1/4	HTC X3A	229	15½	T1B1
13	4886	5020	12-1/4	HTC X3A	134	10	T1B1
	5020	5035	8-7/16	CHRIS. DIA. C8	15	1½	CORE NO. 10
14	5020	5535	12-1/4	HTC X3A	515	22	T1B1
	5535	5553	8-7/16	CHRIS. DIA. C8	18	2½	CORE NO. 11
15	5535	5881	12-1/4	HTC X3A	346	25	T2B1
16	5881	6022	12-1/4	SEC. M4NGJ	141	10-3/4	T1B1
	6022	6042	8-7/16	CHRIS. DIA. C31	22	2-1/4	CORE No. 12
17	6022	6261	12-1/4	SEC. M4NGJ	239	23	T2B1
18	6261	6404	12-1/4	SEC. M4NGJ	143	28-3/4	T2B30 -1/8
19	6404	6520	12-1/4	SEC. M4LGJ	116	21	T2B3
	6520	6533	8-7/16	CHRIS. DIA. C31	13	2-1/2	CORE No. 13
20	6520	6641	12-1/4	SEC. M4LGJ	121	18	T2B2
21	6641	6730	12-1/4	HTC X3A	89	5	T1B1
	6730	6748	8-7/16	CHRIS. DIA.	18	5	CORE No. 14
22	6730	6903	12-1/4	SEC. M4NGJ	173	17-1/4	T1B3
23	6903	7000	12-1/4	SEC. M4NGJ	97	15	T1B2
24	7000	7124	12-1/4	SEC. M4LGJ	124	18	T3B3
25	7124	7234	12-1/4	SEC. M4LGJ	110	14½	T1B2
26	7234	7252	12-1/4	SEC. S6GJ	18	4½	T1B1
	7252	7267	8-7/16	CHRIS. C8	15	3-1/4	CORE No. 15
27	7252	7376	12-1/4	SEC. M4NGJ	124	16¼	T1B2
28	7376	7575	12-1/4	SEC. M4NGJ	199	22¼	T1B2
	7575	7590	8-7/16	CHRIS. C31	15	2	CORE No. 16
29	7575	7706	12-1/4	SEC. M4NGJ	116	16	T3B1
30	7706	7808	12-1/4	SEC. M4NGJ	102	18	T1B2
31	7808	7899	12-1/4	SEC. S6GJ	91	17½	T2B2
32	7899	7944	12-1/4	SEC. S6TJ	45	8	BT1B1

B.O.C. OF AUSTRALIA LTD. Form C-1

BIT RECORD

Well ASHMORE REEF WELL No. 1 Field

Bit No.	Depth From	Depth To	Size	Make and Type	Footage	Hours Run	Remarks
33	7944	8016	12¼	SEC M4NGJ	72	14	BT1B2
	8016	8023	8-7/16	CHR C8	7	1-3/4	Core No. 17
34	8016	8175	12¼	HTC OWVJ	159	15¼	
35	8175	8281	8½	HTC X1GJ	106	6	BT1 B1
	8281	8290	8-7/16	CHRIS C8	9	2½	Core No. 18
36	8281	8477	8½	HTC XD7	196	20½	T3 B2
37	8477	8671	8½	HTC XD7	194	18	T3 B2
38	8671	8835	8½	HTC XD7	164	8½	T2 B1
	8835	8844	8½	CHRIS C8	9	2½	Core No. 19
39	8835	9091	8½	HTC XV	256	18¼	T3 B2
40	9091	9206	8½	HTC XV	115	13¼	T4 B2
41	9206	9295	8½	HTC XV	89	9½	T3 B1
	9295	9317	8-7/16	CHRIS C8	22	3-3/4	Core No. 20
42	9295	9430	8½	HTC XV	135	16	T4 B2 - 0 1/16
43	9430	9565	8½	HTC XD7	135	16½	T6 B2
44	9565	9673	8½	SEC M4LGJ	108	11½	T4 B2
45	9673	9741	8½	SEC M4LGJ	68	11½	T6 B2
	9741	9755	8-7/16	CHRIS C8	14	3¼	Core No. 21
46	9741	9820	8½	REED Y4HGJ	79	12¼	T2 B3
47	9820	9924	8½	HTC X1G	104	12	T2 B3
48	9924	10048	12	HTC X1G	124	12	T3 B2
	10048	10063	8-7/16	CHRIS C8	15	4	Core No. 22
49	10048	10166	8½	HTC X1G	118	13½	01 Two Cones in Hole
50	10125	10150	8½	HTC W7R	25	2½	Reaming (Jammed)
51	10130	10166	8½	HTC W7R	36	3½	Reaming
52	10166	10197	8½	REED YHWGJ	31	8½	T2 B2
53	10197	10249	9½	SEC M4LGJ	52	8½	T2 B1
54	10249	10284	8½	SEC M4LGJ	35	4	Pressure Drop
55	10284	10354	8½	SEC M4LGJ	70	10	T3 B1
56	10354	10417	8½	SEC M4LGJ	63	8½	T2 B2
57	10417	10514	8½	SEC M4LGJ	97	9½	T2 B2
58	10514	10575	8½	SEC M4LGJ	61	7-3/4	T3 B2

B.O.C. OF AUSTRALIA LTD.

Form C-1

BIT RECORD

Well ASHMORE REEF WELL NO. 1 Field

Bit No.	Depth From	Depth To	Size	Make and Type	Footage	Hours Run	Remarks
	10575	10583	8-7/16	CHRIS. C8	8	3	Core No. 23
59	10583	10644	8½	HTC ODV	61	9-3/4	T4 B6
60	10644	10728	8½	HTC ODV	84	11	T4 B6
61	10728	10803	8½	HTC ODV	75	9½	T8 B4 0-1/16
62	10803	10860	8½	SEC. M4NGJ	57	8	T8 B8 0-1¼
63	10826	10860	8½	SEC. H7UGJ	Reaming 37	12¼	BT2 B2
64	10860	10907	8½	SEC. H7UGJ	46	8½	T4 B2
65	10907	10950	8½	SEC. H7UGJ	43	7	T2 B2
66	10950	11024	8½	SEC. H7UGJ	74	10½	T2 B6
	11024	11035	8-7/16	CHRIS. C8	11	5½	Core No. 24
67	11024	11079	8½	SEC. H7UGJ	55	7½	T2 B2
68	11079	11188	8-7/16	CHRIS. D27R	109	37	Matrix unworn No diamondsmissing
69	11188	11260	8½	HTC XDR	72	11½	T7 B1
70	11260	11312	8½	HTC XV	52	8	T7 B1
71	11312	11369	8½	HTC XDR	57	9	T6 B1
72	11369	11406	8½	HTC XDR	37	5	T7 B1
73	11406	11465	8½	HTC XDR	59	10½	T7 B1
74	11465	11542	8½	HTC XDR	77	12½	T6 B1 0-1/16
75	11542	11606	8½	HTC XDR	64	11½	T2 B1
76	11606	11644	8½	HTC XV	38	8	T8 B1 0-1
77	11644	11716	8½	HTC XDR	72	8½	T6 B1
	11716	11724	8-7/16	CHRIS. C8	8	4	Core No. 25
78	11724	11787	8½	HTC XDR	63	7¼	T8 B1 0-1/16
79	11787	11828	8½	HTC XDR	41	7½	T7 B4 0½
80	11828	11860	8½	HTC XDR	32	8	T6 B4
81	11828	11860	8½	SEC. H7UGJ	46	6¼	T8 B7 0-½
82	11906	11937	8½	REED YC46J	31	5	T1 B1
68	11937	11954	8-7/16	CHRIS. D27R	17	11	Groove in bit Junk in hole ?
83	11954	12007	8½	HTC X55R	53	14½	T1 B1
84	12007	12030	8½	REED YC4GJ	23	16½	T1 B1
85	12030	12060	8½	HTC XDR	30	7	T1 B1
	12060	12070	8-7/16	CHRIS. C8	10	6	Core No. 26

B.O.C. OF AUSTRALIA LTD.

Form C-1

BIT RECORD

Well ASHMORE REEF WELL No. 1 Field

Bit No.	Depth From	Depth To	Size	Make and Type	Footage	Hours Run	Remarks
86	12060	12060	8½	HTC XDR	-	-	STUCK IN HOLE
87	12060	12188	8½	HTC XDR	118	16	$T_6B_5^0$ 1/16"
88	12188	12295	8½	HTC XDR	107	16	T_2B_1
89	12295	12423	8½	HTC XDR	128	20¼	T_2B_2
	12423	12423	8-7/16	CHRIS. C8	10	6	Core No. 27
90	12423	12555	8½	HTC XDR	132	20¼	T_2B_2
91	12555	12680	8½	HTC XDR	125	20	T_5B_1
92	12680	12743	8½	HTC XDR	63	13¼	T_6 No bearing wear
93	12743	12785	8½	HTC XDR	42	9	T_7B_1
94	12785	12807	8½	HTC XDR	22	6½	T_5B_1
95	12807	12843	8½	HTC RG7 XJ	36	14	CONES SMASHED OFF.

DAILY MUD RECORD

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1. AREA

MUD COMPANY MAGCOBAR SERVICE ENGINEER A. O'DELL

OCTOBER, 1967

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
16	177	Water with slugs of mud.							194		3			
17	287	"	"	"	"				39		2			
18	364	"	"	"	"				25		2			
19	242	"	"	"	"				12					
20	332	"	"	"	"									
21	332	"	"	"	"				42		2			55
22	337	"	"	"	"				163		15			109
23	337	"	"	"	"									
24	350	"	"	"	"				66		2			8
25	493	8.7	45						130					79
26	980	Water with slugs of mud							48		2			39
27	980	"	"	"	"				24					20
28	1015	"	"	"	"				25					
29	1015	"	"	"	"				167		8			53
30	1015	"	"	"	"				614		9			80
31	1015	"	"	"	"									
					G	H	I	J						
October SUB-TOTAL					15	2	16	6	1549	0	45	0	0	443
CUMULATIVE TOTAL					15	2	16	6	1549	0	45	0	0	443

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs-) C CAUSTIC SODA (100 lbs.) D DIESEL (Bls)

E ZEOGEL (50 lbs) F LCM (Sacks) G. CMC (50 lbs) H. SODA ASH (93 lbs.)

I. SODIUM BICARB (93 lbs.) J LIME (94 lbs.)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1. AREA

MUD COMPANY MAGCOBAR/BAROID SERVICE ENGINEER A. O'DELL

NOVEMBER, 1967

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
1	1015	9.2	43	4/5	9.2	1.5	10.5	1.0	95	120	3			
5	1038	9.2	43	2/6	10.6	1.5	11.0	1.0	152	39	3			
6	1304	9.2	44	2/6	10.4	1.5	10.5	1.0	230	42	3			200
7	1587	9.2	60	2/6	13.6	1.5	9.5	1.0	347	25	8			100
8	2373	9.4	45	4/8	15.0	2.2	10.5	1.0	469	9	4			295
9	2705	9.2	60	4/8	38.0	2.2	10.5	1.0	465	35	16		50	157
10	3030	9.3	64	5/9	38.6	2.2	9.5	1.0	62		9		371	127
11	3258	9.3	80	6/16	44.8	2.2	9.0	1.0					96	
12	3520	9.2	44	0/6	17.5	1.5	10.5	0.5		40	8		38	
13	3650	9.3	57	2/8	13.8	2.2	9.5	0.5	50	55	7			
14	Opening hole	9.3	57	0/3	13.8	2.0	9.5	0.5	20	80	4			
15	" "	9.1	34	0/6	36.6	2.2	8.5	0.5	162	30	15		100	
16	" "	9.1	45	3/6	42.0	2.2	9.5	1.0	238	15	12		210	182
17	" "	9.4	55	2/5	12.2	1.5	9.0	1.0	156	124	17			27
18	" "	9.9	43	2/5	8.4	1.5	9.5	1.5	60	150	15	130		
19	" "	9.7	51	1/4	7.6	1.5	9.5	1.0	50	66	24	54		
20	" "	9.9	53	2/5	8.0	1.5	9.5	1.0	72		3			
21	" "	9.8	52	2/5	9.2	1.5	10.0	1.0	60	20	3			
22	" "	9.7	76	3/12	7.8	1.5	10.5	1.0	74	10	2			
26	3700	9.8	44	0/7	5.4	1.5	11.0	1.0		222	4	33		
27	4063	9.9	48	0/7	4.8	1.5	10.5	1.0		115		45		
SUB-TOTAL									2762	1197	160	262	865	1088
TOTAL														

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (100 lbs.) D DIESEL (bls.)

E ZEOGEL (50 lbs.) F L.C.M. (sacks)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1. AREA

MUD COMPANY BAROID SERVICE ENGINEER D. MARTIN.

NOVEMBER, 1967

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
C.F. 28	4063	9.9	48	0/7	4.8	1.5	10.5	1.0	2762	1197 40	160	262	865	1088
30	4337	10.0	44	0/2	5.8	1.5	10.5	0.7	50	60				
			G	H	I	J	K	L						
November SUB-TOTAL			300	34	10	10	39	9	2812	1297	160	262	865	1088
Cumulative TOTAL			300	49	12	26	45	9	4361	1297	205	262	865	1531

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (100 lbs) D DIESEL (Bls)

E ZEOGEL (50 lbs.) F L.C.M. (Sacks) G. BARYTES (100 lbs.) H CMC (50 lbs.)

I SODA ASH (93 lbs.) J SODIUM BICARB (93 lbs.) K LIME (94 lbs) L EMULSIFIER (55 gals.)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1 AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS-LOMBE.

December 1967

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
1	4512	10.0	43	0/2	12.0	2.2	10.0	0.8	158	60	4			50
2	4560	10.0	45	1/5	4.2	1.5	9.5	1.0	224	90	2	28		235
3	4608	9.9	48	1/6	4.6	1.5	10.5	1.0	234	45		33		363
4	4711	9.8	43	1/3	5.5	1.5	9.0	1.0	394	70	3	20		221
5	4974	9.7	44	1/4	5.6	1.5	9.0	1.0	352	58	6	46		175
6	5120	9.5	46	1/3	4.8	1.5	9.0	1.0	212	50	8			20
7	5440	9.5	46	2/6	6.2	1.5	9.0	0.8	130	90	6			100
8	5553	9.8	45	2/6	6.2	1.5	9.0	0.8			8	14		40
9	5820	10.0	44	1/5	4.2	1.5	10.5	1.0	167	125	10	15		
10	5995	10.0	45	1/5	4.2	1.5	10.5	1.0	51	53	5			40
11	6042	10.0	44	1/5	4.2	1.5	10.5	1.0	65	20	3			
12	6244	10.0	45	1/6	4.4	1.5	10.0	1.0	193	30	3	10		60
13	6337	9.8	47	1/7	4.4	1.5	10.5	1.5	57	60	2			15
14	6404	9.7	45	0/5	4.0	1.5	9.5	1.5		60	3	16		7
15	6515	9.7	47	0/5	3.6	1.5	10.5	0.7		60	2	20		
16	6548	9.6	46	0/4	4.2	1.5	9.7	0.5	45		3			
17	6675	9.6	45	0/5	4.2	1.5	9.5	0.5	120		2	30	14	54
18	6748	9.6	52	0/4	4.4	1.5	9.3	0.25		25	2			
19	6903	9.8	51	0/6	4.2	1.5	9.5	0.25		25	4			
20	7014	10.1	48	0/6	4.0	1.5	9.3	Tr		15	2	20		
21	7140	10.1	51	0/4	4.0	1.5	9.5	0.2		15	2			
SUB-TOTAL									2402	951	80	252	14	1380
TOTAL														

A Bentonite (100lb) B Lignosulphonate (50lb) C Caustic Soda (140lb) D Diesel (bl)

E Zeogel (50lb) F LCM (sack)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1. AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS-LOMBE

DECEMBER, 1967

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
CF									~~2402~~	~~951~~	~~80~~	~~252~~	~~14~~	~~1380~~
22	7236	9.7	44	0/4	7.5	1.5	8.4	0.25	25	15	2			10
23	7270	9.6	51	0/4	5.6	1.5	9.0	Tr.	63		4	50	167	64
24	7397	9.7	43	0/5	4.5	1.5	9.5	Tr.		35	3		147	22
25	7575	9.7	44	0/5	4.6	1.5	9.5	Tr.	155	70	7	24	124	170
26	7627	9.7	48	2/8	4.4	1.5	9.4	Tr.	175	80	8			40
27	7730	9.7	48	0/5	4.6	1.5	9.2	Tr.	130	20	2	48		118
28	7825	9.8	60	3/9	4.5	1.5	9.5	0.1	142	46	3	24	12	130
29	7902	9.6	90	4/14	3.4	1.5	9.2	Tr.	170	58	2	24		
30	7944	9.6	74	2/6	4.5	1.5	9.0	Tr.		105				
31	7980	9.7	57	2/7	4.5	1.5	9.5	Tr						
			G	H	I	J	K	L						
December SUB-TOTAL			1425	42	50	0	0	16-1/2	3262	1380	111	422	464	1934
Cumulative TOTAL			1725	91	62	26	45	25½	7623	2677	257*	684	1329	3465

A BENTONITE (100 lbs) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (140 lbs.) D DIESEL (bls.)

E ZEOGEL (50 lbs.) F L.C.M. (sacks) G. BARYTES (100 lbs) H. CMC (50 lbs.)

I. SODA ASH (93 lb.s) J SODIUM BICARB (93 lbs) K LIME (93 lbs) L EMULSIFIER (55 gals)

* Includes 205 x 100 lb drums used to end of November, expressed as 140 lb units.

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL: ASHMORE REEF NO. 1. AREA:

MUD COMPANY: BAROID SERVICE ENGINEER: W. EVANS-LOMBE

JANUARY, 1968

		Properties							Additives					
Date	Depth 6.00 AM	Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	A	B	C	D	E	F
1	8023	9.7	70	3/9	4.5	1.5	9.2	Tr.		15				
2	8175	9.7	64	2/6	4.4	1.5	9.3	Tr.	55		4	36	2	
4	8175	9.7	57	3/9	4.5	1.5	9.2	Tr.			2			
5	8175								80 in cement)					
9	8281	9.7	43	2/6	6.4	1.5	10.8	Tr.						
10	8336	9.7	45	0/6	4.5	1.5	10.7	Tr.	45				5	
11	8490	9.8	48	0/5	4.5	1.5	10.5	Tr.		35		24		
12	8700	9.7	48	0/6	4.5	1.5	10.1	Tr.	30	15				
13	8844	9.8	47	0/5	4.5	1.5	10.1	Tr.		18	1			
14	9091	9.8	45	1/5	4.8	1.5	10.0	0.7		27	1			
15	9227	9.8	45	0/4	4.8	1.5	10.0	0.5		27	4	24		
16	9317	9.8	44	1/4	4.4	1.5	10.1	0.7		27	4	23		
17	9430	9.9	46	0/5	4.5	1.5	10.0	0.7	20	20	2	24		
18	9565	9.8	44	0/5	4.8	1.5	9.5	0.7	20	30	2	24		
19	9690	9.8	45	1/5	4.2	1.5	10.0	0.7	30		2	29		
20	9755	9.8	45	1/5	4.0	1.5	10.0	0.5	20	15	4			
21	9789	9.8	44	1/5	4.0	1.5	10.0	0.5	20	15	2	29		
25	9820	9.9	48	0/6	4.0	1.5	9.3	Tr.			5			
26	9924	9.7	46	0/6	4.6	1.5	9.9	0.5	194					10
27	10048	9.7	49	0/5	4.5	1.5	9.7	0.5		60	3			2
28	10133	9.7	50	0/4	4.4	1.5	9.5	0.5	16					4
SUB-TOTAL									530	304	36	213	7	16
TOTAL														

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (140 lbs.) D DIESEL

E CMC (50 lbs) F SODA ASH (93 lbs.)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1 AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS-LOMBE

January 1968

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
C.F.									530	304	36	213	7	16
29	10166	9.7	50	0/5	4.5	1.5	9.6	0.25		60	3	76		
30	10166	9.6	46	0/6	2.8	1.5	9.5	Tr				55		
		G	H	I	J	K	L	M						
January SUB-TOTAL		8	1-1/2	655	0	0	0	2	530	364	39	244	7	16
Cumulative TOTAL		34	27	2380	1329	3465	45	2	8153	3041	296	928	98	78

A Bentonite (100lb) B Lignosulphonate (50lb) C Caustic Soda (140lb) D Diesel (bl)

E CMC (50lb) F Soda Ash (93lb) G Sodium Bicarb (93lb) H Emulsifier (55gals)

I Barytes (100lb) J Zeogel (50lb) K LCM (Sacks) L Lime (93lb)

M Pipelax (55gals)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1. AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS- LOMBE

February 1968

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
1	10166	9.7	55	2/6	3.2	1.5	9.2	0.5			1			
3	10217	9.7	55	2/6	3.8	1.5	9.8	0.25	60		3	43	100	
4	10284	9.7	53	2/6	4.0	1.5	9.6	0.25		45	3		140	
5	10367	9.7	49	2/6	3.8	1.5	9.6	0.25	26	25				
6	10509	9.7	55	2/8	3.8	1.5	9.8	0.7	65	15	2			
7	10575	9.7	53	1/6	3.7	1.5	9.7	0.7			1			
8	10610	9.7	53	2/6	3.7	1.5	9.8	0.7						
9	10728	9.7	54	1/5	3.8	1.5	9.8	0.7			2	14	140	
10	10803	9.7	52	2/6	3.9	1.5	9.7	0.5		15				
11	10860	9.7	55	3/9	3.8	1.5	9.8	0.75	10	7				
12	10906	9.8	56	2/6	3.6	1.5	9.9	0.5	53	30	3		145	
13	10954	9.8	53	2/8	4.0	1.5	9.5	1.0		31				
14	11029	9.7	54	2/8	4.0	1.5	9.5	0.5		15	3			
15	11079	9.7	57	2/8	3.9	1.5	9.8	0.5	30		3	29	20	
16	11135	9.6	58	2/8	4.0	1.5	9.7	0.5	120	1	4		60	2
17	11188	9.7	53	2/6	3.9	1.5	10.0	0.5	15	23	4		200	
18	11260	9.7	57	2/8	4.0	1.5	9.8	0.75	5		2	29		
19	11319	9.8	56	2/6	3.9	1.5	9.7	0.5	10	20	2			
20	11406	9.8	57	2/8	4.0	1.5	9.5	1.0	8	30	2	29		
21	11465	9.7	53		4.0	1.5	9.5	0.75	20	20	1			
22	11465	9.7	56		4.0	1.5	9.8	0.75	30		4		100	3
SUB-TOTAL									452	277	40	144	905	5
TOTAL														

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (140 lbs.) D DIESEL (Bls.)

E BARYTES (100 lbs.) F CMC (50 lbs.)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF NO. 1. AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS-LOMBE

February 1968

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
C.F. 23	11542	9.7	57	2/8	4.0	1.5	9.7	3/4	452 20	277 30	40	144	905	5
24	11606	9.7	56	2.8	4.0	1.5	9.7	3/4	35	29		14		2
25	11644	9.7	52	1/7	4.0	1.5	9.5	1/2	22	15				1
26	11716	9.7	55	2/6	3.8	1.5	9.5	3/4	30	15	1		100	2
27	11724	9.7	55	2/7	4.0	1.5	9.7	3/4	5	7		11	70	
28	11787	9.6	52	1/6	4.0	1.5	9.8	3/4	8	16	1	9		4
29	11856	9.5	53	2/7	4.0	1.5	9.6	3/4	5	10				
CUM C.F.		G	H	I	J									
Feb SUB-TOTAL		3	1	0	4				577	399	42	178	1075	14
Cumul. TOTAL		3465	79	34	31				8730	3440	338	1106	3455	112

A BENTONITE (100 lbs.) B LIGNOSUPHONATE (50 lbs.) C CAUSTIC SODA (140 lbs.) D ~~DIESEL~~ (Bls.)

E BARYTES (100lbs) F CMC (50 lbs) G LCM SACKS H SODA ASH (93 lbs.)

I. SODA BICARB. (93 lbs.) J. EMULSIFIED (55 gals.)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF No. 1 AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS-LOMBE, D. MARTIN

MARCH, 1968

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
1	11906	9.5	58	2/6	4.0	1.5	9.8	3/4		12	2			1
2	11951	9.7	53	2/7	4.0	1.5	9.5	3/4		15	1		50	2
3	12007	9.7	58	2/6	4.2	.75	9.6	3/4	18	39	3			7
4	12027	9.7	53	2/7	4.0	1.5	9.8	3/4		27			60	7
5	12060	9.7	54	2/7	3.8	1.5	9.8	1/2	15	12	1	29		1
6	12070	9.7	54	2/7	3.8	1.5	9.7	1/2		12				1
7	12070	9.7	53	2/6	3.8	1.5	9.9	1/2				31		
8	12070	9.6	50	2/5	3.8	1.5	10.0	1/2	10		2	20		1
9	12154	9.5	56	2/8	3.9	1.5	10.0	1/2	64	3	2		40	
10	12188	9.6	60	2/8	3.9	1.5	10.0	1/2	10	22	3			
11	12295	9.7	56	2/8	3.9	1.5	9.8	1/2	10	20	2			
12	12523	9.8	60	2/8	4.0	1.5	9.8	1/2	10	10	1			
13	12433	9.8	61	2/6	3.9	1.5	9.7	1/2	7	10			30	
14	12555	9.7	55	2/6	3.8	1.5	9.8	1/2	30		1	41		
15	12680	9.8	55	2/7	3.9	1.5	9.7	3/4	33			12		
16	12743	9.8	58	2/8	4.0	1.5	9.8	3/4	10	10	2		42	
17	12875	9.8	54	2/7	3.8	1.5	9.7	1/2	4	10	1			
18	12825	9.7	56	2/7	4.0	1.5	9.8	3/4						
19	12843	9.7	60	2/8	3.9	1.5	9.8	1/2		6				5
20	12843	9.7	59	2/7	3.7	1.5	9.7	1/2		10	2		14	
21	12843	9.7	59	2/5	3.7	1.5	9.7	1/2	50	20	4	10	100	
SUB-TOTAL									271	238	28	153	336	25
TOTAL														

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (140 lbs.) D DIESEL (bls.)

E BARYTES (100 lbs.) F C.M.C. (50 lbs.)

Signed .....

Form C-2

B.O.C. OF AUSTRALIA LTD.

DRILLING MUD RECORD

WELL ASHMORE REEF No. 1 AREA

MUD COMPANY BAROID SERVICE ENGINEER W. EVANS-LOMBE

MARCH, 1968

Date	Depth 6.00 AM	Properties: Weight (lbs/gal)	Visc. (Secs.)	Gel.	W/L (ccs)	Filter Cake (mm.)	P.H.	Sand %	Additives: A	B	C	D	E	F
22	12843		LOGGING											
23	12843													
24	12843	9.8	75		5.5	1.5	9.5	1/4		10	2		31	
25	12843									10				
26	12843		SETTING ABANDONMENT PLUGS											
27	12843													
28	12843			WELL CAPPED										
29	12843													
		G	H	I	J	K	L	M						
SUB-TOTAL		0	15	0	0	0	0	3/4	271	258	30	153	367	25
TOTAL		34	94	1329	3468	45	31	2-3/4	9001	3698	368	1259	3822	137

A BENTONITE (100 lbs.) B LIGNOSULPHONATE (50 lbs.) C CAUSTIC SODA (140 lbs.) D ~~DIESEL~~ (bls.)

E BARYTES (100 lbs.) F CMC (50 lbs.) G SODA BICARBONATE (93 lbs.) H. SODA ASH (93 lbs.)

I. ZEOGEL (50 lbs.) J. LCM Sacks K LIME (93 lbs.) L. EMULSIFIER (55 gal.)

M. PIPELAX 55 gal.

Signed .....

CASING AND TUBULAR REPORT

B.O.C. OF AUSTRALIA LTD.

Form B - 1

CASING INFORMATION

Surface Casing
Intermediate Casing O.D. 30"
Production Casing
Liner

Well ASHMORE REEF WELL No. 1 Location ASHMORE REEF Date 22nd. Oc tober, 1967

Joints on Location	Feet on Location	Casing Weight	Grade	Range	Thread	Threads & Couplings	Make	Joints Run	Depth Landed	Feet Run in Well
4	217.90	319	B		VETCO	SQUNCH		3	332	173.15

Shoe: Make BAKER Type FLOAT SHOE Length 1.50

Collars: Make Type Length

Landing Joint (when used) Length 167.35

Overall Length of Casing String 174.65

Feet up from K.B. (Subtract) 10.00

Setting Depth: 332 By Driller By Tally 332.00

Shoe Joint: Overall (Subtract)

Float Collar Landed: By Driller By Tally

CENTRALIZERS: NIL

Make

Number

Positions

SCRATCHERS: NIL

Make

Number

Positions

No. of Joints Welded -

Remarks CASING HELD UP APPROX. 40 FT. FROM BOTTOM CIRCULATED CASING WITH SEA WATER DOWN TO BOTTOM.

Operator's Representative A. FOORD

B.O.C. OF AUSTRALIA LTD.

CASING RUNNING AND CEMENTING REPORT

Form B - 2

Surface Casing
Intermediate Casing O.D. 30
Production Casing
Liner

GENERAL

Well No. 1 Location ASHMORE REEF Date 22nd. OCTOBER, 1967

K.B./G.S. Elevation _____ K.B./G.S. Csg. Flange _____ Total Depth (Driller) 337' KB

Hole Size	36"			Casing in Hole	-		
Depth	337			Depth Set	332' KB		

Mud: Type ~~BENTONITE~~ FRESH WATER Wt. 8.7 (SLUGS) Visc. 45 - 60 W.L. _____

B.O.P.'s NIL

RUNNING

Power Tongs _____ Torque: Max. _____ Nom. _____ Min. _____

Time Pipe Started 24.00 (21/10/67) Time on Bottom 1300 (22/10/67) Time Circ. 3½ hours.

Fill-up Points - Btm. by Casing 332' Ft. up from K.B. _____

Remarks CASING HELD UP APPROXIMATELY 40 FT. FROM BOTTOM CIRCULATED CASING WITH SEA WATER DOWN TO BOTTOM

CEMENTING

Cement Co. HALLIBURTON Operator J. GLORIOD Time on Location _____

Types & Quantities of Cement A total of 1700 sacks construction cement (3 sacks nut plug) with 400 of these pumped down annulus.

Water ahead 10 Bbls. Mix Times: Start 1407 Finish 1504 Slurry Wt. 15.6

Calc. Disp. 81 Bbls. Est. Disp. time - Mins. Start 1504 Finish 1520

Max. Pumping Press. _____ Bump. Press. _____ Bumped by _____ No. times bump. _____

Cement Returns: Yes/No. Remarks No cement returns to sea bed cement within two feet of surface after cementing down annulus.

LANDING

Time Landed 1300 Date 22nd. October, 1967 Init. Wt. of Cem. String (Less Blks.) 54,000

Wt. Landed in Slips _____ Make of Bowl _____ Nom. Size _____ Series _____

Slip and Seal Assembly PERMANENT GUIDE BASE IS 5 FT. ABOVE SEA FLOOR.

Remarks ~~ROTARY TO SEA BED 160 FEET.~~

A. FOORD

Operator's Representative

Form C - 4

B.O.C. OF AUSTRALIA LTD.

CASING AND TUBING TALLY

Page 1 of 1 Joint No. 1 to 4 Date 22nd. October, 19 67

WELL: ASHMORE REEF Size 30" Weight 319 Grade B Range Condition

Manufacturer DAIKEI KORAN Threads: On Off No. of Threads Coupling: Short Long

No. of Joints: Received at Well 5 Used 4 Disposition of Joints not used BROOME

Length of Cut-Off Joint above casing bowl Disposition

Joint No.	Length of Joint		Joint No.	Length of Joint		Joint No.	Length of Joint		Joint No.	Length of Joint	
01	42	25	31			61			91		
02	43	28	32			62			92		
03	43	55	33			63			93		
04	45	57	34			64			94		
05			35			65			95		
06			36			66			96		
07			37			67			97		
08			38			68			98		
09			39			69			99		
10			40			70			00		
TOTAL	174	65	TOTAL			TOTAL			TOTAL		

11			41			71		
12			42			72		
13			43			73		
14			44			74		
15			45			75		
16			46			76		
17			47			77		
18			48			78		
19			49			79		
20			50			80		
TOTAL			TOTAL			TOTAL		

21			51			81		
22			52			82		
23			53			83		
24			54			84		
25			55			85		
26			56			86		
27			57			87		
28			58			88		
29			59			89		
30			60			90		
TOTAL			TOTAL			TOTAL		

TALLY SUMMARY

Group No. Ending	Length (Forward)	
10		
20		
30		
40		
50		
60		
70		
80		
90		
00		
TOTAL		

Tally By: A. FOORD

Checked By:

(Note: Include casing shoe and collar in first joint)

REMARKS:

Operator's Representative A. FOORD

Form B - 1

B.O.C. OF AUSTRALIA LTD.

CASING INFORMATION

Surface Casing
Intermediate Casing O.D. 20"
Production Casing
Liner

Well ASHMORE REEF Location No. 1 Date 29th October, 1967

Joints on Location	Feet on Location	Casing Weight	Grade	Range	Thread	Threads & Couplings	Make	Joints Run	Depth Landed	Feet Run in Well
20	863.32	94	H-40	-	VETCO	SQUNCH		19	985	819.56
							20" CASING HANGER			7.00

Shoe: Make BAKER Type FLOAT SHOE Length 2.00

Collars: Make BAKER Type FLOAT COLLAR Length 2.00

Landing Joint (when used) Length (4½" Drill Pipe) 185.00

Overall Length of Casing String

Feet up from K.B. (Subtract) 30.00

Setting Depth: 985 By Driller — By Tally 985.56

Shoe Joint: Overall — (Subtract) 84.00

Float Collar Landed: 901 By Driller — By Tally 901.56

CENTRALIZERS: NIL

Make

Number

Positions

SCRATCHERS: NIL

Make

Number

Positions

No. of Joints Welded

Remarks

Operator's Representative A. FOORD

B.O.C. OF AUSTRALIA LTD.

CASING RUNNING AND CEMENTING REPORT

Form B - 2

Surface Casing
Intermediate Casing O.D. 20"
Production Casing
Liner

GENERAL

Well ASHMORE REEF Location No. 1 Date 30TH OCTOBER, 1967

K.B./G.S. Elevation 40 ft. AIMS K.B./G.S. Csg. Flange _____ Total Depth (Driller) 1015

Hole Size	36"	26"		Casing in Hole	30"		
Depth	337'	1015'		Depth Set	332'		

Mud: Type BENTONITE (SALT WATER) Wt. 9.0 Visc. 80 W.L. -

B.O.P.'s NIL

RUNNING

Power Tongs _____ Torque: Max. _____ Nom. _____ Min. _____

Time Pipe Started 1800 : 29/10/67 Time on Bottom 0030 : 30-11-67 Time Circ. 30 min.

Fill-up Points Every third joint Btm. by Casing _____ Ft. up from K.B. 985

Remarks Casing worked down without circulating from 915 - 985

CEMENTING

Cement Co. HALLIBURTON Operator J. GLORIO Time on Location RESIDENT

Types & Quantities of Cement 1400 sacks construction cement.

Water ahead 10 Bbls. Mix Times: Start 0115 Finish 0210 Slurry Wt. 15 lb./gal

Calc. Disp. 241 Bbls. Est. Disp. time 45 Mins. Start 0210 Finish 0300

Max. Pumping Press. 425 Bump. Press. _____ Bumped by _____ No. times bump. _____

Cement Returns: Yes/No. Remarks GOOD RETURNS WHILE PUMPING CEMENT AND FIRST 90 BLS. DISPLACEMENT WATER. RETURNS PRACTICALLY ZERO PRIOR TO COMPLETION OF DISPLACEMENT.

LANDING

Time Landed 0030 (30/10) Date 30TH OCTOBER, 1967 Init. Wt. of Cem. String (Less Blks.) _____

Wt. Landed in Slips 48,000 Make of Bowl _____ Nom. Size _____ Series _____

Slip and Seal Assembly NIL.

Remarks CEMENT RETURNS INSIDE 30 INCH CASING SHOE.

A. FOORD.

Operator's Representative

B.O.C. OF AUSTRALIA LTD.

CASING AND TUBING TALLY

Form C - 4

Page 1 of 1 Joint No. 1 to 19 Date 29th October, 1967

WELL: ASHMORE REEF No. 1 Size 20" Weight 94 Grade H40 Range Condition

Manufacturer Threads: On Off No. of Threads Coupling: Short Long

No. of Joints: Received at Well 20 Used 19 Disposition of Joints not used

Length of Cut-Off Joint above casing bowl Disposition

Joint No.	Length of Joint	Joint No.	Length of Joint	Joint No.	Length of Joint	Joint No.	Length of Joint
01	45 80	31		61		91	
02	40 85	32		62		92	
03	42 80	33		63		93	
04	44 18	34		64		94	
05	44 40	35		65		95	
06	41 60	36		66		96	
07	43 00	37		67		97	
08	43 38	38		68		98	
09	43 50	39		69		99	
10	43 38	40		70		00	
TOTAL	432 89	TOTAL		TOTAL		TOTAL	
11	43 40	41		71			
12	43 38	42		72			
13	42 50	43		73			
14	41 95	44		74			
15	44 73	45		75			
16	42 65	46		76			
17	43 28	47		77			
18	44 15	48		78			
19	44 63	49		79			
20	HANGER 7 00	50		80			
TOTAL	397 67	TOTAL		TOTAL			
21		51		81			
22		52		82			
23		53		83			
24		54		84			
25		55		85			
26		56		86			
27		57		87			
28		58		88			
29		59		89			
30		60		90			
TOTAL		TOTAL		TOTAL			

TALLY SUMMARY

Group No. Ending	Length (Forward)
10	432 89
20	397 67
30	
40	
50	
60	
70	
80	
90	
00	
TOTAL	830 56

Tally By: A. FOORD

Checked By:

(Note: Include casing shoe and collar in first joint)

REMARKS:

Operator's Representative A. FOORD

B.O.C. OF AUSTRALIA LTD.

CASING INFORMATION

Form B - 1

Surface Casing
Intermediate Casing O.D. 13-3/8
Production Casing
Liner

Well ASHMORE REEF No. 1 Location _____ Date 22nd. November, 1967

Joints on Location	Feet on Location	Casing Weight	Grade	Range	Thread	Threads & Couplings	Make	Joints Run	Depth Landed	Feet Run in Well
131	4019.26	68	J55	2	BUTTRESS		API	110	3589	3427-49

Shoe: Make BAKER Type FLEXIFLOW Length 2-20

Collars: Make BAKER Type FLEXIFLOW Length 1-70

Landing Joint (when used) Length 183-93

Overall Length of Casing String 3615-32

Feet up from K.B. (Subtract) 26-32

Setting Depth: 3589.00 By Driller . By Tally 3589-00

Shoe Joint: 65.36 Overall (Subtract) 65-36

Float Collar Landed: 3523.64 By Driller By Tally 3523-64

CENTRALIZERS: NIL

Make _____

Number _____

Positions _____

SCRATCHERS: NIL

Make _____

Number _____

Positions _____

No. of Joints Welded _____

Remarks _____

Operator's Representative _____

B.O.C. OF AUSTRALIA LTD.
CASING RUNNING AND CEMENTING REPORT

Form B - 2

Surface Casing
Intermediate Casing O.D. 13-3/8
Production Casing
Liner

GENERAL

Well No. 1 Location ASHMORE REEF Date 22nd. November. 1967

K.B./~~G.S.~~ Elevation 160 above sea bed at o Ft. tide. K.B./G.S. Csg. Flange 155 Total Depth (Driller) 3650

Hole Size	17½			Casing in Hole	30	20	
Depth	3650			Depth Set	332	985	

Mud: Type SPERSENE/XP20 Wt. 9.6 Visc. 76 W.L. 7.8

B.O.P.'s 20" Hydril

RUNNING

Power Tongs - Torque: Max. - Nom. - Min. -

Time Pipe Started 2230 (21/11) Time on Bottom 0800 (22/11) Time Circ. 45 mins.

Fill-up Points Every 5 joints Btm. by Casing 3589 Ft. up from K.B. 25

Remarks

CEMENTING

Cement Co. HALLIBURTON Operator J. GLORIOD Time on Location RESIDENT

Types & Quantities of Cement 1400 sacks Class H with 6% gel and 0.5% HR4 followed by 400 sacks Class H neat.

Water ahead 20 Bbls. Mix Times: Start 0952 Finish 1150 Slurry Wt. 13.5 and 15.0

Calc. Disp. 530 Bbls. Est. Disp. time 45 mins. Mins. Start 1202 Finish 12.45

Max. Pumping Press. 970 Bump. Press. 1250 Bumped by Rig Pump No. times bump. One

Cement Returns: Yes/No. Remarks Cement cut mud of weight 12.0 lb./gal. returned to surface after displacing 440 bl.

LANDING

Time Landed 0800 Date 22/11/67 Init. Wt. of Cem. String (Less Blks.) 244,000

Wt. Landed in Slips 200,000 Make of Bowl - Nom. Size - Series -

Slip and Seal Assembly -

Remarks Two previous unsuccessful attempts made to run.
Cementation carried out in one stage.

Complete surface returns obtained during displacement first 440 bl.
During displacement of last 35 bl. a complete loss circulation occurred.

Operator's Representative

B.O.C. OF AUSTRALIA LTD.

CASING AND TUBING TALLY

Form C - 4

Page 1 of 1 Joint No. 01 to 100 Date 22nd. November, 1967

WELL: ASHMORE REEF NO.1 Size 13-3/8 Weight 68 Grade BUTTRESS Range 2 Condition NEW

Manufacturer JAPANESE Threads: On ..... Off ..... No. of Threads ..... Coupling: Short ..... Long .....

No. of Joints: Received at Well 131 Used 110 Disposition of Joints not used ON BARGE

Length of Cut-Off Joint above casing bowl ..... Disposition .....

Joint No.	Length of Joint	Joint No.	Length of Joint	Joint No.	Length of Joint	Joint No.	Length of Joint
01	35.13	31	31.48	61	31.35	91	29.94
02	30.23	32	30.84	62	31.79	92	29.62
03	30.18	33	30.70	63	31.48	93	31.50
04	31.86	34	31.23	64	30.70	94	30.46
05	31.84	35	32.20	65	33.43	95	32.23
06	30.78	36	29.53	66	31.50	96	31.14
07	30.75	37	30.42	67	30.22	97	32.03
08	31.49	38	31.60	68	30.70	98	29.92
09	29.05	39	32.40	69	30.46	99	30.02
10	30.33	40	31.86	70	31.30	00	31.62
TOTAL	311.64	TOTAL	312.26	TOTAL	312.93	TOTAL	308.48
11	30.84	41	31.43	71	31.33		
12	30.45	42	31.28	72	30.65		
13	30.50	43	29.31	73	31.43		
14	32.62	44	31.22	74	31.92		
15	31.00	45	32.43	75	30.43		
16	31.48	46	31.63	76	31.46		
17	30.84	47	31.58	77	31.50		
18	31.55	48	31.82	78	31.31		
19	32.75	49	29.98	79	33.43		
20	31.08	50	31.08	80	31.44		
TOTAL	313.11	TOTAL	311.76	TOTAL	314.90		
21	31.70	51	30.90	81	31.82		
22	31.61	52	30.83	82	31.38		
23	32.37	53	29.94	83	31.00		
24	32.67	54	29.87	84	31.11		
25	31.50	55	31.13	85	32.61		
26	29.28	56	30.60	86	30.70		
27	31.25	57	31.07	87	32.55		
28	30.52	58	31.28	88	30.26		
29	30.64	59	30.20	89	30.58		
30	32.02	60	31.50	90	29.00		
TOTAL	313.56	TOTAL	307.32	TOTAL	311.01		

TALLY SUMMARY

Group No. Ending	Length (Forward)
10	311.64
20	313.11
30	313.56
40	312.26
50	311.76
60	307.32
70	312.93
80	314.90
90	311.01
100	308.48
110	314.42
TOTAL	3,431.39

Tally By: .....

Checked By T.C. Tyner

(Note: Include casing shoe and collar in first joint)

REMARKS:

101	31:02
102	30:10
103	31:79
104	29:10
105	31:31
106	30:55
107	31:40
108	31:47
109	31:68
110	36:00 (W/H Joint)
TOTAL	314:42

B.O.C. OF AUSTRALIA LTD.

Form B - 1

CASING INFORMATION

Surface Casing
Intermediate Casing O.D. 9-5/8"
Production Casing
Liner

Well ASHMORE REEF WELL No. 1 Location _____ Date 4-5/1/68

Joints on Location	Feet on Location	Casing Weight	Grade	Range	Thread	Threads & Couplings	Make	Joints Run	Depth Landed	Feet Run in Well
16	2155.51	47	N80	2	BUTTRESS			16	663.00	505.23
159	4918.42	43.5	N80	2	BUTTRESS			159	5581.42	4918.42
30	970.84	47	N80	2	BUTTRESS			30	6552.26	970.84
71	2155.51	47	P110	2	BUTTRESS			52	8135	1578.24

Shoe: Make BAKER Type G DIFFERENTIAL Length 2.60

Collars: Make BAKER Type G DIFFERENTIAL Length 1/90

Landing Joint (when used) Length 173.94

Overall Length of Casing String 8151.17

Feet up from K.B. (Subtract) 16.17

Setting Depth: 8135.00 By Driller By Tally 8135.00

Shoe Joint: 65.69 Overall (Subtract) 65.69

Float Collar Landed: 8069.31 By Driller By Tally 8069.31

CENTRALIZERS:

Make NIL

Number

Positions

SCRATCHERS:

Make NIL

Number

Positions

No. of Joints Welded NIL

Remarks

Operator's Representative STOCKWELL

B.O.C. OF AUSTRALIA LTD.

CASING RUNNING AND CEMENTING REPORT

Form B - 2

~~Surface Casing~~
Intermediate Casing O.D. 9-5/8"
~~Production Casing~~
~~Liner~~

GENERAL

Well ASHMORE REEF No. 1 Location _____ Date 4-5/1/68

K.B./G.S. Elevation R.T. 160' above seabed K.B./G.S. Csg. Flange _____ Total Depth (Driller) 8175

Hole Size	26	17½	12¼	Casing in Hole	30	20	13-3/8
Depth	1015	3650	8175	Depth Set	332	985	3589

Mud: Type Lignosulphonate Wt. 9.7 Visc. 57 W.L. 4.5

B.O.P.'s 13-5/8" stack with Hydril, 2 - 4½" pipe rams and blind rams.

RUNNING

Power Tongs - Torque: Max. - Nom. - Min. -

Time Pipe Started 10.30 (4/1) Time on Bottom 23.30(4/1) Time Circ. ½ hour

Fill-up Points - Btm. by Casing 8135 Ft. up from K.B. 16.17

Remarks _____

CEMENTING

Cement Co. HALLIBURTON Operator GLORIOD Time on Location -

Types & Quantities of Cement 1000 sacks Class H blended with 6% Gel and 0.5% HR4, followed by 250 sacks neat Class H cement

Water ahead 10 Bbls. Mix Times: Start 0132 (5/1) Finish 0241 (5/1) Slurry Wt. 13.4 / 15.0

Calc. Disp. 598 Bbls. Est. Disp. time 30 Mins. Start 0247 (5/1) Finish 0317

Max. Pumping Press. 1400 Bump. Press. 1700 Bumped by Rig Pump No. times bump. 1

Cement Returns: ~~Yes~~/No. Remarks MUD LOSSES TO FORMATION : 180 BARRELS WHILE CIRCULATING PRIOR TO CEMENTING, APPROX. 300 BLS. WHILE CEMENTING AND DISPLACING.

LANDING

Time Landed 23.30 Date 4-1-1968 Init. Wt. of Cem. String (Less Blks.) 200,000

Wt. Landed in Slips - Make of Bowl - Nom. Size - Series -

Slip and Seal Assembly NATIONAL SUPPLY

Remarks _____

Operator's Representative STOCKWELL

B.O.C. OF AUSTRALIA LTD.

Form C - 4

CASING AND TUBING TALLY

Page 1 of 3 Joint No. 1 to 100 Date 4/1/68 19

WELL: ASHMORE REEF No. 1 Size 9-5/8 Weight 47# Grade N80/P110 Range 2 Condition New

Buttress 43.5#

Manufacturer SUMITOMO Threads: On Off No. of Threads Coupling: Short Long

No. of Joints: Received at Well 276 Used 257 Disposition of Joints not used -

Length of Cut-Off Joint above casing bowl - Disposition -

Joint No.	Length of Joint		
01	47#	35	22
02	P110	30	47
03		31	19
04		29	56
05		29	73
06		30	65
07		29	76
08		30	76
09		30	94
10		30	95
TOTAL		309	23

Joint No.	Length of Joint		
31		29	95
32		30	25
33		31	06
34		29	73
35		31	34
36		30	69
37		31	41
38		30	22
39		30	84
40		28	36
TOTAL		303	85

Joint No.	Length of Joint		
61		33	39
62		33	45
63		33	20
64		31	41
65		31	37
66		31	16
67		33	26
68		32	99
69		30	34
70		31	90
TOTAL		322	47

Joint No.	Length of Joint		
91		30	76
92		31	01
93		31	67
94		29	89
95		32	31
96		31	89
97		31	66
98		31	81
99		30	29
100		31	28
TOTAL		312	57

11		31	40
12		30	93
13		31	00
14		26	37
15		29	56
16		31	45
17		30	27
18		31	20
19		30	73
20		29	34
TOTAL		302	25

41		30	18
42		30	14
43		30	59
44		30	66
45		30	01
46		29	07
47		30	52
48		31	75
49		30	03
50		31	25
TOTAL		304	20

71		33	49
72		31	25
73		31	18
74		33	23
75		32	54
76		33	16
77		33	29
78		33	43
79		33	37
80		31	40
TOTAL		326	34

21		31	08
22		30	18
23		29	80
24		29	97
25		30	04
26		30	69
27		30	10
28		29	24
29		30	46
30		30	73
TOTAL		302	29

51	47#	31	13
52	P110	29	79
53	47#	32	89
54		33	44
55	N80	31	43
56		31	11
57		31	31
58		30	86
59		33	39
60		33	20
TOTAL		318	55

81	47#	31	67
82	N80	32	73
83	43.5#	31	58
84	N80	30	36
85		31	68
86		30	27
87		28	22
88		29	64
89		32	37
90		31	43
TOTAL		309	95

(Note: Include casing shoe and collar in first joint)

TALLY SUMMARY

Group No. Ending	Length (Forward)	
10	309	23
20	302	25
30	302	29
40	303	85
50	304	20
60	318	55
70	322	47
80	326	34
90	309	95
100	312	57
TOTAL	3111	70

Tally By:

Checked By:

REMARKS:

Operator's Representative STOCKWELL

B.O.C. OF AUSTRALIA LTD.

CASING AND TUBING TALLY

Form C - 4

Page 2 of 3 Joint No. ..... to ..... Date ..... 19.....

WELL: ..... Size ..... Weight ..... Grade ..... Range ..... Condition .....

Manufacturer ..... Threads: On ..... Off ..... No. of Threads ..... Coupling: Short ..... Long .....

No. of Joints: Received at Well ..... Used ..... Disposition of Joints not used .....

Length of Cut-Off Joint above casing bowl ..... Disposition .....

Joint No.	Length of Joint		
101	43.5#	29	05
102	N80	32	36
103		30	78
104		31	48
105		31	50
106		31	07
107		32	21
108		32	13
109		31	30
110		31	15
TOTAL		313	03

Joint No.	Length of Joint	
131	32	07
132	30	50
133	30	48
134	30	83
135	30	95
136	31	65
137	31	82
138	31	62
139	30	91
140	31	64
TOTAL	312	47

Joint No.	Length of Joint	
161	30	45
162	31	10
163	28	75
164	28	25
165	31	74
166	30	05
167	31	41
168	31	05
169	31	77
170	30	85
TOTAL	305	42

Joint No.	Length of Joint	
191	31	21
192	31	35
193	32	01
194	29	33
195	31	90
196	31	00
197	31	87
198	31	40
199	30	19
200	31	68
TOTAL	311	94

111	31	78
112	31	41
113	31	14
114	31	97
115	31	00
116	29	69
117	31	08
118	30	77
119	31	27
120	31	22
TOTAL	311	33

141	31	37
142	31	17
143	31	86
144	31	26
145	30	85
146	31	20
147	31	52
148	33	59
149	30	95
150	30	98
TOTAL	314	75

171	29	94
172	31	70
173	31	00
174	30	87
175	31	54
176	31	31
177	30	65
178	30	54
179	30	44
180	29	54
TOTAL	307	53

121	30	74
122	31	04
123	32	27
124	31	83
125	31	99
126	31	40
127	30	70
128	31	60
129	31	10
130	30	18
TOTAL	312	85

151	29	08
152	30	37
153	27	46
154	31	86
155	31	37
156	30	69
157	30	51
158	30	19
159	30	95
160	32	47
TOTAL	304	95

181	31	40
182	31	18
183	31	37
184	30	40
185	31	03
186	31	91
187	29	78
188	30	53
189	31	35
190	30	76
TOTAL	309	71

(Note: Include casing shoe and collar in first joint)

TALLY SUMMARY

Group No. Ending	Length (Forward)	
01-100	311	70
110	313	03
120	311	33
130	312	85
140	312	47
150	314	75
160	304	95
170	305	42
180	307	53
190	309	71
200	311	94
TOTAL	6215	68

Tally By: .....

Checked By: .....

REMARKS: _____

Operator's Representative STOCKWELL

B.O.C. OF AUSTRALIA LTD.

CASING AND TUBING TALLY

Form C - 4

Page 3 of 3 Joint No. ..... to ..... Date ..... 19.....

WELL: ..... Size ..... Weight ..... Grade ..... Range ..... Condition .....

Manufacturer ..... Threads: On ..... Off ..... No. of Threads ..... Coupling: Short ..... Long .....

No. of Joints: Received at Well ..... Used ..... Disposition of Joints not used .....

Length of Cut-Off Joint above casing bowl ..... Disposition .....

Joint No.	Length of Joint		Joint No.	Length of Joint		Joint No.	Length of Joint		Joint No.	Length of Joint	
201	31	95	231	31	14	61			91		
202	31	28	232	29	85	62			92		
203	30	47	233	31	98	63			93		
204	31	15	234	32	10	64			94		
205	30	53	235	29	83	65			95		
206	32	15	236	31	63	66			96		
207	30	95	237	30	67	67			97		
208	31	40	238	30	92	68			98		
209	30	85	239	29	75	69			99		
210	30	79	240	30	86	70			00		
TOTAL	311	52	TOTAL	308	73	TOTAL			TOTAL		

211	31	08	241	43.5#N80	30	74	71				
212	31	77	242	47#	30	86	72				
213	30	32	243	N80	29	77	73				
214	30	43	244		31	22	74				
215	31	05	245		31	47	75				
216	29	41	246		32	91	76				
217	30	80	247		30	55	77				
218	29	51	248		31	75	78				
219	29	96	249		31	42	79				
220	30	73	250		31	38	80				
TOTAL	305	06	TOTAL		312	07	TOTAL				

221	30	30	251	30	55	81		
222	31	23	252	32	98	82		
223	31	58	253	27	24	83		
224	28	37	254	31	11	84		
225	27	45	255	29	66	85		
226	31	35	256	31	10	86		
227	26	36	257	31	26	87		
228	32	05	258	10	00	88		
229	30	39	259			89		
230	31	19	260			90		
TOTAL	300	27	TOTAL	223	90	TOTAL		

(Note: Include casing shoe and collar in first joint)

TALLY SUMMARY

Group No. Ending	Length (Forward)	
01-200	6215.	68
210	311	52
220	305	06
230	300	27
240	308	73
250	312	07
260	223	90
270		
280		
290		
300		
TOTAL	7977	23

Tally By: .....

Checked By: .....

REMARKS: _____

Operator's Representative _____ STOCKWELL

Form C-3

B.O.C. OF AUSTRALIA LTD.

CORING SUMMARY

Well: ASHMORE REEF WELL NO.1

Location: 12°10'42.7" S.; 123°5'10.4" E.

Coring Company: CHRISTENSEN

Service Supervisor: H. GULIKERS, B. PRYOR 16 to 20

	Cored Intervals	Type Core	Core Diameter	Feet Rec'd.	Recovery %	R.P.M.	Pump Press.	Calc. Pumping Vol. GPM	Weight on Bit	Formation	Remarks
16	7575 - 7590	C31	4"	15'	100	40 - 60	750-1000	300	10 - 20	LIMESTONE	CORING RATE BETWEEN 6 AND 9 MIN/FT.
17	8016 - 8023	C 8	4"	4'	57	35 - 50	800-1000	200	8 - 25	SHALE	CORING RATE 10-25 MIN/FT. Torque to 250 while coring. Core jammed in barrel.
18	8281 - 8290	C 8	4"	9'	100	40	850	270	20	VOLCANICS	CORING RATE UP TO 25 MIN/FT. Unable to core below 8023'.
19	8835 - 8844	C 8	4"	7½'	83	35 - 45	1250-1350	260-280	20	VOLCANICS	CORING RATE 12-23 MIN/FT. Core jammed in bottom catcher.
20	9295 - 9314	C 8	4"	19'	100	30	1150	270	18	SANDSTONE	CORING RATE 5-17 MIN/FT. Aver. 7 MIN/FT.
21	9741 - 9755	C 8	4"	14'	100	40 - 50	750-950	260	20	SANDSTONE/SHALE	Finger of collet core catcher bent upwards, blocking entrance of barrel. 8-7.16" hole.
22	10048 - 10063	C 8	4"	15'	100	50	700	260	20	SANDSTONE/SHALE	CORING RATE 13-22 MIN/FT.
23	10575 - 10583	C 8	4"	8'	100	40	1000	280	20	SANDSTONE	CORING RATE 13-39 MIN/FT. Torque increased below 10582'.
24	11024 - 11035	C 8	4"	11'	100	40	1000	280	20	SHALE	CORING RATE 28 MIN/FT. No penetration for last 25 mins.
25	11716 - 11724	C 8	4"	8'	100	50	1200	290	20	SHALE	CORING RATE 30 MIN/FT.
26	12060 - 12070	C 8	4"	10'	100	35	1150	220	20	SHALE/LIMESTONE	CORING RATE 40 MIN/FT.
27	12423 - 12433	C 8	4"	10'	100	50	950	250	20	LIMESTONE	CORING RATE 33 MIN/FT.

Form C-3

B.O.C. OF AUSTRALIA LTD.

CORING SUMMARY

Well: ASHMORE REEF NO. 1

Location: 12°10'42.7"S; 123°5'10.4"E.

Coring Company: Christensen

Service Supervisor: H. Gulikers; B. Pryor.

	Cored Intervals	Type Core	Core Diameter	Feet Rec'd.	Recovery %	R.P.M.	Pump Press.	Calc. Pumping Vol. GPM	Weight on Bit	Formation	Remarks
1.	1125-1152	Dia	4"	3/4'	2.8	41-49	275-300	150	4-10	Dolomitized Limestone	Recovered 3 broken pieces of Limestone.
2.	2286-2310	DiaC8	4"	14½'	60	32	750-1000	290	6-18	Limestone	Coring Rate between 2 & 5 min/ft.
3.	2619-2644	DiaC8	4"	13	52	33	400-1000	290	8-12	Tertiary Limestone	Coring Rate between 1½ & 8 min/ft.
4.	2901-2928	DiaC8	4"	22	81	40-45	900-1300	270	10.15	Calcilutite	Coring Rate between 3 & 15 min/ft.
5.	3212-3240	DiaC8	4"	Nil		50	1000-1400	240	15-20	Marl	Lack of Rec. due to mud being full
											of cuttings and LCM and clayey nature of form.
6.	3245-3270	DiaC8	4"	Nil		50	1100-1400	240	20-25	Marl	Reason for nil rec. as before.
7.	3622-3645	DiaC31	4"	16'	70	40	900-1300	270	20-25	Shale	Coring Rate between 6 & 20 min/ft.
8.	4036-4063	DiaC8	4"	26	97	40-60	700-900	250-300	10-18	Calcarenite	Coring Rate between 2 & 7 min/ft.
9.	4540-4566	DiaC8	4"	25½	98	40-65	800-1000	250-300	10-15	Calcarenite	Coring Rate between 5 & 15 min/ft.
10.	5020-5035	DiaC8	4"	15	100	40-60	850-1000	150-300	10-20	Calcilutite	Coring Rate between 3 & 8 min/ft.
11.	5535-5553	DiaC8	4"	14	78	40-55	900-1300	150-300	10-20	Calcilutite	Coring Rate between 3 & 13 min/ft.
12.	6022-6042	DiaC31	4"	20	100	40-60	800-900	250-300	10-17	Calcilutite	Coring Rate between 3 & 17 min/ft.
13.	6520-6533	DiaC31	4"	10	77	40-60	800-900	270-300	10-15	Limestone	Coring Rate between 4 & 13 min/ft.
14.	6730-6748	DiaC31	4"	18	100	40-60	1000	300	14-20	Limestone/Marl	Coring Rate between 11 & 27 min/ft.
15.	7252-7267	DiaC8	4"	13½	90	40-60	800	300	10-25	Calcilutite/Marl	Coring Rate between 11 & 15 min/ft.

DRILL STEM TEST REPORT

B.O.C. OF AUSTRALIA L1

Form B - 4

WIRELINE FORMATION TEST REPORT

Well: Ashmore Reef No.1 Test No. 1 Date 21/3/68

Testing Company: Schlumberger Seaco Inc. Operator: R. Hanwright, I. Schoss

Formation Tested: Sandstone (Triassic)

Test Depth: 9230 ft. Formation Rw 0.04 @ 195°F

Depth of Well: 12843 From R.T. Zero tide K.B. - G.L. -

Type of Mud: LIGNOSULPHONATE Rmf = 0.35 @ 86°F

Weight 9.7 Visc. 59 W.L. 3.7 Res. m. 0.35 @ 87°F

(i) Sample Unit Size Gallons: 0.362 (10250 cc) Main chamber choked.

Sampling Time: 9 Min. 45 Sec.

Shut in Time: In. 6 Min. 15 Sec., Fin. 16 Min. 0 Sec.

Sampling Pressure: 3390 psi.

Hydrostatic Pressure: 4830 psi.

Shut in Pressure: In. 4150 psi., Fin. 4060 psi.

Surface Pressure: 300 psi.

Recovery: - cu. ft. gas; - c.c. Distillate; - c.c. Oil; 10250 c.c. Water; - c.c. Mud; 1 c.c. Sand

Water Description: Dark grey water equivalent NaCl 12800 ppm. Ca + Mg 316 ppm. Core Laboratories analysis

(ii) Sample Unit Size Gallons: 0.0786 (2225 cc) Segregator Chamber

Sampling Time: 0 Min. 36 Sec.

Shut in Time: In. 8 Min. 54 Sec., Fin. 9 Min. 30 Sec.

Sampling Pressure: 990 psi.

Hydrostatic Pressure: 4830 psi.

Shut in Pressure: In. psi., Fin. 4120 psi.

Surface Pressure: 400 psi.

Recovery: - cu. ft. gas; - c.c. Distillate; - c.c. Oil; 2225 c.c. Water; - c.c. Mud; - c.c. Sand

Water Description: Dark grey water equivalent NaCl 21780 ppm. Ca + Mg 850 ppm. Core Laboratories analysis.

Mud Description: No mud in sample

Water Sample Res. Unfiltered: -

Water Sample Res. Filtered: (i) 0.27 @ 77°F (ii) 0.19 @ 74°F (Core Lab.)

Mud Filtrate Res.: -

Minimum Gas/Oil Ratio: -

Oil A.P.I. Gravity at 60°F.: - Color

Samples Sent To: B.M.R. B.O.C. By: Air freight

Do you consider test satisfactory: Yes X No

Present at Test: Tyner, Stroud

Remarks: Tool type F.I.T. with surface controlled segregator, located using S.P.

OPERATOR REPRESENTATIVE: S. Stroud
21/3/68

Copy 2

File No.: 67/4264

Well Name: ASHMORE REEF NO. 1

B.O.C.

WIRE LINE FORMATION TEST F.I.T.

Test No. & Type:	1st Sample main chamber	2nd sample main chamber	sample from small, second chamber
Depth Interval:	9230'	9230'	9230'
pH:	7.5/8 Filtrate very dark tannin stained	7.5/8 Filtrate very dark tannin stained	7.5/8 Filtrate very dark tannin stained
Resistivity @ 20°C (68°F)	0.38 17,000 *	0.39 16,500 *	0.25 24,000 *
Titratian Salinity: (ppm NaCl)	1,300	1,400	2,400

* Apparent salinity, derived from resistivity is high probably due to sodium hydroxide in mud, water very heavily tannin stained; tannin usually added along with caustic soda.

LOG OF SAMPLES

GEOLOGY

by

R.W. Craig

SUMMARY OF PREVIOUS WORK:

Field activity on the part of the oil exploration industry in the Ashmore Reef area of the Sahul Shelf began in 1963 with the conduct of a reconnaissance aeromagnetic survey by Aero Service Limited on behalf of Woodside (Lakes Entrance) Oil Co. N.L. Profile lines run in the Ashmore Reef area consisted of a northwest line to the reef, a northeast line to Hibernia Reef and a southeast line back shoreward to Cartier Reef. With hindsight it is interesting to note that these broad reconnaissance data yielded a depth estimate to magnetic basement of 7000 feet at a point immediately north of Ashmore Reef. However, with the indications of thick sedimentary section yielded by the following described seismic surveys, these loosely controlled data were considered unreliable.

Initial seismic investigations of the general Ashmore Reef area were undertaken in 1964 by B.O.C. of Australia Limited, Operator for the Group tenement holders. Included in the seismic survey which was shot by Western Geophysical Company of America but interpreted by Seismograph Services Limited of London were a suite of reflection lines around Scott and Seringapatam Reefs and a northeastern trending step-like pattern of east-west and north-south lines which passed south and east of Ashmore Reef.

In 1965, the Montebello-Mermaid Shoal seismic survey included additional reflection seismic south, east, and north of Ashmore Reef. These data indicated for the first time the presence of a sizeable structure associated with Ashmore Reef.

Therefore the 1966 Rankin-Troubadour seismic survey included lines which boxed in Ashmore Reef and which served to delineate the size, orientation and magnitude of the east-west longitudionally faulted Ashmore Reef anticline.

In early 1967 the Ashmore Reef shallow water marine seismic survey was specifically undertaken to investigate the geographic relationship between the anticlinal apex and the lagoon and islands of the reef as well as to confirm the magnitude of southwestern closure on the structure. As a result of this survey it was confirmed that the apex of the structure lay to the northeast of the reef proper and the islands are at considerably lower structural elevations on the south and southwest flanks of the structure.

STRATIGRAPHY

The ages assigned the various stratigraphic units penetrated at Ashmore Reef are based on palynological studies by B.E. Balme and on palaeontological studies by P.J. Coleman, both of the University of Western Australia, Perth and on micropalaeontological studies by Dr. D.J. Belford of the Bureau of Mineral Resources, Canberra.

Informal stratigraphical names are put forward for three Tertiary-Upper Cretaceous units and for the Upper Jurassic volcanic sequence. This has been done after discussion with Dr. N.H. Fisher, Secretary of

Ashmore Reef No.1.

the Stratigraphic Nomenclature Committee of the Geological Society of Australia and in consideration of the following factors which suggest the desirability and the validity of considering these units as formational divisions:

a) The Tertiary-Upper Cretaceous sequence is the most palaeontologically complete known to date in the Indo-Pacific region and therefore significant as a type section.

b) The chosen unit boundaries coincide with seismic reflections which are mappable over a wide area of the Sahul Shelf. Less tangible is the high degree of seismic record character continuity over intervals representative of the units proposed.

While the terminology has been discussed with the appropriate authorities the following names are considered as unpublished and therefore have no standing; these should not be used in a publication without definition and the approval of the Divisional Stratigraphic Nomenclature Subcommittee.

The following rock units were encountered:

Age	Formation	Depth (datum=rotary table adjusted to Mean Indian Springs Low Water) d to top.	Thickness	
			RT = +160	
Quaternary/ Pliocene	foraminiferal limestone and calcarenite	160'	893'	276
---------- U N C O N F O R M I T Y ----------				
early Middle to late Lower Miocene	increasingly foraminiferal, some crystalline limestone.	1053'	1582'	482
---------- D I S C O N F O R M I T Y ----------				
early Lower Miocene	Limestone, crystalline to foraminiferal. Calcilutite, argillaceous	2635'	427'	130
Oligocene	'Cartier Beds'	3062'	947'	289
---------- D I S C O N F O R M I T Y ----------				
Eocene-Paleocene	'Hibernia Beds'	4009'	2534'	772
Paleocene-Upper Cretaceous	'Woodbine Beds'	6543'	1413'	431
---------- U N C O N F O R M I T Y ----------				
Upper Jurassic	shale, sandstone, calcarenite	7956'	146'	
	'Ashmore Volcanic Beds'	8102'	1041'	
---------- U N C O N F O R M I T Y ----------				
Upper Triassic	upper unnamed clastic beds	9143'	2837'	
	unnamed carbonate beds	11980'	723'+	
	lower unnamed clastic beds	12703'	143'+	
	Total Depth	12843'		

The details of these units are given in an appendix (Geology) to this section of the report and are set out graphically on the composite log of Plate 4.

Quaternary/Pliocene

Unnamed carbonates - (seabed-1053')

The Quaternary/Pliocene sediments can be subdivided into two lithologic units. An upper white foraminiferal limestone with minor lamellibranchs and coral fragments persists from the sea floor (160 feet subdatum) to 540 feet (380 feet thick). These beds exhibit good intergranular porosity; loss of circulation was experienced in the interval 400-495 feet and the same lithology is there assumed. Between 540 feet and 1053 feet (513 feet thick) a white to cream, very fine to fine grained calcarenite which is poorly sorted and consists of angular calcareous fragments is the major lithology with minor crystalline limestone interbeds.

The basal contact is well marked on the induction electric log by a marked increase in resistivity and on the compensated formation density log by a sharp increase in density. Palaeontologically the contact is bracketted by possible Pliocene beds in the lower portion of the interval 600-1000 feet (from cuttings analysis) and by a probable late Lower but possibly early Middle Miocene age assignment for core No.1 at 1125 feet. The contact is therefore unconformable with Quaternary/Pliocene beds resting on Miocene beds.

Late Middle to early Lower Miocene

Unnamed carbonates - (1053'-2635')

This interval may be subdivided into two lithological units; an upper 329 feet (1053'-1382') of white to cream foraminiferal limestone with minor interbeds of greyish green calcareous mudstone and a lower 1253 feet (1382'-2635') of white to light brown very finely crystalline, partly dolomitic limestone in which foraminiferal content increases downwards.

The basal contact of these unnamed beds is well marked on the induction electric log by a marked decrease in resistivity and on the sonic log by an increase in interval transit time. The base of these beds is coincident with a disconformable seismic event. Palaeontologically the lower contact is bracketted by a Lower Miocene age assignment to cores No.2 (2286'-2310') and No.3 (2619'-2632') and by an early Lower Miocene (Aquitanian or Tertiary upper "e") assignment to core No.4 (2901'-2928'). Therefore the basal contact is believed to represent an intra-Lower Miocene disconformity.

Early Lower Miocene

Unnamed beds - (2635'-3062')

This unnamed 427 foot interval is characterized by the first downwards appearance of calcilutite as interbeds in a cryptocrystalline and foraminiferal limestone (to 2818') or a marly, foraminiferal limestone (2818'-3062'). The base of the unit is lithologically gradational as evidenced by the marly nature of the foraminiferal limestones. It is marked on the induction electric log by a decrease in resistivity, on

TABLE I REGIONAL CORRELATION OF ROCK UNITS

the sonic log by an increase in interval transit time, and on the formation density log by a marked decrease in density. Seismically, this interval is apparently confined to a local area at Ashmore Reef. Elsewhere it is truncated by a post-early Lower Miocene unconformity, late Lower Miocene, or younger beds rest directly on the Oligocene 'Cartier beds'.

Oligocene

'Cartier beds' - (3062'-4009')

The 'Cartier beds' are a gradational and interbedded sequence of marl and shale. Marl is the sole lithology to 3413 feet (351 feet thick) where shale interbeds first appear and become dominant downwards to 3648 feet (235 feet thick). Shale is the sole lithology from 3648 feet to 3887 feet (239 feet thick) where marl reappears and becomes dominant to the base of the 'Cartier beds' at 4009 feet (122 feet thick).

The basal contact of the 'Cartier beds' is lithologically abrupt and marked on the wireline logs by a marked increase in S.P., a marked decrease in interval transit time and decrease in both gamma radiation and density.

Palaeontologically Coleman has bracketted the upper contact with an early Lower Miocene age assignment to a sidewall core at 3045 feet and an Oligocene age assignment of a sidewall core at 3065'. Concerning the age of the lower portion of this sequence Coleman has assigned an Oligocene age to core No.7 (3622'-3645') and an Upper Eocene age to core No.8 (4040'-4063') from just below the basal contact. Therefore the 'Cartier beds' are considered entirely Oligocene in age with the possibility that the basal disconformity represents a part of the Lower Oligocene.

Upper Eocene-Lower Paleocene

'Hibernia beds' - (4009'-6543')

The 'Hibernia beds' are a thick (2534 feet) gradational series of several carbonate rock types. Calcarenite prevails to 4209 feet and remains dominant with minor interbeds of calcilutite to 4484 feet where calcilutite prevails through to 4760 feet. Calcarenite briefly reappears between 4760 feet and 4783 feet. The interval between 4783 and 5556 feet is an interbedded sequence of calcilutite and calcisiltite with the calcisiltite gradationally becoming dominant downwards. Between 5556 feet and 5730 feet calcisiltite is the sole lithologic component. Calcilutite is the dominant lithology between 5730 feet and 6177 feet but with minor interbeds of calcarenite and shale. Micro- to crypto-crystalline limestone is the dominant lithology between 6177 feet and 6543 feet but calcilutite interbeds persist downwards to about 6250 feet. The limestone becomes gradational to marl near the base. Chert nodules and irregular thin bands are present throughout the 'Hibernia beds'.

Due to the gradational nature of the composite rock types it is not felt meaningful to subdivide the 'Hibernia beds' into lithological units. The basal contact, although somewhat gradational, is fairly well marked lithologically by the first prominent appearance of marl. The contact is marked on the induction electric log by a decrease in both S.P. and resistivity and on the sonic log by an increase in interval transit time. The basal contact coincides with a strong mappable seismic

reflection. Coleman and Belford have both assigned cores No.8 (4040'-4063') and No.9 (4540'-4566') an Upper Eocene age. Neither palaeontologist was successful in obtaining identifiable material from cores No.10 or 11 (5020'-5035') and (5535'-5553'). Belford has assigned core No.12 a basal Eocene or Upper Paleocene age and core No.13 an Upper Paleocene age. Coleman, in contrast, has nominated a Middle to Lower Paleocene age for the interval represented by these cores based on his tentative identifications of several early Globorotalia species.

The formation is regarded as ranging in age through the Eocene and part of the Paleocene.

Upper Cretaceous

'Woodbine beds' - (6543'-7956')

The 'Woodbine beds' are a further gradational series of three basic carbonate lithologies. Although the sequence is gradational it may be useful to consider the following subdivision units:

6543'-6857' (314 feet)	Marl, light green to dark grey, about 55% calcareous, slightly glauconitic, with interbeds of white to cream microcrystalline limestone. Calcareous shale at 6732-6739 feet.
6857'-7007' (150 feet)	Limestone, essentially as above, with Marl interbeds below 6980 feet.
7007'-7440' (433 feet)	Calcilutite and Marl Calcilutite, white to light brown, lithographic, grades into light grey, light green and dark grey marl; 65-50% calcareous, argillaceous, pyritic, chloritic. Marl is dominant in the interval 7188 feet to 7273 feet.
7440'-7688' (248 feet)	Limestone, light brown to brown, microcrystalline, variable minor ferruginous or manganese material, abundant limonite styolites throughout and iron-rich chert nodules towards base.
7688'-7956' (268 feet)	Marl, light greenish grey, 40% calcareous; grading downwards to calcilutite, >65% calcareous, below 7835 feet.

The base of the 'Woodbine beds' is easily recognised lithologically by the abrupt change to shales below. The induction electric log exhibits a downwards decrease in resistivity while the gamma-sonic shows an increase in gamma radiation and an increase in interval transit time.

The gradational relationship of the lithology of the upper portion of the 'Woodbine beds' to the overlying 'Hibernia beds' has already been discussed. Also, the difficulties in nominating a stage within the Paleocene for basal 'Hibernia beds' has been pointed out. Within the 'Woodbine beds' Coleman initially assigned an Upper Cretaceous age to core No.14 (6730'-6748') based on thin section identifications. (He had been unable to recover free specimens from digested samples).

Belford, however, was successful in obtaining free specimens and, as a result, nominated an Upper Paleocene age. Coleman has since seen some of Belford's material and (verbal communication) concurs in a Paleocene age assignment. Core No.15 (7252'-7267') has been assigned a Maestrichtian age by both workers whereas Core No.16 (7575'-7590') is regarded as Maestrichtian by Coleman and as Santonian or Campanian by Belford. Sidewall core from 7891 feet and cuttings between 7700 and 7950 feet were analysed without firm results. Coleman, however, does suggest that the interval represents the remainder of the Upper Cretaceous and possibly part of the Lower Cretaceous as well. In the absence of firm palaeontological evidence the writer would prefer to regard the 'Woodbine beds' as being Paleocene through Upper Cretaceous with no Lower Cretaceous present.

The base of the 'Woodbine beds' coincides with a regionally mappable seismic disconformity.

While the subdivision of the conformable and gradational sequence of Eocene-Paleocene carbonates into two "formations", the 'Hibernia beds' above and 'Woodbine beds' below, has been recommended on the basis of the regional mappability of the boundary by seismic means, it is to be emphasized that the succession is conformable and comprises several cycles of carbonate sedimentation.

Upper Jurassic

Unnamed sediments - (7956'-8102')

The interval 7956 feet to 8031 feet consists of dark grey to black slightly to non-calcareous shale with very fine mica, minor pyrite and glauconite, minor fossils, and with current bedding. The underlying 23 feet (8031'-8054') consists of lithic sandstone, green to grey, medium grained, dominantly argillaceous with grains of opaque volcanics and rare quartz, fresh feldspar, fossiliferous with a green highly glauconitic matrix. The basal unit of this unnamed sedimentary sequence consists of 48 feet (8054'-8102') of light brown to greenish grey calcarenite containing subangular to subrounded dark greenish grey volcanic fragments and subangular hard calcite fragments in a cryptocrystalline matrix, slightly fossiliferous, rarely ferruginous.

Core No.17 (8016'-8023') from near the base of the shale interval yielded no useful macro or microfossils. However, Balme recovered spores and pollen which are not chronologically significant but are suggestive of a Jurassic or Lower Cretaceous age. The microplankton similarly are not accurately definitive but the genus Scrinrodinium is apparently typical of the Upper Jurassic although a species occurs in the Lower Cretaceous of Western Australia. On balance Balme considers "the assemblage is late Jurassic although an early Cretaceous age is not out of the question".

Considering that this unnamed sedimentary sequence contains clastic material derived from the underlying volcanic sequence and, considering also the relative ages of these sediments and the underlying volcanics, it is probable that these sequences are essentially conformable.

2469 - 2487 m

'Ashmore volcanic beds' - (8102'-9143')

The informally named 'Ashmore volcanic beds' may be subdivided into two units:

8102'-8172' Altered amygdaloidal basalt, dark grey, with phenocrysts of pyroxene and probably feldspar in a matrix of iron oxides including haematite, and altered feldspar. Irregular aggregates are a mixture of green chlorite, calcite and a zeolite and resemble amygdales.

Interbedded claystone, grey, light chocolate to brown, plastic, slightly calcareous, silty, foraminiferal, glauconitic.

8172'-9143' Olivine basalt lavas with tuff interbeds in the intervals -

8200'-8370', 8540'8800', 8850'-9073',

and with calcite filled amygdales common in some intervals.

Samples from core No.18 (8281'-8290') were radiometrically dated by the potassium-argon method by Dr. Ian McDougall of the Research School of Physical Sciences, Department of Geophysics and Geochemistry at the Australian National University, Canberra. He reports an age, based on duplicate measurements, of 137.3 ± 3 million years. The age obtained can be regarded as a minimum value; owing to the deuteric alteration in the rock some diffusive loss of radiogenic argon may have occurred so that the true age may be a few percent older.

The presence of numerous tuffaceous interbeds attests to several distinct volcanic flows. These individual flows may have been separated by several days or several million years. Accordingly, samples of core No.19 from 8841.5 feet and 8842.5 feet were submitted to Dr. McDougall in an attempt to determine if an appreciable portion of Jurassic time is represented by the volcanic sequence. The two samples yielded comparable dates at 129.4 ± 3.0 million years which is regarded as a reliable minimum age. Clearly these samples have leaked more argon than those from the higher core. This may be due to a greater degree of alteration and/or to the greater depth and attendant higher temperatures that core No.19 samples have experienced. Dr. McDougall concludes that the volcanic sequence was erupted during one main volcanic episode of relatively short duration (say several million years). The writer concludes that it is unlikely that pre-Tithonian Jurassic beds are present at Ashmore Reef. The 'Ashmore volcanic beds' are unconformably underlain by Upper Triassic beds according to Balme's age assignment of core No.20 (9295'-9317').

Upper Triassic

Upper unnamed Upper Triassic Clastics - (9143'-11,980')

This interval of the well contains a diversity of interbedded and gradational predominantly clastic rock types. Sandstone grades from rarely silty though mainly fine to medium grained but occasionally conglomeratic, is subangular to subrounded, and has carbonaceous, micac ous and argillaceous bands and Shale interbeds with similar composition ar found between 9143 feet to 9674 feet. These beds are noticeably non-calcareous and are taken to represent a paralic environment.

Similarly composed but slightly calcareous siltstones, sandstones and shales are dominant from 9674 feet to 9953 feet (261 feet thick). An occurrence of slightly quartzose calcilutite at 9742 feet to 9753 feet represents the uppermost occurrence of carbonate in the Upper Triassic sequence. The overall interval is slightly more marine in aspect than the overlying.

The balance of the clastic sequ nc to 11,524 feet has the sam accessories and is described as only slightly calcareous. Limestone interb ds are pr sent. The sequ nc is regarded as paralic.

The shale between 11,524 feet and 11,657 feet (133 feet) is up to 50% calcareous and regarded as a normal epineritic marine deposit. The clastics from 11,657-11,980 feet are again relatively sparse in carbonate and are regarded as paralic.

Balme has variously described cores Nos.20-25 from this interval as "probably Upper Triassic", "consistent with Upper Triassic" and "not likely older than Middle Triassic". On balance he considers the sequence, at least down to 10,583 feet, to be Upper Triassic. At 11,024 feet (core No.24) Coleman has identified Costatoria suggestive of an Upper Triassic age.

Unnamed Upper Triassic Carbonates - (11,980'-12,703')

This interval consists of cryptocrystalline limestone with minor interbeds of slightly calcareous fossiliferous shale. These lithologies are indicative of shallow quiet water marine environment. Above 12,148 feet the upwards appearance of 33 feet of non-calcareous siltstone, interbeds of slightly quartzose shale and the argillaceous and quartzose nature of the limestone itself attest to the early influx of clastic material to the previously low energy environment.

From core No.27 (12,423'-12,433') Coleman has identified a molluscan fauna similar to an Upper Triassic assemblage found in Indonesia. The gradational nature of the upper and lower contacts attest to the conformity of the sequence and suggest the continuance of an Upper Triassic age to total depth.

Lower Unnamed Upper Triassic Clastics - (12,703'-12,843') (T.D.)

These beds are the oldest penetrated by Ashmore Reef No.1. Therefore it cannot be stated whether the interbedded calcareous siltstone and sandstone with cryptocrystalline limestone and slightly calcareous shale represent a minor clastic influx into a quiet shallow water marine environment or the closing phase of a much more extensive older clastic sequence.

Table 1 shows the regional age relationships between the section penetrated at Ashmore Reef and rock units in the Carnarvon Basin and on Portugese Timor.

STRUCTURE

Through the interval of unnamed early Middle to late Lower Miocene sediments between 1053 feet and 2635 feet the Schlumberger dipmeter recorded dips ranging from 0° to 47°. The average dip of the observations is 13.7° whereas the median observation is 12°. The median azimuth of dip (for 569 observations) is 079°. From seismic it is now recognised that the underlying early Lower Miocene through Palaeocene rock sequence is regionally thick and therefore Ashmore Reef was situated in a regional low during these stages. It is interpreted that the uplift required to form the present day Ashmore Reef seismic structure began during the late Lower-early Middle Miocene and the relatively high observed dips are due, at least in part to primary sedimentary dip on syntectonic clastic beds. It is possible, however, that in these semi-consolidated sediments, the dipmeter is recording spurious data and the higher magnitude dips are not present.

TABLE OF OBSERVED DIPS

DIPMETER							CORES					
INTERVAL (FEET)	MAX. DIP	MIN. DIP	AVERAGE DIP	DIP QUALITY	MEDIAN AZIMUTH	AZIMUTH QUALITY	INTERVAL (FEET)	CORE NO.	DIP	HOLE DEVIATION	RELIABILITY OF DIP	REMARKS
1053-2633	47°	0°	13.7°	poor	079°	fair						
2638-3062	32°	0°	4.7°	good	030°	good	2619-2644	3	0°	1°	good	
							2901-2928	4	0°	1°	good	
3064-4009	23°	0°	6.7°	good	089°	fair	3622-3645	7	0°	1°	good	
4010-5083	28°	0°	6.8°	fair	279°	v.good	4036-4063	8	0°	1½°	good	
							4540-4566	9	0°	1½°	good	
							5020-5035	10	0°	½°	good	
5085-6543	16°	0°	4.7°	good	319°	v.good	6020-6042	12	0°	½°	good	
							6520-6533	13	10°	½°	good	
6543-6741	14°	0°	9.0°	good	008°	v.good						
6782-6838	6°	0°	3.5°	good	317°	v.good						
6853-6889	7°	1°	4.2°	good	230°	v.good						
6891-6965	9°	1°	4.3°	good	346°	v.good						
6967-7094	8°	0°	3.4°	good	168°	v.good						
7098-7166	7°	0°	2.7°	good	023°	fair						
7171-7229	10°	4°	6.6°	good	272°	good						
7231-7358	12°	0°	3.4°	good	347°	good	7252-7267	15	2-3°	1°	good	
7368-7515	7°	1°	3.0°	fair	072°	fair						
7517-7956	11°	0°	2.8°	good	143°	good						
7960-8102	10°	0°	3.5°	good	093°	good						
8105-9139	22°	1°	7.6°	good	212°	good						
9160-9505	23°	0°	13.5°	fair	139°	v.good						
9513-11,965	24°	1°	11.7°	fair	136°	v.good	9741-9755	21	0-30°	4½°	good	dip probably depositional
							10,048-10,063	22	7-17°	5°	good	cross-bedded
							10,575-10,583	23	0-10°	5°	good	current-bedded
							11,024-11,035	24	0-5°	4½°	good	
							11,716-11,724	25	0-6°	2°	good	15° in slumped band
11,982-12,702	21°	1°	8.6°	fair	140°	good	12,060-12,070	26	8-35°	2¼°	good	average 15°
12,704-12,843	15°	1°	7.2°	fair	113°	v.good						

Ashmore Reef BEFORE AND AFTER DRILLING - STRUCTURAL SECTIONS

The early Lower Miocene interval of 2635 feet to 3062 feet exhibits a dipmeter baseline of dip of 2°-3° with downwards decreasing or increasing dip patterns up to a maximum dip of 20°. The true structural dip is interpreted as 2°-3° to the ENE. Downwards increasing dip patterns may be indicative of minor normal faults at 2662 feet, 2735 feet and 2756 feet.

Other dip patterns are interpreted as due to primary sedimentary dip.

Similarly, the Oligocene marls from 3062 feet to 4009 feet exhibit a dipmeter baseline of dip of between 0° and 2°. Numerous downwards increasing or decreasing patterns of greater dip are most likely due to differential compaction of these plastic sediments. Small normal faults, also attributable to this cause, also may be present.

The Eocene-Palaeocene carbonates of the interval 4009-6543 feet exhibit a dipmeter baseline of dip which increases downwards from 2° to 5°. Numerous increasing or decreasing downwards patterns of dip are interpreted as indicative of primary sedimentary dip, although minor normal faults may result in some of the increasing downwards patterns. Rose diagram plots of dip azimuths suggest dip to 279° in the upper part of the sequence, changing to 319° towards the base.

The Cretaceous sequence of marls and limestones from 6543 feet to 7956 feet exhibits a pronounced dipmeter baseline of dip of 5° down to 6740 feet and of 1°-2° from there to the base. As before, the numerous greater dips observed fall into patterns interpreted as due to primary sedimentary dip. One possible exception is the pattern of increasing dips (to 9°) which terminates abruptly at 7226 feet, this could indicate a minor normal fault at that depth. Median azimuth of baseline dips is 143°.

The thin sequence of uppermost Jurassic sediments which unconformably underlie the Upper Cretaceous sequence in the interval 7956 feet to 8102 feet exhibit a baseline of dip of 1°-2° on the dipmeter. Patterns of greater dip (up to 10°) are attributed to primary sedimentary dip. Median dip azimuth is 93°. The 'Ashmore volcanic beds' between 8102 feet and 9143 feet, as would be expected, exhibit a somewhat variable baseline of dip of from 1° to 6°. Numerous greater dips are interpreted as due to irregular lava flow contacts. Median azimuth of dip is to the SW.

The unnamed Upper Triassic clastic sequence from 9143 feet to 11,980 feet exhibits a baseline of dip between 3 and 10° with extremely numerous patterns of greater dip (up to 24°) indicative of primary sedimentary dip. Median azimuth of both the baseline of dip and of the sedimentary dip patterns is southeast. The Upper Triassic carbonates between 11,980 feet and 12,703 feet have a baseline of dip at 1° to 6°. Median azimuth of these dip observations is 245°. Numerous patterns of greater dip are interpreted as due to primary dip; these have a median azimuth of 140°. The deepest Upper Triassic beds drilled between 12,703 feet and 12,843 feet exhibit a baseline of dip between 1° and 5° with a median dip azimuth of 52°. Greater dips are interpreted of sedimentary origin; median azimuth of these is 113°.

The dipmeter results agree with the observations of dip in recovered cores (see Table of Observed Dips). The low magnitude of dips and variability of dip azimuth throughout the Lower Miocene to Upper Cretaceous rock units suggests that the well was located very near the apex of the Ashmore Reef anticline. Jurassic beds have a slightly steeper structural dip ($< 6^{o}$) as do those of the Upper Triassic clastics ($<10^{o}$), respective southwesterly and southeasterly median azimuths of dip apply. It therefore could be argued that the well is consierably downdip in a southerly direction from the structural apex in rocks of these ages. However, due to the presence of the major down-to-the-north, northeasterly trending normal fault located approximately 1 mile north of the well, it is unlikely that a significant area of higher structural elevation is present.

Figure 1 shows the interpretation of the Ashmore Reef structure before and after drilling.

RELEVANCE TO OCCURRENCE OF PETROLEUM

Hydrocarbon Shows

No signs of liquid hydrocarbon were observed in the Ashmore Reef No.1 well.

The only indications of gas from the mud analyser were of a very minor nature and occurred while drilling the Upper Jurassic 'Ashmore volcanic beds', especially from the upper interval of altered amygdaloidal basalt. Between 8152 feet and 8174 feet percentages of 1.3% methane and 0.046% ethane were recorded. Intermittent shows of methane up to 0.47% persisted to a depth of 8885 feet. Thereafter trip gas containing up to 1% methane and nitrogen was observed during drilling to total depth. The magnitude of these gas indications was insufficient to warrant testing which was not recommended.

Porosity and Permeability

Intervals of good porosity and permeability were encountered in the Quaternary, early Middle to late Lower Miocene, early Lower Miocene, Eocene-Paleocene, and Upper Triassic rock sequences.

Porosity logs were not run on the Quaternary foraminiferal limeston and calcarenite above 978 feet. However, these posed continuing lost circulation problems during drilling and are presumably highly porous and permeable. Between 978 and 1053 feet these beds have log-indicated porosities of 31-32%.

The early Middle to late Lower Miocene log porosities between 1053 and 2635 feet vary from 22 to 35% (see log interpretation for greater detail). Core No.2 from 2286 feet to 2310 feet revealed similar porosities of 21 to 35% with permeabilities of between 15 and 1134 millidarcies. Core No.3 of the interval 2619 to 2644 feet analysed between 19 and 24% porosity and 0.96 to 5.44 millidarcies.

The Eocene calcarenites of the 'Hibernia beds' in the interval 4009 to 4484 feet exhibit sonic log porosities of between 20-27% porosity and average 23%. Core No.8 of the interval 4036-4063 feet analysed to 18-30% porosity with 19.7 to 312 millidarcies permeability. A lower calcarenite interval 4760 to 4783 f et analys d 20 to 23% porosity on the sonic log.

Sandstones in the Upper Triassic mixed clastic sequence in the interval 9143 to 11,980 feet have porosities varying between 20 and 9% as revealed by log analysis. In a general way, sandstones near the top of the interval tend to be more porous and permeable than those below. The following ranges of porosities and permeabilities were recorded from sandstone beds in cores:

Core	Interval	Porosity Range	Permeability Range
20	9295'-9317'	9.4-19.5%	131-956 md.
21	9741'-9755'	11.0-12.4%	0.44-32.6 md.
22	10,048'-10,063'	10.5-16.5%	4.6-31.4md.
23	10,575'-10,583'	1-5.5%	0.2-0.4 md.
24	11,024'-11,035'	nil -	not analysed
25	11,716'-11,724'	nil -	not analysed

Igneous Activity

The occurrence of Upper Jurassic volcanics in the interval 8102 feet to 9143 feet is only detrimental to petroleum prospects in this and older age sediments insofar that associated volcanic necks and presumably present associated dykes and sills may have broken up any pre-existing oil migration pattern. Although the corresponding seismic interval of high energy dies out rapidly at Ashmore Reef, this does not preclude the regional presence of additional volcanic sequences in the Sahul Shelf area.

CONTRIBUTIONS TO GEOLOGICAL KNOWLEDGE

Virtually every aspect of geologic information from as remote a stratigraphic test as Ashmore Reef No.1 is of importance. The most significant contributions to geological knowledge are:

(a) The thick (5321 foot) interval of Lower Miocene through Upper Cretaceous sequence of terrigenous-poor sediment is palaeontologically paraconformable and regarded by palaeontologists as possibly the most complete in a time-rock sense yet revealed in the Indo-Pacific region. Nevertheless, sharp lithological boundaries and possible faunal gaps tend to support the seismic record section evidence of unconformable/disconformable relationships of the Oligocene 'Cartier beds' marls to the underlying Eocene-Paleocene 'Hibernia beds'. Furthermore, the seismic interval isochron map of the Tertiary portion of this 'paraconformable' sequence suggests Ashmore Reef to be in a depositional synclinal position, during those times, within the general Sahul Shelf area.

(b) The uplift which produced the Ashmore Reef anticlinal structure was post-early Middle Miocene in age.

(c) The apparent absence of Lower Cretaceous sediments or appreciable Jurassic sediments sets the Ashmore Reef area apart from either Timor or the Carnarvon Basin. Due to the angular unconformity on seismic records at the base of the Uppermost Jurassic volcanics, this uplifting phase of the area probably occurred in pre-late Jurassic but post-late Triassic times. The area remained above wave base (except for a minor phase at the close of Jurassic) until Upper Cretac ous times.

(d) The presence of the thick incompletely drilled sequence of Upper Triassic beds is problematical because of their clastic character and southeasterly sedimentary dip. Thus a clastic source area must be invoked in the area northwest of Ashmore Reef. However, the Ladinian through Norian Aitutu formation in Portugese Timor comprises 80% calcilutite, 15% shales and only 5% calcarenites, quartz arenites and radiolarites. Thus the postulated landmass northwest of Ashmore did not contribute significant amounts of clastic material to Portugese Timor.

(e) The presence of Upper Jurassic volcanics are not seriously detrimental to petroleum prospects in older beds. The areal distribution of these volcanics on the Sahul Shelf is unknown.

(f) Rocks at Ashmore Reef No.1 which were found porous and hence are regionally potential reservoir rocks on the Sahul Shelf are the upper calcarenite facies of the 'Hibernia beds' and the upper portion of the unnamed Upper Triassic clastic sequence. The porous Miocene beds could be prospective in other parts of the Sahul Shelf if these can be found beneath an effective cap rock.

LOG ANALYSES

LIST AND INTERPRETATION OF SCHLUMBERGER LOGS

INDUCTION ELECTRICAL LOG

Run No.	Interval
1	331 - 982
2	983 - 3645
3	3589 - 6400
4	6250 - 8178
5	8140 - 10170
6	10000 - 11618
7	11000 - 12842

MICROLOG/MICROLATEROLOG/MICROCALIPER

Run No.	Interval
1	983 - 3644

FORMATION DENSITY LOG

Run No.	Interval
1	983 - 3644
2	3589 - 8178 (includes Gamma Ray Log)
3	8140 - 10170
4	10000 - 12837 (includes Gamma Ray Log)

BOREHOLE COMPENSATED SONIC LOG

Run No.	Interval
1	331 - 972 (160-954 Gamma Ray)
2	983 - 3634
3	3589 - 6391
4	6250 - 8171
5	8140 - 10170 (includes Gamma Ray Log)
6	10000 - 11609 (includes Gamma Ray Log)
7	11400 - 12832 (includes Gamma Ray Log)

GAMMA RAY LOG

Run No.	Interval
2	980 - 3580

EPITHERMAL NEUTRON

Run No.	Interval
1	9000 - 12838

CONTINUOUS DIPMETER

Run No.	Interval
1	983 - 3630
2	3589 - 8174
3	8140 - 10160
4	10000 - 12840

TEMPERATURE SURVEY

Run No.	Interval
1	200 - 840
2	3000 - 8082

CALIPER LOG

Run No.	Interval
1	8664 - 10000

B.O.C. OF AUSTRALIA LIMITED

ASHMORE REEF WELL NO. 1

LOG INTERPRETATION 985 FEET-3650 FEET

27th November 1967 M.J.W. Lofting/T.C. Tyner

I. INTERPRETATION

The hole was logged using a seawater mud having a salinity of approximately 29,000 ppm. NaCl.

The following tools were run:-

Induction-Electrical	983-3650 ft. Run No.2
B.H.C. Sonic	983-3634 ft. Run No.2
B.H.C. Formation Density	983-3644 ft. Run No.1
Proximity/Microlog	983-3644 ft. Run No.1
Dipmeter	983-3630 ft. Run No.1

The Gamma Ray tool failed to function which was unfortunate as a direct shale reading would have been useful.

The interval 1168-985 feet is badly washed out in bands and quantitative interpretation in this interval is difficult. The interval 1168-2635 feet is remarkably close to gauge and is suitable for quantitative work. The interval 2635-3650 is more shaly and the hole averages about 13 inches diameter. A slight drift on the S.P. is present but most of the magnetism seen on Run No.1 has been removed.

II. NOTES

(a) Rw

There is no S.P. deflection throughout most of the logged interval indicating that Rw and Rmf are very close. The calculated formation water salinity is in the order of 30,000 ppm NaCl.

Two zones immediately below 2635 feet give moderately high salinity and below this depth a marked positive shift in the S.P. base line occurs.

(b) Rt

The induction curve which approximates Rt is generally less than 4 ohm but shows thin peaks up to 4.5 ohms over tight zones.

(c) Porosity

Porosities as determined from Formation Density are generally lower than those derived from the Sonic Log due to shaliness and possibly due to lack of consolidation. A slight decrease in sonic transit time on the Sonic Log between 1380 ft. and 2635 ft. suggests increased compaction while on the Formation Density Log a marked decrease in average bulk density suggests a marked increase in compaction.

(d) Sw

Derived from Archies Formula using the parameters derived as above.

III. INTERPRETATION

(a) Interval 978-1053 feet

Lithology - very fine grained or silty, poorly consolidated, calcarenite.

Rw - 0.18 ohm/m, salinity 29,000 ppm.

Rt - 1.0 ohm/m.

Porosity - 32-31%

Sw - 100%

Velocity - 6630 ft./sec.

(b) Interval 1053-1382 feet

Lithology - Limestone with bands of soft material.

Rw - 0.18 ohm/m salinity 29,000 ppm.

Rt - 2-3 ohm/m

Porosity - variable 22-33%

Sw - 100%

Velocity - 8640 feet/sec.

(c) Interval 1382-1800 feet (approx.)

Lithology - Limestone very fossiliferous poorly consolidated.

Rw - as above.

Rt - 1.5 ohm/m. (max. 3 ohm/m.)

Porosity - average 30% Resistive peaks 20%

Sw - 100%

Velocity - 9500 feet/sec.

(d) Interval 1800-2634 feet

Lithology - Limestone, formation density indicates marked increase in compaction probably correlateable with incoming of micrycrystalline clastics in samples.

Rw - .17 ohm/m. salinity 29,000 ppm.NaCl.

Rt - 1.1 ohm rising to 2.5 ohm in tight zones.

Porosity - 2287-2300
side wall cores 24%-35%)
formation density 24%-28%) average 25.0%

2619-2632
side wall cores 19%-24%)
formation density 19%-22%) average 20.5%

Sw - 100%

Velocity - 10,500 feet/sec.

(e) Interval 2634-2820 feet

Lithology - Limestone, very marly, tending to calcilutite. A marked formation change is suggested in all logs.

Rw - 0.11 ohm. salinity 42,000 ppm.NaCl. at 2640, 2700.

Rt - 1.0 ohm rising to 2.5 ohm.

Porosity - 22.5-28% (FD) Sonic log readings badly effected by shale.

Sw. - 100%

Velocity - 10,900 ft./sec.

(f) Interval 2820-3060 feet

Lithology - Calcilutite with bands of limestone and marl.

Rw - .17 ohm/m. salinity 29,000 ppm. NaCl.

Rt - 2.5 ohm/m.

Porosity - 14%-17%

Sw - 100%

Velocity - 10,200 ft./sec.

(g) Interval 3060-3645 feet

Lithology - Calcareous clay, marl and shale, no porous zon s.

IV. CONCLUSIONS

(i) The logged interval is entirely water bearing.

(ii) Well defined lithostratigraphic units are suggested by logs, cores and sidewall cores.

983-1053 feet Siltstone

---------- sharp boundary ----------

1053-2634 feet Limestone, very soft poorly consolidated, becoming more compact downwards.

---------- sharp boundary ---------

2634-3060 feet Marly limestone becoming more shaly downwards.

---------- possibly transitional ----------

3060-3645 feet Calcareous clay, marl becoming shaley downwards with rare thin bands of marly limestone.

(iii) The following velocities were calculated from the integrated Sonic Log.

Interval (ft.)	Thickness (ft.)	(m/secs.) Travel Time	Velocity (ft./secs.)
986-1053	67	9.3	7,200
1053-2634	1581	157.0	10,000
2634-3060	426	40.0	10,650
3060-3635	575	65.0	8,850

B.O.C. OF AUSTRALIA LIMITED

ASHMORE REEF WELL NO.1

DECEMBER, 1967 LOG INTERPRETATION 3650-6404 FEET

M.J.W. Lofting

1. INTRODUCTION

Consolidation surveys were run to 6404 feet consisting of an induction Electrical Survey and a Sonic/Gamma-Ray/Caliper Survey.

The Gamma-Ray failed to operate due to reasons as yet unknown. The panel appears inadequate to treat the pulses generated and is presently being stripped down.

II. NOTES

(a) General

The following parameters were used in the interpretation.

Rm 0.3824 @ 86°F; Rmf = 0.231 @ 83°F; Rmc = 0.595 @ 83°F.

B.H.T. = 149°F; Hole size = 12¼ inches.

(b) Rw

This parameter was derived using the SP and was checked by sonic/resistivity plots. Interval d, e, f, give Rw = 0.07 ohm/m from S.P. whereas the sonic/resistivity plot indicates that 0.055 ohm/m. is a better value. It seems probable that with the difficulty of picking a shale base line, the log is reading P.S.P.

(c) Rt

The induction curve was taken to read Rt. despite some invasion. It is noteworthy that the calcareous shales being tight show a much higher resistivity than the limestones which are salt water bearing.

(d) Porosity

Porosity was derived from the sonic log using Chart 37 having previously determined the velocity matrix line from a sonic/resistivity plot.

The porosity values determined are in good accord with those obtained from conventional cores.

(e) Sw

Derived from Archies formula using the parameters derived as above.

III. INTERPRETATION

(a)	Interval	3589 - 4010 feet
	Lithology	Shale and calcareous clay
	Rt	
	Velocity	8,100 ft./sec.

(b)	Interval	4010 feet - 4452 feet
	Lithology	Calcarenite with occasional beds calcareous shale.
	Rw	0.05 ohm/m = 90,000 ppm NaCl.
	Rt	0.5 ohm/m = calcarenite average. 1.0 - 2.2 ohm/m. = calcareous shale.
	Porosity sonic.	Calcarenite range = 20-27% Average 23% Resistive zones range = 9-19% Average 14%
	Sw	100%
	Velocity	11,800 ft./sec. Vm = 18,500 ft./s c.
(c)	Interval	4452 feet - 4760 feet
	Lithology	Calcilutite with beds of calcareous shale and occasional chert nodules
	Rw	0.55 ohm/m. ≐ 80,000 ppm NaCl.
	Rt	Calcilutite range 1.0 - 2.1 ohm/m; Average 1.4 ohm/m. Calcareous shale range 2.5 - 4.0 ohm/m; Average 2.95 ohm/m.
	Porosity	Calcilutite range 14-17%; Average 16% Calcareous shale range 9-14%; Average 12%
	Sw	100%
	Velocity	13,100 ft./sec.
(d)	Interval	4760 feet - 5728 feet
	Lithology	Calcarenite with bands calcilutite
	Rw	0.055 ohm/m; Salinity = 70,000 ppm
	Rt	Calcarenite 0.8 ohm/m. Calcilutite Range 1.5-3.8 ohm/m, Average 2.5 ohm.
	Porosity	Calcarenite Range 20-23% Average 22% Calcilutite Range 11-19% Average 15.5%
	Sw	100%
	Velocity	12,400 ft./sec. Vm 19,500 ft./sec.
(e)	Interval	5728 feet - 6180 feet
	Lithology	Mostly calcilutite
	Rw	0.055 ohm/m. Salinity = 70,000 ppm.
	Rt	Range 1.4-5.0 ohm Average 2.0 ohm
	Porosity	Range 12-21% Average 16%
	Sw	100%
	Velocity	14,000 ft./sec. Vm 21,000 ft./sec.
(f)	Interval	6180 feet - 6400 feet
	Lithology	Limestone with bands chert
	Rw	0.055 ohm/m. Salinity = 70,000 ppm

(f) Rt — Range 4.0-11 ohm/m.

Porosity — Average 9% rarely 16%

Sw — 100%

Velocity — 15,700 ft./sec. Vm 21,000 ft./sec.

Interval (ft.)	Footage (ft.)	Time (Microsec.)	Interval Velocity (H/sec.)
3589 - 4010	421	52	8,100 ft./sec.
4010 - 4452	442	37.5	11,800 ft./sec.
4452 - 4760	308	23.5	13,100 ft./sec.
4760 - 5728	968	78	12,400 ft./sec.
5728 - 6180	452	34	13,300 ft./sec.
6180 - 6400	220	14	15,700 ft./sec.
4010 = 6180 (average)	2170	171	12,700 ft./sec.

V. CONCLUSIONS

(i) The sequence is entirely water bearing.

(ii) The formation water has a salinity 70,000 - 90,000 ppm Cl^-

(iii) It is recommended that no further resistivity logs be run over this interval.

B.O.C. OF AUSTRALIA LIMITED

ASHMORE REEF WELL NO. 1

JANUARY, 1968 LOG INTERPRETATION 6404-8175 FT.

M.J.W. Lofting

I. INTRODUCTION

A complete suite of surveys, consisting of Induction-Electrical Survey, Sonic Log, Formation Density/Gamma Ray/Caliper Survey and Continuous Dipmeter Log, were taken as well as 30 sidewall cores.

II. NOTES

(a) General

The following parameters were used in the interpretation:-

Rm 0.48 @ 92°F., Rmf 0.33 @ 87°F., Rmc 0.64 @ 86°F. B.H.T. 158°F.
Hole size 12¼ inches.

(b) Rw

This parameter was derived using the SP curve. The values obtained above 7900 feet may be somewhat high, as the mud was more saline while drilling above this depth. Thus true Rmf and consequently true Rw, may be lower.

(c) Rt

The induction curve was taken to read Rt.

(d) Porosity

Porosity was derived from the Formation Density Log. The porosities obtained from the Sonic Log differed in many cases, often due to "shaliness". Further study will be required to explain other discrepancies.

(e) Sw

Derived from Archie's formula using the above parameters.

III. INTERPRETATION

(a) Interval 6404-6510 feet

Lithology - Limestone with chert bands.

Rw - 0.09 ohm/m. = 38,000 ppm. NaCl.
This resistivity compares with 0.055 ohm/m. obtained for the range 6180-6400 from the consolidation survey at 6404 feet. See comment in para. 11(b) above.

Rt - Range 2-12 ohm/m.

Porosity - 5-10%

Sw - 100%

Velocity - 16,100 feet/second.

(b) Interval 6510-7440 feet

Lithology - Alternations of Marl and Calcilutite

Rw - 0.12 ohm/m (may be less, see para 11(b)) = 27,000 ppm. NaCl.

Rt - Marl 1.0-3.0 ohm/m.
Calcilutite 1.0-10.0 ohm/m. with one peak to 20.

Porosity - Calcilutite 4-6% with thin zones to 25%.

Sw - 100%

Velocity - 13,100 ft./sec.

(c) Interval 7440-7685 feet

Lithology - Argillaceous Limestone.

Rw - 0.06 ohm/m. (may be less, see para. 11(b)) = 58,000 ppm. NaCl.

Rt - 2.5-7.2 ohm/m.

Porosity - 5-12%

Sw - 100%

Velocity - 15,300 ft./sec.

(d) Interval 7685-7956 feet

Lithology - Alternations of Marl and Calcilutite.

Rt - 3.5-15.0 ohm/m.

Velocity - 14,200 ft./sec.

(e) Interval 7956-8035 feet

Lithology - Silty Shale.

Rt - 3.0-7.5 ohm/m.

Velocity - 13,300 ft./sec.

(f) Interval 8035-8058 feet

Lithology - Lithic argillaceous sandstone.

Rw - 0.12 ohm/m. = 25,000 ppm. NaCl.

Rt - 1.8-3.0 ohm/m.

Porosity - 0-4%, peak to 9%

Sw - 100%

Velocity - 11,500 ft./sec.

(g) Interval 8058-8102 feet

Lithology - Limestone with lithic fragments

Rw - 0.12 ohm/m. = 25,000 ppm. NaCl

Rt - 5-15 ohm/m.

Porosity - 5%

Sw - 100%

Velocity - 15,000 ft./sec.

(h) Interval 8102-8124 feet

Lithology - Severely weathered basalt.

Rt - 1.5-2.2 ohm/m.

Velocity - 12,000 ft./sec.

(i) Interval 8124-8175 ft.

Lithology - Weathered basalt.

Rw - ? 0.05 ohm/m.

Rt - 2.0-6.7

Porosity - 0-15%

Sw - 100%

Velocity - 12,300 ft./sec.

IV. CONCLUSIONS

The sequence is entirely water bearing.

B.O.C. OF AUSTRALIA LIMITED

ASHMORE REEF WELL NO.1

LOG INTERPRETATION 8140 - 10171 FT.

M.J.W. Lofting

1. INTRODUCTION

The following surveys were run:

I.E.S.	10170 - 8140 ft.	Run No.5
Sonic/Caliper	10161 - 8140 ft.	Run No.5
Gamma Ray	10140 - 8000 ft.	Run No.4
Formation Density	10170 - 8140 ft.	Run No.3
Dipmeter	10160 - 8140 ft.	Run No.3
Sidewall Cores	as specified in Appendix	

The 9-5/8" casing shoe was located at 8140 ft. and the bottom of the 8½" hole was logged at 10,171 ft.

The memoriser of the conductivity curve failed during the Induction Electric Survey and a re-run was made. During the Sonic/Gamma Ray/Caliper Survey a hydraulic pressure leak caused the tension to slack off in the Rucker Compensating System, and resulted in unacceptable errors in the depth scale of the Schlumberger logs. After repairs to the hydraulic system the survey was re-run.

The surveys were initially intended for consolidation purposes but examination of the I.E.S. suggested certain lithological anomalies. To resolve these problems the Formation Density Log and sidewall cores were added to the programme. After taking 17 cores a fault in the electrical circuits terminated the operation and remaining cores will be taken during the next surveys.

Below the 9-5/8" shoe, down to 9138 feet, the hole is washed out to an average diameter of 11 inches. Below 9138 feet the hole condition is better, having an average size of 9 inches, with maxima and minima of 9-3/4 inch and 8½ inches, respectively.

II. NOTES

(a) The following physical parameters were used in the interpretation:

Rmf = .37 @ 82°
Rmc = .88 @ 81°
Rm = .59 @ 84°
BHT = 210° @ T.D.
Hole Size = 8½ inches

(b) Rw

Water resistivity was calculated using the very strongly developed SP curve. Rw is in the order of 0.034 ohms. equivalent to a salinity of 85,000 ppm.

By making formation density/resistivity plot (Chart 52) a similar value for Rw can be calculated from the equation $Rw = \frac{Ro}{F}$

(c) Rt

The induction curve was taken to read Rt.

(d) Porosity

The Sonic derived porosity is lower than the Formation Density porosity. It is tenatively suggested that the matrix velocity line used in Chart 37 should be higher than 18,000.

(e) Sw

Water saturation was derived from Archie's Formula, using the parameters as determined above.

III. INTERPRETATION.

Detail is given in the Appendix.

(a)	Interval	9143 - 9284 feet (Unit B - Sand 1)
	Lithology	Sandstone with thin shales near top. Net clean sand 92 ft.
	Rw	.034 ohm/m. @ 198°F equivalent salinity 85,000 ppm.
	Rt	0.5 - 0.9 ohm/m. High resistivity in this zone is associated with shaly bands.
	Porosity	Maximum 17.5%S - 19.5% FD Minimum 8.0%S - 9.0% FD Average 13.6%S - 18.2% FD
	Sw	100%
(b)	Interval	9305 - 9424 feet (Unit B - Sand 2)
	Lithology	Sandstone with interbedded shale. Net clean sand 70 feet.
	Rw	.034 ohm/m. @ 200°F equivalent salinity = 85,000 ppm.
	Rt	0.8 ohm/m. rising to 5 ohm. in tight sands
	Porosity	Variable 9% - 20%; good correlation at 9305 - 9314 between core, sonic and density derived porosity.
	Sw	100%
(c)	Interval	9446 - 9584 feet (Unit B - Sand 3)
	Lithology	Sandstone, massive with occasional bands shale and mudstone. Net clean sand 91 feet.
	Rw	0.034 ohm @ 202°F equivalent salinity 85,000 ppm.
	Rt	0.6 - 0.9 ohm/m. Tight shaly bed at top has Rt rising to 2.0 ohm.
	Porosity	17% FD 15%S
	Sw	100%

(d)	Interval	9606 - 9675 feet (Unit B - Sand 4)
	Lithology	Sandstone; with occasional bands mudstone Net clean sand 35 feet.
	Rw	0.0335 ohm/m. equivalent salinity - 82,000 ppm @ 204°F
	Rt	0.8 ohm/m rising to 2.9 ohm/m. in tight zone
	Porosity	13-14.5%
	Sw	100%
(e)	Interval	9742 - 9752 feet
	Lithology	Calcilutite
	Rt	5.0 ohm/m
	Porosity	very low
(f)	Interval	9753 - 9767 (Unit C - Sand 1)
	Lithology	Sandstone, silty, with interbedded siltstone. This unit is probably that sectioned with Core No.21 which almost certainly was logged 10 feet high. Net clean sand 10 feet.
	Rw	0.0335 ohm/m
	Rt	3.8 ohm/m.
	Porosity	11.5 - 12% by core, sonic and density.
	Sw	100%
(g)	Interval	9830 - 9927 feet (Unit C - Sand 2)
	Lithology	Sandstone locally becoming silty particularly downwards.
	Rt	0.6 - 1.4 ohm/m.
	Rw	0.032 ohm/m. equivalent salinity. 90,000 ppm @ 207°F.
	Porosity	Sonic; max. 16%; minimum 10%; Average 13.1% Density; max. 17.5%; minimum 12%; average 15.3%
	Sw	100%
(h)	Interval	10027 - 10140 feet (Unit C - Sand 3)
	Lithology	Sandstone, very fine grained tending to siltstone.
	Rt	2.0 ohm/m.
	Rw	0.037 ohm/m. probably affected by shaliness. Equivalent salinity 78,000 ppm @ 210°.
	Porosity	10-13% variable probably due to shale.
	Sw	100%

IV. SEISMIC

The following interval velocities were calculated from the integrated sonic log.

Interval (ft.)	Thickness (ft.)	Travel-Time (m-sec.)	Velocity (ft./sec)
8102 - 9143	1042	79.3	13120
9143 - 9675	532	38.4	13850
9675 - 10170	495	34.8	14210

V. LITHOLOGY

The surveys revealed firstly, that the interbedded volcanics logged in drill cuttings below 9400 feet are not present and secondly that areanaceous beds extend upwards to at least 9143 feet.

The interval between 9143 feet and 8950 feet cannot be shale because of its low radioactivity and is probably weather basalt or tuff but final definition must await confirmatory sidewall cores during the next log run.

The following general subdivisions are tentatively proposed:-

Unit A	8140 - 8950	Volcanics - definitely
	8950 - 9143	Volcanics - possibly tuff.
Unit B	9143 - 9675	Sandstone, massive very fine grained (Sand/Shale Ratio 1:0.61)
Unit C	9675 - 10170	Siltstones with massive beds very fine grained sandstone and occasional bands calcilutite. (Sand/Shale ratio 1:1.9)

The cavings from the volcanics present below the 9-5/8" casing have badly contaminated the underlying succession to an extent not realised while drilling. While drilling, the extremely fine grained sandstones were broken up and the grains passed completely through the screens. Normally this would have been recorded in the flow line mud sample, but with the high mud volumes and slow penetration rate the sand quantities did not rise above 1%.

VI. CONCLUSIONS

(i) The logged interval is entirely water bearing. The salinity of the water is approximately 85,000 ppm.

(ii) Three lithostratigraphic units are suggested although final definition must await further sidewall cores. It is certain that there are no interbedded volcanics below 9400 feet and it is very probable that volcanics are absent below 9143 feet.

B.O.C. OF AUSTRALIA LIMITED

ASHMORE REEF No. 1

LOG INTERPRETATION 10171 - 12843

1. INTRODUCTION

The following surveys were run :

Induction Electrical	Run No. 6	10000 - 11618	
Induction Electrical	Run No. 7	11000 - 12842	
Sonic/Gamma Ray/Caliper	Run No. 6	10000 - 11609	
Sonic/Gamma Ray/Caliper	Run No. 7	11400 - 12832	(G.R. lacks definition)
Epithermal Neutron	Run No. 1	9000 - 12838	
Formation Density/Gamma Ray/ Caliper	Run No. 4	10000 - 12837	(G.R. 11400 - 12837 only)
Continuous Dipmeter	Run No. 4	10000 - 12840	
Side wall cores	Runs 4, 5, & 6		
Formation Test	No. 1	9230	

The bottom of the 8-1/2" hole was logged at 12,843 ft., same as driller's depth.

The sidewall core guns proved very inconsistent and only 38 acceptable cores were obtained from 4 runs.

The hole is washed out to an average of 11" over most of the range and to over 14" in the ranges 11810 - 11860 and 11935 - 11970 ft. However, no difficulty was encountered in running the sondes.

11. NOTES

(a) The following parameters were used in the interpretation :

Depth	10170 - 11619	11619 - 12843
Rm	0.71 at 83°	0.51 at 100°
Rmf	0.41 at 80°	0.37 at 95°
BHT	240° at 11619	250° at 12843
Hole size	8-1/2"	8-1/2"

(b) Rw

Formation water resistivity was calculated using the SP curve, yielding the following values :

10171 - 12200 = 0.025 ohm/m, salinity 100 - 115,000 ppm NaCl
12750 - 12768 = 0.042 ohm/m, salinity 50,000 ppm NaCl.

(c) Rt

The induction curve was taken to read Rt.

(d) Porosity

The sonic-derived porosity values were used as it appears that these are nearest to the true porosity. The neutron yields high porosities in the sandstone ranges, indicating shaliness. The Formation Density is inconsistent. In the ranges above 11,500', 12360' - 12550' and 12575' - 12600' the Density yields higher porosities than the Sonic, but in the other limestones below 12000' it yields excessively low porosities.

(e) Sw

Water saturation was derived from Archie's Formula using the above parameters. Sw values are occasionally less than 100%, but can be attributed to optimistic porosity values from the Sonic due to shaliness.

111. INTERPRETATION

(a)	Interval	10,170 - 10590
	Lithology	Sandstone and silty shale. Sand/shale ratio 1 : 0.50
	Rw	0.025 ohm/m @ 220°F. Equivalent salinity 115,000 ppm NaCl.
	Rt	Sandstones 1.0 - 5.0 ohm/m.
	Porosity	Maximum 14% Velocity 14,330 ft./sec. Minimum 4% (limestone) Average 10%
	Sw	100%
(b)	Interval	10,590 - 10,740
	Lithology	Shale, with calcareous sandstone 10,708 - 10,720
	Rt	Sandstone : maximum 27.0 ohm/m
	Porosity	Sandstone 3 - 8% Velocity 14,560 ft./sec.
	Sw	Sandstone 100% (assuming Rw 0.025 ohm/m)
(c)	Interval	10,740 - 10,900
	Lithology	Sandstone and Shale. Sand/shale ratio 1 : 0.33
	Rw	0.025 ohm/m @ 230°F. Equivalent salinity 110,000 ppm NaCl.
	Rt	Sandstone 1.0 - 4.5 ohm/m with peaks 10,838 - 10846 9 ohm/m 10,878 - 10900 6 - 10 ohm/m (high due to shaliness)
	Porosity	6 - 11%, average 8%. Velocity 15,530 ft./sec.
	Sw	100%
(d)	Interval	10,900 - 11,213
	Lithology	Siltstone and shale, with thin calcareous sandstones and limestones.
	Rt	Sandstone 11,010 - 11020 : 2.2 - 3.8 ohm/m.
	Porosity	Sandstones/limestones 3 - 6% Velocity 10900 - 10005 : 14,000 ft./sec. 11005 - 11213 : 15,760 ft./sec.
	Sw	100%

(e)	Interval	11,213 - 11,526 ft.
	Lithology	Sandstone and shale. Sand/shale ratio 1 : 0.30
	Rw	0.025 ohm/m @ 240°F. Equivalent salinity 105,000 ppm NaCl.
	Rt	Sandstones 1.0 - 3.0 ohm/m.
	Porosity	Maximum 9% Velocity 15,190 ft./sec. Minimum 3% (limestone) Average 7%
	Sw	100%
(f)	Interval	11,526 - 11980 ft.
	Lithology	Sandstone, shale and siltstone. Sand.shale ratio 1 : 1.0
	Rw	0.026 ohm/m at 233°F. Equivalent salinty 100,000 ppm NaCl.
	Rt	Sandstones 3.5 - 11 ohm/m Limestones 16 - 34 ohm/m
	Porosity	Sandstones 3 - 13% Velocity 16200 ft./sec. Limestones 1 - 3%
	Sw	100%
(g)	Interval	11980 - 12176 ft.
	Lithology	Limestone, calcareous shale and siltstone.
	Rw	0.026 @ 233°F. Equivalent salinity 100,000 ppm NaCl.
	Rt	Limestones 9 - 40 ohm/m
	Porosity	Limestones 1 - 6% Velocity 16,200 ft./sec.
	Sw	100%
(h)	Interval	12176 - 12405 ft.
	Lithology	Limestone
	Rt	55 - 200 ohm/m
	Porosity	2%
	Velocity	20,000 ft./sec.
	Sw	100% (Assuming Rw = 0.025)
(i)	Interval	12405 - 12703 ft.
	Lithology	Limestone and calcareous Shale.
	Rt	14 - 180 ohm/m.
	Porosity	Limestones 2 - 4%
	Velocity	18,200 ft./sec.
	Sw	100% (assuming Rw = 0.025)
(j)	Interval	12703 - 12843 ft.
	Lithology	Shales and Sandstones
	Rw	0.042 @ 247°F.
	Rt	Sandstone 40 ohm/m.
	Porosity	Sandstone 2%
	Velocity	15,500 ft./sec.
	Sw	100%

1V. FORMATION TEST

The formation test at 9230 feet recovered 10750 ccs of mud filtrate and 2250 ccs of mixture of 10 - 13% formation water and 90 - 87% mud filtrate. The components of the mixture are estimated from the salinities of the sample, mud filtrate and the formation water. The salinity of the formation water is derived from the SP curve.

Maximum formation pressure measured was 4120 p.s.i.

Permeability was calculated to be 2.75 mds. This very low figure is presumably caused by "mudding" of the formation adjacent to the borehole. It is very likely that if a conventional production test was conducted the formation would be cleaned up and a more reasonable permeability would be indicated.

V. CONCLUSIONS

The logged interval is entirely water bearing. The salinity of the formation water is 100,000 ppm NaCl above 12,200 feet and 50,000 ppm NaCl in the range 12750 - 12768 feet. Sidewall cores confirmed that the base of volcanics is at 9143 feet.

APPENDIX

INTERPRETATION OF: INTERVAL 8140 - 10171 FT.

DEPTH	CORE	Δ+	Øs	Density P	ØFD	F FD	F S	Rw	FxRws	RII	Sw
9146 - 9152	-	72	12.0	2.38	15.0	35	60				100
9163 - 9168	-	67	8.0	2.5	9.0	110	145			1.8	100
9182 - 9194	-	74	14.0	2.39	15.0	37	42		1.36	0.8	100
9206 - 9284											
9208	-	72	12.0	2.40	15.0	37	60		1.25	0.9	100
9213	-	75	14.5	2.33	19.5	22	40		.80	0.5	100
9220	-	73	13.0	2.34	19.0	23	50		.80	0.6	100
9227	-	72	12.0	2.35	18.0	25	60		1.30	0.7	100
9235	-	72	12.0	2.33	19.5	26	60	.034	.90	0.8	100
9244	-	75	14.5	2.33	19.5	26	40		1.30	0.55	100
9248	-	77	16.0	2.34	19.0	22	32		.90	0.9	100
9253	-	79	17.5	2.34	19.0	22	26		1.1	0.65	100
9258 - 9274	-	77	16.0	2.38	16.0	32	32		1.1	0.7	100
9277 - 9284	-	73	13.0	2.45	12.0	60	50		2.0	1.7	100
9305 - 9424											
9305 - 9314	11.6	72	12.0	2.45	12.0	60	60		2.0	1.3	100
9316 - 9326	16.0	76	15.0	2.32	20.0	20	35		1.0	0.6	100
9333 - 9343	-	67	8.0	2.50	9.0	110	145		5.0	5.0	100
9352 - 9356	-	68	9.0	-	-	-	110		3.7	5.0	100
9362 - 9368	-	73	13.0	2.42	14.0	42	50	.034	1.5	1.5	100
9370 - 9383	-	73	13.0	2.47	11.0	75	50		2.2	0.8	100
9394 - 9406	-	74	14.0	2.38	16.0	32	42		1.2	0.8	
9406 - 9416	-	70	11.0	2.48	10.0	88	75		2.9	2.3	100
9418 - 9424	-	75	14.5	2.43	13.5	47	40		1.5	2.0	100
9446-9584											
9446 - 9456	-	66	7.5	2.48	10.0	88	170		2.9	2.0	100
9467	-	72	12.0	2.40	15.0	35	60		1.2	0.7	100
9473	-	72	12.0	2.37	17.0	28	60		1.0	0.6	100
9487	-	74	14.0	2.37	17.0	28	42		1.0	0.7	100

DEPTH	CORE	Δ+	Øs	Density P	ØFD	F FD	F S	Rw	FxRws	Ril	Sw
9500	-	72	12.0	2.38	16.0	32	60		1.1	1.6	100
9510	-	73	13.0	2.39	15.0	35	50	.034	1.2	1.0	100
9520	-	74	14.0	2.36	17.5	26	42		0.9	0.9	100
9530	-	74	14.0	2.38	16.0	32	42		1.1	0.8	100
9536	-	77	16.0	2.36	17.5	26	32		0.9	0.75	100
9565	-	78	17.0	2.35	18.0	25	28		0.85	0.55	100
9572	-	77	16.0	2.35	18.0	25	32		0.85	0.70	100
9578	-	76	15.0	2.30	21.0	19	35		0.70	0.55	100
9606 - 9653	-	73	13.0	2.38	16.0	32	50				
9660 - 9675	-	73	13.0	2.43	13.5	47	50			2.9	100
9742 - 9753	-	55	4.0	2.70	0	-	-			5.0	100
9753 - 9763	Core No.21 12	72	12.0	2.46	11.5	68	60			3.8	100
9830 - 9927											
9835	-	77	16.0	2.36	17.5	32	26	.032		0.6	100
9847	-	75	14.5	2.36	17.5	32	40			0.8	100
9857	-	73	13.0	2.37	17.0	28	50			1.0	100
9864	-	72	12.0	2.37	17.0	28	60			1.0	100
9873	-	69	10.0	2.45	12.0	60	88			1.1	100
9879	-	70	11.0	2.42	14.0	42	70	.032		1.4	100
9898	-	72	12.0	2.41	14.5	40	60			1.2	100
9908	-	74	14.0	2.40	15.0	35	42			1.4	100
9923	-	74	14.0	2.43	13.5	47	42			1.0	100
9934 - 9944	(1st)	52	4.0	2.67	3.0					42.0	100
10027 - 10076	-										
10031	-	84	21.0	2.32	20.0	20	19	.037		0.5	100
10044	-	73	13.0	2.42	14.0	42	50			1.5	100
10051	13.5	73	13.0	2.42	14.0	42	50	.037		0.9	100
10064	13.5	76	15.0	2.42	14.0	42	35			1.4	100
10116 - 10140											
10117		72	12.0	2.46	11.5	68	35			2.1	100
10130	Silt-stone	80	18.0	2.50	9.0	110	25			2.0	100

INTERPRETATION OF INTERVAL 10171-12843 FT.

CHART 55

DEPTH	Δt	Øs	~	Ød	Øn App List	Corr.	P	Ø	Fsl	FRw	Rt	Sw
10194-204	75	14	2.40	15	20	23	20	11	40	1.0	1.0	100
10212-15	72	12	2.43	13½	18	21	20	10	60	1.5	1.1	100
10222-55	71	11.5	2.43	13½	15-20	18-23	20	10	65	1.6	0.9-1.6	100
10292	70	11	2.42	14	20	23	23	10	70	1.75	1.7	100
10347	53	4	2.72		2	2			600	15.0	40	Tight
10359	75	14	2.46	11½	20	23	30	8	40	1.0	1.5	85
10373	70	11	2.50	9	16	19	24	5	70	1.75	2.7	85
10404-08	75	14	2.50	9	22	25	40	4	40	1.0	1.4	88
10412-16	70	11	2.46	11½	23	26	38	7	70	1.75	1.0	100
10430-36	71	11.5	2.32	20	22	25	12	18	65	1.6	1.0	100
10443-45	67	8.5	2.39	15½	20	23	20	13	120	3.0	2.0	100
10485	68	9	2.50	9	20	23	35	5	107	2.7	4.0	85
10506-10	70	11	2.45	12	17	20	23	9	70	1.75	1.4	100
10510-14	75	14	2.45	12	23	26	35	8	40	1.0	1.4	88
10517-35	Av.70	Av.11	Av.2.47	11	19	22	30	6	70	1.75	1.5	100
10550-78	Av.70	Av.11	Av.2.45	12	15	18	18	10	70	Av.1.75	0.6-2.5	100
10708-12	58	5	2.65	3½	3	3			380	9.5	40	Tight
10750-53	78	17	2.46	11½	20	23	30	8	27.5	0.69	1.5	70
10772-75	76	15	2.43	13½	16	19	18	10	35	0.9	1.0	100
10776-84	71	11.5	2.45	12	14	17	10	10	65	1.6	1.5	100
10790-96	68	9	2.47	11	14	17	20	7	107	2.7	2.5	100
10804-10	60	3	2.63	4½	8	8	15	0	1100	27.0	9.5	100
10814-26	Av.64	Av.6	Av.2.58	4	12	15	25	1	250	6.2	4.8-6.0	100
10838-40	64	6	2.52	8	9	12	8	7	250	6.2	6.2	100
10840-46	64	6	2.58	4	11	14	25	1	250	6.2	9.0	85
10850-58	67	8.5	2.50		11½	14½	18	9	120	3.0	3.5	100
10864-70	68	9	2.46		14	17	18	9	110	2.75	2.0	100

10878-82	63	5.5	2.52		10	13	18	6	300	7.5	8.5	100
10890	68	9	2.50		12	15	18	8	110	2.75	6.0	70
11018-24	56	3	2.71		4½	4½			1100	27.5	38	Tight
11088-90	55	5	2.80		5	5			380	9.5	30	"
11138-42	53	4	2.70		4	4			600	15.0	48	"
11160	54	4.5	2.75		6	4.5			500	12.5	32	"
11178	55	5	2.70		4½	5			380	9.5	40	"
11195	58	7	2.73		8	7			190	4.75	35	"
11220-40	Av.65	Av.7	2.47		14	17	18	9	190	4.75	1.0-1.8	100
11268	65	7	2.48		12	15	18	7	190	4.75	1.9	100
11278	67	8.5	2.55		15	18	30	2	120	3.0	1.3	100
11284	65	7	2.50		14	17	22	5	190	4.75	2.0	100
11298-317	Av.65	Av.6	Av.2.43		16	19	18	10	250	6.2	1.0-1.8	100
11323-38	64	6	2.47		14	17	18	9	250	6.2	1.1	100
11354-59	53	4	2.63		3	3			600	15.0	20	Tight
11380-82	60	3	2.58		7	7	2	6	1100	27.5	5.5	100
11390-92	63	5.5	2.63		10½	13½			300	7.5	2.8	100
11420-25	64	6	2.50		19	22	23	6	250	6.2	3.0	100
11435-40	?		2.45		12	15	10	10	250	6.2	1.3	100
11442-86	68	9	2.43		14	17	8	10	110	2.75	1.0	100
11494-98	72	12	2.70		15	18			60	1.5	0.8	100
11512-24	?		2.49		13	16	20	7			1.1	

VELOCITY SURVEY

ASHMORE REEF NO.1 WELL

by

B.O.C. OF AUSTRALIA LIMITED

Introduction

B.O.C. of Australia Limited contracted Western Geophysical Company of America to perform the velocity survey. Under the contract Western agreed to furnish the following:

Two Gulf-type Model GCE101 Pressure Sensitive Well Geophones
One Amplifier case including 12 S.I.E. P-11 Amplifier channels
One Amplifier case including 2 Water Break Amplifiers
One S.I.E. PRO-11 Camera with 12 galvanometer elements
Two battery type blasters
Two Kaar TR327 radios (Citizens Band type)
One portable developing system
Necessary power supplies, cabling etc.

In addition Western furnished one observer and one shooter. The survey was conducted on the 23rd and 24th of March 1968, at times convenient for the well operation.

Survey Procedures

The survey was conducted in very calm weather and at the Neap Tide period, when the tidal variations of the water level were very small.

1. Shot Positioning

The shots were fired to the northeast and southwest of the well. A reference geophone was lowered 25 feet below the water in the moonpool of the rig and was used to record the water break. The distances that shots were fired from the well were calculated from the water break times.

2. Explosives

Fifty pound charges of Dupont Nitromon WW were used for all well geophone stations. The majority of shot to well distances were between 1500 and 2000 feet.

3. Well Geophone Positioning

All depth measurements were made using the Schlumberger depth indicator and compensations were made for the tidal variations of the sea.

The following procedure was used to keep the geophone stationary in the bore hole when the shots were fired: the marine riser was disconnected from the derrick floor and lowered to the casing top; the Schlumberger cable was clamped with a T-bar device and the cable was lowered until the T-bar rested on top of the marine riser.

Instrumentation

The seismic instruments were set up behind the Schlumberger unit, on the port side of the upper deck on the "Investigator". The location permitted good communication with Schlumberger and the derrick floor. Eight traces were utilised on the survey records. Traces 1 through 4 monitored the well geophone at four different gain levels. Traces 5 and 6 monitored the well reference geophone in the moonpool. The time break was recorded on trace 7. Trace 8 was used for the 100 cycle timing checker trace. On the amplifiers receiving signals from the well geophone, wide band filtering, and fixed-gain recording mode were

used throughout the survey. The master gain levels were varied betw n shots in anticipation of the signal strengths to b recorded. Signals from the well reference geophone in the moonpool were passed through the two specially designed water break amplifiers.

Results

Shots were fired with the well geophone stationed at sixteen differ nt levels, ranging from 1360 to 12,710 feet below the Mean Low Water Spring tide datum. Check shots from opposing sides of the well were obtained at five different levels.

The results of the velocity survey have been shown on the attach d computation sheet and graph. The record quality varied from good to questionable, the majority being fair. Adequate check shots were obtain d to yield a reliable survey.

Conclusions

(1) The velocity survey will provide identification for the seismic reflection horizons recorded in the vicinity of the well.

(2) The velocity survey data comparable to the integrated Sonic Log data show fairly good overall agreement. It is felt that where the Sonic Logs are of good quality, a limited number of check shots, with the geophon stationed at intervals in excess of 2,000 feet, would be sufficient to provide absolute times to tie the Integrated Sonic data.

L. MacLean
11th April, 1968.

COMPARISON OF SONIC LOG INTEGRATED TIMES WITH VELOCITY SURVEY TIMES

ASHMORE REEF NO.1 WELL

Depth M.L.W.S.	Interval Thickness	Comparable Interval Times Sonic Log	Velocity Survey	Differences Observed
1360				
	1180	.1119	.1095	+.0024
2540				
	420	.0388	.0370	+.0018
2960				
	500	.0553	.0479	+.0074
3460				
	550	.0634	.0686	-.0052
4010				
	2450	.1893	.1918	-.0025
6460				
	400	.0325	.0341	-.0016
6860				
	600	.0421	.0407	+.0014
7460				
	700	.0492	.0475	+.0017
8160				
	1000	.0758	.0799	-.0041
9160				
	1000	.0713	.0709	+.0004
10160				
	800	.0459	.0464	-.0005
10960				
	1200	.0860	.0804	+.0056
12160				
	550	.0294	.0300	-.0006
12710				
	$\Sigma\Delta t$	.8909	.8847	+.0062

ASHMORE REEF No.1
S.P. NE
GEOPHONE DEPTH

ASHMORE REEF No.1
S.P.
GEOPHONE DEPTH

ASHMORE REEF No.1
R.N. 12
S.P. NE
GEOPHONE DEPTH 2580'

ASHMORE REEF No.1
R.N. 14
S.P. NE
GEOPHONE DEPTH

ASHMORE REEF No.1
S.P.
GEOPHONE DEPTH

ASHMORE REEF No.1
S.P.
GEOPHONE DEPTH

SHEET 1

ASHMORE REEF No. 1
S.P. NE 50 lb at 6'
GEOPHONE DEPTH
-477
-312

ASHMORE REEF No. 1
S.P. SW 50 lb at 6'
GEOPHONE DEPTH 4500'
-369
-570

ASHMORE REEF No. 1
S.P. SW 50 lb at 6'
GEOPHONE DEPTH 6500'
-460
-380

ASHMORE REEF No. 1
S.P. NE 50 lb at 6'
GEOPHONE DEPTH 6900'
-655
-330

ASHMORE REEF No. 1
S.P. NE 50 lb at 6'
GEOPHONE DEPTH 6000'
-697
-713

ASHMORE REEF No. 1
S.P. SW 50 lb at 6'
-780
-575

SHEET 2

ASHMORE REEF No-1

ASHMORE REEF No-1

ASHMORE REEF No-1

ASHMORE REEF No-1

ASHMORE REEF No-1

ASHMORE REEF No-1

ASHMORE REEF No. 1
R.N. 2 15:10 HRS 24 MARCH 1968
S.P. N.E. 50 lb at 6'
GEOPHONE DEPTH 12,200'
1947
373

ASHMORE REEF No. 1
R.N. 3 15:50 HRS 24 MARCH 1968
S.P. N.E. 50 lb at 6'
GEOPHONE DEPTH 12,750'
1978
343

ASHMORE REEF No. 1
R.N. 4 15:50 HRS 24 MARCH 1968
S.P. S.W. 50 lb at 6'
GEOPHONE DEPTH 12,750'
1978
276

CORE AND FLUID ANALYSES

LITHOLOGICAL SEQUENCE

(All Depths Below Permanent Datum)

UNNAMED QUATERNARY BEDS

160-330 No Samples; mud returns to sea floor.

330-400 Limestone; white, abundant foraminifera, minor lamellibranch and coral fragments, poorly consolidated, good intergranular porosity.

400-495 No Samples; complete loss of circulation.

495-540 Limestone; white, abundant foraminifera, minor lamellibranch and coral fragments, poorly consolidated, good intergranular porosity.

540-1053 Calcarenite; white to cream, very fine to fine graned, poorly sorted, angular calcareous fragments, very minor angular quartz, unconsolidated, good intergranular porosity, with rare very thin beds of crystalline limestone.

---------- u n c o n f o r m i t y ----------

UNNAMED EARLY MIDDLE-LATE LOWER MIOCENE BEDS

1053-1382 Limestone; white to cream, fine grained, dolomitic, minor corals, foraminifera and lamellibranchs, mostly soft, good intergranular and vugular porosity, with minor beds of Mudstone; greyish green, calcareous.

1382-2635 Limestone; white to light brown, very finely crystalline, partly dolomitic, foraminifera increasing towards base, good intergranular and vugular porosity.

---------- d i s c o n f o r m i t y ----------

UNNAMED EARLY LOWER MIOCENE BEDS

2635-2818 Limestone; white to cream, cryptocrystalline to microcrystalline, locally soft, foraminiferal, Calcilutite; white to greenish grey, up to 40% argillaceous material, foraminiferal, poor intergranular porosity.

2818-3062 Calcilutite; light grey to light green, up to 5% foraminifera, bryozoa and echinoderms, slightly pyritic, locally tending to marl (30-40% calcareous). Interbedded Limestone; bluish grey, marly, foraminiferal, fairly hard, probably gradational with limestone in overlying unit and with the marl of the underlying "Cartier Beds". Basal contact is drawn at the last upwards occurrence of marl.

'CARTIER BEDS'

3063-3104 Marl; light grey to light green, with up to 5% foraminifera, bryozoa and echinoderms, slightly pyritic, calcareous (35-65%) more compacted than previous calcilutite.

3104-3334 Marl; light grey to light green, calcareous (35-65%), fossiliferous.

3334-3413 Marl; as above with higher resistivity.

3413-3884 Shale; light grey to light green, locally silty, partly pyritic with pyrite replacing fossils (mostly foraminifera), less than 35% calcareous material, very slightly glauconitic and micaceous, with occasional beds of Marl; pale green plastic, calcareous content gradationally greater than the shale.

3884-4009 Interbedded Marl (78%) and Shale (22%), both lithologies as above. Upper contact is gradational. Contact with underlying unit is sharp.

---------- d i s c o n f o r m i t y ----------

'HIBERNIA BEDS'

4009-4484 Calcarenite; white to cream, dominantly fine to very fine grained, minor silt sized grains, compacted, mainly composed of calcareous clastics with minor amounts of white to cream calcareous matrix, slightly dolomitic, rarely fossiliferous, fair to good intergranular porosity with rare interbeds of Calcilutite, white to cream, microcrystalline, foraminiferal, pyritic and abundant Chert nodules; dark grey, translucent, slightly calcareous.

4484-4760 Calcilutite; white to cream, entirely clay sized calcareous mat rial, minor pyrite and glauconitic, fossiliferous (mostly foraminifera); abundant chert nodules, dark grey, translucent.

4760-4783 Calcarenite; white to cream, hard, silt sized to very fine grained.

4783-5040 Calcilutite (70%) interbedded with Calcisiltite (30%); Both lithologies intergradational, white to cream, hard, calcareous matrix with minor argillaceous material, minor pyrite, fair intergranular porosity. Nodules and possibly thin interbeds of Chert.

5040-5556 Calcisiltite (60%), as above; with interbedded calcilutite (40%).

5556-5730 Calcisiltite, as above.

The above four units comprise a gradational sequence.

5730-6177 Calcilutite; (85%) light creamy-buff, hard, composed predominantly of calcareous silt and calcareous clay, minor silt sized quartz and argillaceous material, rare pyrite and unidentified black minerals, minor fossils, locally tending to Calcarenite (15%) cream to buff, hard, microcrystalline with shale laminae rarely pyritic, fossiliferous, very slightly dolomitic; minor Shale; dark grey, firm, fissile, calcareous, silty in part, pyritic, carbonaceous and micaceous. Chert present throughout as thin bands and nodules.

6177-6512 Calcilutite; (13%) light creamy-buff as before, with increasing amounts of calcareous cement, becoming dominantly Limestone; (87%) cream to buff, micro to cryptocrystalline, hard, massive, homogenous, mostly calcareous, very slightly dolomitic, rarely pyritic and fossiliferous, poor fracture porosity; with Chert; white to grey, slightly calcareous, as thin bands and nodules.

6512-6576 Limestone; white cream or buff, hard, dense, argillaceous as above with Chert nodules throughout and interbedded Marl; light grey to light green, soft, never less than 60% calcareous material, slightly glauconitic and pyritic, fossiliferous. This is a gradational unit between the overlying limestone and the underlying marl.

6543 'WOODBINE BEDS'

Note: The upper contact of the 'Woodbine Beds' is chosen at the first downwards appearance of marl in the lithological sequence. The continuity of the interbedded limestone lithology across the contact attests to the gradational and conformable nature of the contact.

6576-6823 Marl; light green to dark grey, soft, approximately 55% calcareous, argillaceous, slightly glauconitic. At 6717 feet one bed of Limestone, white to cream, microcrystalline entirely clay sized particles, hard, 90% calcareous, slightly pyritic and fossiliferous, zero to poor fracture porosity underlain by Calcareous Shale; grey to green, fissile, up to 35% calcareous but dominantly argillaceous.

6823-6857 Marl; as above with calcareous content increasing downwards locally tending to Limestone as above. Unit is transitional upwards and downwards.

6857-7007 Limestone; cream to light grey, mainly microcrystalline, partly cryptocrystalline, hard, 90% calcareous, rarely dolomitic, minor fossils (foraminifera) very minor pyrite and glauconite, zero to poor fracture porosity, with rare thin beds Marl; argillaceous.

7007-7188 Calcilutite; white to light brown, lithographic, soft, mostly calcareous, partly argillaceous, minor chlorite replacing fossil remains, locally grading into Marl; light grey, light green, dark grey, soft but compact, 65-50% calcareous, argillaceous, pyritic, chloritic.

7188-7273 Marl; light grey to light green, dark grey, soft but compact, 65-50%, calcareous, pyritic, argillaceous content variable locally tending to Calcilutite; white to light brown, lithographic, soft, 80% calcareous, partly argillaceous, minor chlorite replacing fossil remains.

7273-7440 Calcilutite; as above with minor interbedded Marl as above.

7440-7687 Limestone; light brown to brown, microcrystalline, massive, compact, almost entirely calcareous, variable minor ferruginous or manganese material, rare fossils, zero to poor fracture porosity, abundant limonitic styolites throughout, with minor iron-rich Chert nodules towards base.

7687-7956 Marl; light greenish grey, soft, approximately 40% calcareous, grading to Calcilutite (greater than 65% calcareous) below 7835. Basal contact is sharp.

---------- u n c o n f o r m i t y ----------

UNNAMED UPPER JURASSIC BEDS

7956-8031 Shale; dark grey to black, hard, fissile, slightly calcareous to non-calcareous, very fine mica throughout, minor pyrite and glauconite, minor fossils, current bedded with thin beds of Marl; light grey, soft, argillaceous, calcareous.

8031-8054 Lithic Sandstone; green to grey, medium grained dominantly argillaceous with grains of opaque volcanics and rare quartz, fresh felspar (labradorite), fossiliferous, with a green, highly glauconitic matrix.

8054-8102 Calcarenite; light brown to greenish grey, with friable subangular to subrounded fragments of dark greenish grey volcanic fragments and subangular, hard, calcite fragments, set in a brown, cryptocrystalline, calcareous cement, slightly fossiliferous, rarely ferruginous, zero to poor porosity.

ASHMORE VOLCANIC BEDS

8102-8172 Altered Amygdaloidal Basalt, dark grey, with phenocrysts in groundmass containing irregularly shaped feldspar aggregates of green chlorite and calcite which resemble amygdales with interbedded claystone, grey, light chocolate to brown to plastic, slightly calcareous, silty, foraminiferal, glauconitic.

8172-8975 Ultra-basic Volcanics; mainly Olivine basalt, dark greenish grey to bluish grey, hard, fresh in part, composed of green and black phenocrysts of olivine, augite and calcium feldspar, set in a dark grey to black groundmass containing chlorite, analcite and calcite as accessories. Amygdales of calcite common in some zones with minor iron oxides; interbeds of Tuff, light grey, light green, light brown and cream with dark grey, volcanic glass throughout as well as variously coloured angular volcanic fragments.

8975-9143 Highly weathered volcanics.
Tuff as above.

---------- u n c o n f o r m i t y ----------

UPPER UNNAMED UPPER TRIASSIC CLASTIC BEDS

9143-9674 Sandstone; light grey to light brown, very fine, fine to medium grained with occasional silty bands and rare conglomeratic bands, mainly well sorted, subangular to subrounded partly recrystallized, friable, quartzose, common thin bands rich in carbonaceous, micaceous and argillaceous material, minor kaolinitic matrix, moderate to good porosity with occasional 5-15 feet beds of Shale; dark grey, partly fissile, mainly argillaceous, locally very micaceous, slightly pyritic and carbonaceous. Possibly becomes less fissile towards base.

9674-9742 Siltstone; dark grey to brown, dominantly argillaceous, slightly quartzose, micaceous, carbonaceous and Shale as above with minor Sandstone, white to light grey, very fine to fine grained, well sorted, subangular to subrounded, partly recrystallised, quartzose, slightly pyritic, minor amounts of kaolinitic and calcareous matrix, poor to moderate porosity.

9742-9752 Calcilutite; dark grey to dark brown, lithographic, up to 75% calcareous, slightly quartzose, no porosity, rarely fossiliferous.

9752-9830 Siltstone and minor Sandstone; as above.

9830-9933 Sandstone; white to light grey, very fine to fine grained, well sorted, subangular to subrounded, friable, almost entirely quartzose, slightly pyritic with minor amounts of silt sized quartz matrix, moderate to good porosity with one thin band near base of Shale; dark grey, fissile, hard, very micaceous in part, slightly carbonaceous.

9933-9946 Limestone; buff to light brown, cryptocrystalline, zero porosity, rarely fossiliferous, with varying amounts of medium to coarse grained, well rounded, clear quartz grains.

9946-10025 Siltstone; dark grey to brown, dominantly argillaceous, locally tending to Shale and Mudstone; grey, very calcareous, micaceous, carbonaceous, probably fossiliferous with several very thin bands of Limestone; dark grey to dark brown, lithographic, up to 75% calcareous, partly argillaceous and quartzose, zero porosity, minor fossils.

10025-10303 Sandstone; white to light grey, well sorted, subrounded, partly recrystallised, very fine grained almost entirely quartzose, slightly pyritic with minor amounts of kaolinitic, calcareous or silt sized quartz matrix, moderate to good porosity locally tending to Siltstone; with interbedded Shale, dark grey, fissile, hard, locally very micaceous, slightly carbonaceous. Rare beds of Limestone as above.

10303-10338 Siltstone; dark grey, dominantly argillaceous as above.

10338-10357 Limestone; buff to light brown, cryptocrystalline, up to 70% calcareous, traces of dolomite, remainder quartzose with coarse to very coarse rounded grains of clear quartz, grades into an extremely calcareous Sandstone; nil porosity, slightly fossiliferous.

10357-10404 Siltstone; dark grey hard argillaceous, micaceous, carbonaceous dominantly Sandstone; white to light grey, very fine grained subrounded, rarely medium grained subangular, good to moderate sorting, locally friable, mostly quartzose, slightly micaceous, carbonaceous and pyritic, with variable amounts of kaolinitic matrix and siliceous cement, moderate porosity, rarely good porosity.

10404-10590 Sandstone with Interbeds of Siltstone and Shale:

Sandstone, (54%) white to light grey, dominantly very fine grained and subrounded but some medium grained and subangular, good to moderat sorting, variable amounts of kaolinitic matrix and siliceous cement, micaceous, carbonaceous, pyritic with interbedded Siltstone, (35%) dark grey, argillaceous, micaceous, carbonaceous, pyritic, hard and Shale, (11%) dark grey to dark brown, silty, micaceous, in part carbonaceous and pyritic, slightly calcareous.

10590-10703 Shale; dark grey to dark brown, hard, silty, micaceous locally carbonaceous, and pyritic, slightly calcareous, minor quartz.

10703-10897 Sandstone; brownish grey, very fine to rarely medium grained, silty, quartzose, subrounded to subangular, moderate sorting, variably calcareous, slightly kaolinitic, locally pyritic, compact, rarely friable grading to Siltstone; light to dark grey, subangular, clear quartz, compact, matrix clay sized and non-calcareous, slightly carbonaceous and micaceous. Interbeds of Shale dark grey to dark brown, hard, silty, micaceous, locally carbonaceous and pyritic, slightly calcareous.

10897-11004 Shale, medium to dark grey, 4% calcareous, soft, non-fissile, thinly bedded.

11004-11216 Limestone with Interbedded Siltstone and Shale:

Limestone, (50%) white to light grey, cryptocrystalline, slightly carbonaceous, mostly unfossiliferous but some fragmental fossils, brittle to soft with interbedded Siltstone (41%) and Shale (9%) as above.

11216-11524 Sandstone; white to light grey, fine to medium grained, compact, britti , partly recrystallised rounded, well sorted, mostly quartzose, slightly carbonaceous with up to 20% kaolinitic matrix, moderate to poor porosity. Minor beds of Shale, dark grey to brown, rarely silty, slightly calcareous, micaceous and pyritic, rarely dolomitic. Thin Limestones at the top white to light grey; cryptocrystalline or lithographic, brittle to soft, slightly carbonaceous, minor fossils.

11524-11657 Shale; dark grey, silty, compact, brittle, calcareous content increasing with depth (up to 50%) slightly dolomitic, micaceous and pyritic, fossiliferous (Pelecypods and Foraminifera).

11657-11715 Sandstone with Interbeds of Siltstone and Shale at base:

Sandstone; (60%) light grey, medium grained to silt sized, subrounded, moderate sorting, clear quartz grains, 5% siliceous cement, pyritic, compact, brittle with interbedded Siltstone; (17%) dark grey, argillaceous, slightly calcareous, pyritic, carbonaceous, micaceous, hard and Shale; (23%) dark grey, silty, partly calcareous, pyritic, carbonaceous, hard.

11715-11763 Limestone; buff to cream, mostly microcrystalline, some cryptocrystalline, pure but grades to Shale, traces of recrystallised fossils, with thin non-calcareous shale interbeds.

11763-11812 Sandstone; light grey, very fine to fine grained, rarely medium grained, subangular, well sorted, strongly recrystallised mainly quartzose, very pyritic, partly carbonaceous, poor porosity, grading into a Sedimentary Quartzite white to light grey crystalline displaying no grain boundaries, mostly siliceous, partly pyritic. In thin section displays numerous fine to coarse quartz grains with solution intergrowth common. Minor shale dark grey, non-calcareous, very carbonaceous.

11812-11864 Interbedded Siltstone, Shale and Quartzite as above.

11864-11935 Quartzite; as above.

11935-11980 Siltstone; as above interbedded with Quartzite; as above.

UNNAMED UPPER TRIASSIC CARBONATE BEDS

11980-12115 Limestone; light grey to light brown, cryptocrystalline, hard, up to 85% calcareous slightly dolomitic and pyritic, argillaceous and quartzose, fossiliferous (corals and bryozoa), nil porosity with interbedded Calcareous Shale, light grey, poorly fissile, up to 45% calcareous, slightly quartzose, rarely fossiliferous at following depths.

12,041-12,047; 12,060-12,065; 12,068-12,070.

12-15-12148 Siltstone; brown, hard and brittle, strongly indurated, pyritic with minor grains of quartz, calcite and kaolin set in a brown argillaceous and siliceous cement non-calcareous. Minor Chert at the top. Grades into an impure quartzite i.e. a strongly indurated protoquartzite.

12148-12703 Limestone; grey brown to very pale brown, crystalline, to cryptocrystalline, almost entirely calcareous, slightly dolomitic with rare fragments containing oolites. Becomes dark brown below 12290, cryptocrystalline entirely calcareous with a concoidal fracture. Nil porosity. Below 12460 are thin irregular Shale beds, dark grey slightly calcareous, fossiliferous. These become more common towards the base.

LOWER UNNAMED UPPER TRIASSIC CLASTIC BEDS

12703-12843 Siltstone; light grey to white and brown, hard, brittle, quartzos , with 10% calcareous and siliceous cement, poor porosity grading into a Sandstone white, hard, brittle, very fine to fine grained, moderate sorting, subrounded quartzose with a calcareous and siliceous cement, slightly kaolinitic, poor porosity with interbedded Limestone; dark brown, entirely calcareous as before and Shale dark grey, slightly calcareous.

T.D. 12843 Driller
12843 Schlumberger

LOG OF CORES

B.O.C. OF AUSTRALIA LIMITED

CORE DESCRIPTIONS

ASHMORE REEF WELL NO. 1

All conventional cores were cut into three slabs with the exception of Core No.18 (cut into two with one slab sent to the University of Western Australia and the other to B.M.R. Canberra for Subsidy Entitlement). One of the three slabs was sent to each of the following:-

(i) University of Western Australia for age investigation and later stored at Core Laboratories Storehouse, Mills Street, Bently, Perth.

(ii) Bureau of Mineral Resources, Canberra, for Subsidy Entitlement.

(iii) Bureau of Mineral Resources, Canberra, for Micro-palaeontological Examination.

B.O.C. OF AUSTRALIA LIMITED

CORE NO.	INTERVAL & RECOVERY	DESCRIPTION
1.	1125' - 1152' Recovered 9" (3%)	LIMESTONE; white to cream, fragments vary from fine to very coarse, minor fossil fragments mainly foraminifera, good intergranular and vugular porosity.
2.	2286' - 2310' Recovered 14½ ft. (60%)	FORAMINIFERAL LIMESTONE. Two types are present with both grading into each other. (1) White to cream, composed of cream calcareous clastics (1 mm. to maximum of 2 cms.) and foraminifera (40% of rock) as well as minor fragments of light grey to light blue calcareous clastics. All are set in a light brown to cream calcareous cement which contains significant numbers of small well formed calcite or dolomite crystals. Good intergranular and vugular porosity is present throughout. Semi-consolidated. (2) Light brown, composed of up to 60% forams generally white, minor black ones. Porosity is fair to poor and mostly vugular. Harder than type (1). No petroleum indications.
3.	2619' - 2644' Recovered 13' (52%)	CALCILUTITE; light grey to light brown crossed horizontally by large numbers of white and dark grey calcareous streaks. Fossils (30% foraminifera) generally lie parallel to colour bands. Approximately 40% of the rock is cream calcareous clastics set in a light grey to light brown cement or matrix, poor vugular porosity, interbedded with Coquinite light and dark grey, hard, well compacted grading into the calcilutite. Foraminifera are present with the two large forams dominant. One is biconvex and tends to distort the other disc shaped type. The latter is dominant and has distinct concentric ornament. Increasing numbers of a black biconvex foram are present towards the base. Porosity poor. It is probable that there is little to no dip.
4.	2901' - 2928' Recovered 22 ft. (81.5%)	CALCILUTITE; white to light grey, generally clay sized with the white zones rich in silt sized calcite grains. From 2907 to 2912 ft. and 2916 to 2923 ft. there are large numbers of very thin disc shaped foraminifera with their long axes mainly parallel and extending across core. Often they are present in clusters and are then randomly orientated. In areas between the abovementioned bands very fine fossils are present. No obvious porosity is present. Dip is probably horizontal.
5.	3212' - 3240' Rec. Nil	

6.	3245' - 3270' Rec. Nil	
7.	3622' - 3645' Recovered 16 ft. (70%)	SHALE; grey, fissile, silty in part, argillaceous, slightly micaceous and up to 25% calcareous with very fine unidentifiable fossil fragments as well as minor foraminifera often replaced by pyrite. Towards the base, areas of light grey fragments of microcrystalline limestone occur up to 2" across, generally partly rounded with a sharp contact with the surrounding Shale. These are probably clastics and are much harder than the Shale. The fissility would indicate probably zero dip. No indication of hydrocarbons.
8.	4036' - 4063' Recovered 26 ft. (97%)	CALCARENITE; white to light brown, granular, with equal amounts of silt sized, very fine grained and fine grained, calcareous clastics, slightly dolomitic and fossiliferous with thin bands rich in elongated fragments, possibly fossil remains, good to fair intergranular porosity. A possible break in deposition occurs at 4059'6" where there is a sharp break downwards from white to light blue calcareous material. This grades back to the white to light brown type by 4060'6". Above this disconformity are very thin laminations of black possibly carbonaceous and or ferruginous material which are primary bedding structures. Secondary structures or Styolites are present throughout. All styolites show only minor irregularity, i.e. they do not appear as a wriggly trace but as a straight or curved line. Dip: Nil; strong odour of H_2S when core is broken.
9.	4540' - 4566' Recovered 25½ ft. (98%)	CALCILUTITE; white to cream, microcrystalline, almost entirely calcareous with fossils common throughout. Porosity is fair to poor and is probably intergranular and vugular. Most vugs seen are associated with fossils. Chemical structures including nodules and styolites are present throughout. Nodules composed entirely of Chert are found in the top six feet of the core. They vary from ½" to 4" across. They have a regular outline but are often branching. Styolites are rare and poorly developed. Towards the base, zones enriched with glauconite or chlorite are present. The basal and most outstanding zone has a sharp upper contact with the base grading back into the Calcilutite. Large amounts of pyrite often in cubes are present in this zone which extends across most of the core. Fossils include Pelecypods, Foraminifera and Crustacea. No apparent dip; strong sulphide odour when core is broken.
10.	5020' - 5035' Recovered 15 ft. (100%)	CALCILUTITE; cream to light brown, microcrystalline, or microgranular, almost entirely calcareous minor pyrite throughout, generally in cube form, fossils absent. Porosity is

poor and where present is a result of fracturing. This is particularly apparent at the base of the core where there is a slickenslide coated with clear crystals of dolomite. Throughout the core but more concentrated in the top foot are laminations slightly darker than the surrounding material, still very calcareous and probably due to increasing amounts of carbonaceous or argillaceous material. These are completely irregular and change shape and direction considerably. Also present throughout are well developed styolites.

Dip; probably horizontal with a strong sulphide odour when core is broken.

11.	5535' - 5553' Recovered 14 ft. (78%)	CALCILUTITE; light buff grey, dense, tough, composed essentially of calcareous mud, probably mainly of clastic rather than chemical origin; small fraction of quartzose silt, non calcareous clay and silt sized grains of a black mineral dispersed through the rock; calcareous cement; irregular bands and patches of very fine grained Calcarenite (a slightly coarser version of the Calcilutite) and of small streaks of dark grey and black carbonaceous material, indicate a lack of dip or very low dip. Light bluish grey nodules of Chert with off-white haloes and irregular to rounded shapes commonly less than an inch across are scattered throughout the core; the nodules which are only slightly calcareous are of secondary origin. The core is intersected by many irregular fractures which commonly dips at high angles; fracture planes show developed slickensides which impart a styolitic appearance; fracture planes are lined with fine calcite crystals and a dark carbonaceous material. Intergranular porosity is very poor.
12.	6022' - 6042' Recovered 20 ft. (100%)	LIMESTONE; mottled light greenish-grey, massive, tight, microcrystalline with scattered lath-like aggregates (mainly less than ¼" long) of very finely crystalline pyrite and other dark minerals; the laths are surrounded by very light green limestone (suggesting secondary origin ? replacement of organic matter) which gives the rock a faint mottling; the laths are elongate, both normal and parallel to the length of the core. Very thin wavy and sub-horizontal laminae of dark Shale appear noticeably at about 6024 feet; the laminae become more obvious downwards and at 6025.5 feet, several Shale laminae in a zone about ½" thick are present. The SHALE is firm to hard, fissile, calcareous and slightly pyritic, silty, carbonaceous and micaceous. The Limestone grades downwards into CALCILUTITE which is semi-crystalline in the upper part only. It grades from very light greenish-grey to creamy-buff; it consists of calcareous mud and silt (partly recrystallised in the upper part) bound into a firm rock with calcareous cement; quartzose silt and non-calcareous clay form about 10-20% of the rock; silt-sized grains of pyrite and a black mineral are scattered through the rock.

Several zones, up to 4" thick, of wavy laminations and streaks of dark Shale are present; the zones are commonly associated with well-developed styolites. The calcilutite shows several small-scale sedimentational structures including load-casts, convolutions and flame structures; shaly laminae are depressed below and arched over, pillow-like structures, which appear to be load-casts; the sedimentational structures give the rock a faint mottling. Several light grey rounded CHERT nodules, about an inch across, are present in the calcilutite; one nodule has a styolitic boundary with the host rock and shaly laminae are arched over it.
At about 6037 feet several dark bluish patches with irregular outlines, consist in part of crystals of calcite and very finely crystalline pyrite, with rims highly concentrated in pyrite; the origin of the bluish colour is unknown.
Irregular fractures intersect the calcilutite at high angles; the fractures are lined with calcite in places. The shaly laminae indicate negligible dip. Very poor intergranular porosity is probably present in the non-crystalline calcilutite.
Fracture porosity is also present.

13.	6520' - 6533' Recovered 10 ft. (77%)	LIMESTONE; with minor thin beds enriched with argillaceous material. Limestone; white to cream, made up mainly of clay or smaller than clay sized particles with large amounts of microcrystalline calcite and up to 20% argillaceous material, slightly pyritic associated with a black metallic like mineral, very minor carbonaceous material and clear angular quartz grains. Porosity is poor to nil and due entirely to fractures. Approximately vertical fractures often less than 1" apart are present throughout. Brecciated zones associated with these are also present. Crystals of calcite are often present along these fractures. Evidence of faulting in the form of a pronounced slickenside surface is present at 6524'. This runs at an angle of 40 degrees and has a coating of argillaceous material. Running parallel with this are a number of minor fractures. The Limestone is compact and hard. Argillaceous rich bands up to 3" thick are present throughout with an upper gradational surface with the Limestone and generally a sharp lower boundary. Thin argillaceous and possibly carbonaceous lamellae are present with no less than 65% calcareous material. These lamellae can be extremely thin and irregular in shape and extent. They indicate a possible dip of up to 10 degrees.
14.	6730' - 6748' Recovered 18 ft. (100%) 6730' - 6731'6"	CALCILUTITE' white to cream, entirely clay sized, hard with 90% calcareous material, minor pyrite and quartz, rare glauconite and fossils. Porosity is poor to nil. Two Styolites are present both approximately ¼" thick and both made up of partly calcareous, argillaceous and phosphatic material. No fracturing is present in this interval.

	6731'6" - 6741'	CALCAREOUS SHALE; grey to green with all particles clay sized, fissile, slightly glauconitic and pyritic, up to 25% calcareous material. All pieces disintegrate readily. Dark streaks bearing no relation to the bedding are present throughout. These have a greater calcareous content than the surrounding material. It is possible that some of glauconite present has replaced the original forams. There is a sharp break with the overlying calcilutite which is probably a disconformity only.
	6741' - 6748'	MARL; grey entirely clay sized, fissile with less glauconite than previous interval, minor pyrite with up to 50% calcareous material. It is also harder and does not disintegrate as readily as the previous interval. Slickenside surfaces indicating minor faulting is present in both argillaceous intervals.
15.	7252' - 7267' Recovered 13½ ft. (90%)	MARL grading into thin beds of CALCILUTITE. MARL; light and dark grey, grading from equally calcareous and argillaceous to 75% calcareous, fissile pyritic with large grains of pyrite up to an inch in diameter, also replacing or infilling fossils; minor amounts of flaky elongated chlorite. This is probably chamosite and replaces compressed fossil remains. Individual beds or laminae of marl with the same calcareous content are generally thin i.e. the core is composed of a large number of thin grey and dark grey areas with the dark grey areas containing increased amounts of argillaceous material. Boundaries are gradational. Irregularly shaped darker areas are also common and were probably pockets of more argillaceous oozes. Often these are composed of predominantly silt sized material. Unidentifiable fossil remains and foraminifera are present throughout. CALCILUTITE; white to light grey, probably rarely crystalline, composed almost entirely of clay sized material, approximately 80% calcareous with most of the remainder argillaceous, partly pyritic with fossils common, also containing darker irregular bodies of more argillaceous material as present in the Marl. The upper boundaries of the Calcilutite beds (range up to 6" thick) are quite often sharp while there is always a gradation of the lower boundary into a Marl. A zone of Marl at 7260' indicates a dip of approx. 2-3 degrees as well as minor compaction before the deposition of the overlying rock. The water current appears to have eroded this surface forming a microintraformational breccia above the darker Marl.
16.	7575' - 7590' Recovered 15 ft. (100%)	LIMESTONE; light brown to brown, tending to a pinkish brown in part, massive, microcrystalline, compact but not hard, almost entirely calcareous with varying but small amounts of ferruginous material throughout, numerous fossil fragments

throughout with few recognizable. Forams are present (Globotruncana). All fossils are present as dark brown calcareous outlines infilled with the microcrystalline groundmass. This groundmass contains numerous dark brown calcite fragments which vary from 0.5mm down to approx. the same size as the surrounding material.
Styolites are present throughout particularly in the darker zones in which there can be up to four per foot. They vary in thickness from very thin traces up to ½" thick and are composed entirely of limonite. Any colour changes in the Limestone occurs across these styolites. On rare occasions crystals of fibrous calcite also occur in the styolites. Vertical fractures are common and often only ½" apart. A fault plane is present at the base of the core associated with minor brecciation as well as fibrous calcite recrystallization along the fault plane. A slickenside surface is also associated with this fault.
Porosity is poor and never exceeds 10%. It is probably due entirely to fractures.

17. 8016' - 8023'

Recovered 4 ft. (57%)

SHALE; dark grey to black, hard, massive when fresh but fissile when dry, occasional shell fragments and crinoids, otherwise only very slightly calcareous or non-calcareous, very fine mica flakes throughout, rare pods of pyrite, glauconitic, current bedded.

18. 8281' - 8290'

Recovered 9 ft. (100%)

BASALT; black, composed predominantly of black and green phenocrysts of pyroxene and olivine set in a black pyroxene and felspathic groundmass. No other minerals including quartz appear to be present. The core is completely homogenous except for an irregularly shaped zone of chlorite and calcite approx. ½" thick at 8285' and a 1" thick darker and finer grained bed of volcanic material at the base of the core. Surrounding this irregular vein of chlorite and calcite, the rock has been altered to a light brown colour. The alteration extends no more than ¼" into the volcanic material.
The dark band at the base of the core would indicate that the dip does not exceed 5 degrees.

19. 8835' - 8844'

Recovered 7½ ft. (83%)
8835' - 8836½'

WEATHERED BASALT; dark grey, hard but containing large numbers of very thin hairlike fractures mostly filled with a light blue-green mineral, also contains quite large numbers of irregularly shaped vesicles and amygdales of calcite. All tend to be elongated at approx. 45 degrees to the axis of the core. The groundmass is black and contains numerous grains of a black mineral rarely greater than 1 mm. across. These tend to be lineated in approx. the same direction as the elongated amygdales mentioned above. The fractures are probably due to movement of the lava just prior to solidification.

8836½' - 8842½'

BASALT; dark grey, very hard, only slightly weathered with the composition almost identical to top interval, rare vesicles with the ones present still containing calcite. Slickenside

surfaces, common and contain quite large numbers of calcite crystals (up to 5 mm. across) and large amounts of chlorite. Fracturing of the rock in the vicinity of these surfaces is normal. The fine black phenocrysts mentioned in the previous section are also present. No flow indications are present. The boundary with the upper interval again appears to make an angle of approximately 45 degrees with the axis of the core.

20.	9295' - 9314'	SHALE; dark grey, poorly fissile, slightly micaceous and pyritic. (9295'-9295'8").
	Recovered 19 ft. (100%)	
	9295'8" - 9297'9"	SANDSTONE; white to light brown, medium grained rarely coarse, subrounded to subangular, recrystallised in part, well sorted, almost entirely quartzose, with minor amounts of kaolinitic matrix, fair to good intergranular porosity grading in a CONGLOMERATE which is dominantly quartzose with quartz grains up to 4 mm. across and minor light grey Shale fragments up to 12 mm. across. Groundmass is fine to medium grained quartz.
	9297'9" - 9298'2"	SILTSTONE; very light grey, almost entirely quartzose, partly micaceous, very pyritic with circular slightly darker bodies of quartzose material rarely greater than 5 mm. across throughout; grading into SHALE; dark grey as before and generally very micaceous.
	9298'2" - 9301'	SANDSTONE; white to light grey, porous as before. Across this interval are very thin bands of black, very carbonaceous and micaceous material. All mica is orientated parallel to the bedding plane.
D. Priscom !!!	9301' - 9304'6"	SILTSTONE; with rare beds of tight SANDSTONE. SILTSTONE; very light grey, grading into a very fine SANDSTONE, dominantly quartzose, micaceous and kaolinitic, poor porosity throughout.
	9304'6" - 9305'2"	SHALE with numerous thin beds of SILTSTONE.
	9305'2" - 9305'6"	SHALE and SILTSTONE both as before.
	9305'6" - 9316'8"	SANDSTONE; light brown, medium grained, subangular well sorted, almost entirely quartzose with excellent intergranular porosity and permeability. Irregularly directed bands of very fine grained quartzose material are present throughout.
	9316'8" - 9317'	SHALE as before with thin irregularly shaped SILTSTONE bodies as before. The boundary between the two lithologies is always irregular and often marked by a graduation of the SHALE from brown to the original dark grey.
21.	9741' - 9755'	
	Recovered 14 ft. (100%)	

9741' - 9744'	CALCILUTITE; very dark grey, very hard, 68-88% calcareous, argillaceous, ? carbonaceous.
9744' - 9744'6"	MUDSTONE; very dark grey, very hard, brittle, 0-9% calcareous, 22% dolomitic, ? carbonaceous.
9744'6" - 9753'6"	SANDSTONE; dark grey, hard, brittle, very fine to fine grained, locally medium to coarse grained moderate sorting, subangular to subrounded, almost entirely clear quartz grains, muscovite, occasional light brown to buff calcareous grains, frequent carbonaceous, micaceous laminations, up to 5% cement, argillaceous, locally siliceous and, above 9751'6", slightly calcareous. A 2 mm. thick dark brown coal lamination occurs at 9749'. Calcite pods and veins below 9750'. Laminations are very irregular and wavy. Sandstone is generally broken up into rounded pods surrounded by carbonaceous and mudstone laminations, suggesting depositional movement. Irregular dips varying from horizontal to 30 degrees are most probably depositional. Slickensides occur along a fault plane from 9752'9" to 9753'6". The fault dips at 70 degrees. The slickensides indicate that movement was 25° from vertical.
9753'6" - 9755'	SANDSTONE as above interbedded with MUDSTONE, very dark grey, very hard, brittle, 2% dolomitic, non-calcareous, ? carbonaceous: Minor steep fractures, infilled with carbonaceous material, calcite or mudstone, with displacements of up to -3/4" visible. These appear to be sedimentary. Sandstone laminations, up to -3/4" thick, can be seen broken into blocks about 1" long, mudstone filling the areas between the pieces. May be the result of slumping.

22. 10048' - 10063'

Recovered 15 ft. (100%)

10048' - 10060'6"	SANDSTONE; light brown, up to 95% very fine grained with remainder fine grained, well sorted, subrounded, recrystallised in part, dominantly quartzose, slightly micaceous, carbonaceous and lithic rarely felspathic with minor areas rich in pyrite. (Large carbonaceous remains are present throughout). The matrix is mostly kaolinitic rarely calcareous with the kaolin varying from 5 to 15% of rock. When kaolin is more common, the amount of calcareous matrix also increases. Porosity is poor, rarely moderate. Minor laminations of dark grey to black argillaceous micaceous and carbonaceous material is present throughout. When broken these exhibit a rough glossy surface. One poorly developed slickenside surface is present. It is quite rich in pyrite.
10060'6" - 10063'	SHALE with minor beds of SANDSTONE. SHALE dark grey to black, partly fissile, mainly argillaceous, partly carbonaceous, variably micaceous with minor pyrite nodules and numerous thin darker more carbonaceous beds.

SANDSTONE; light grey, very fine grained to silt sized rich in argillaceous material where it grades into the Shale, dominantly quartzose, completely irregular in shape, often present as small lenses. In one bed approx. 3" thick, excellent cross-bedding is present. Both top-set and fore-set beds are apparent. Sedimentary structures in the shale include flow-casts and well developed assymetrical ripple marks with the high angle side on the up dip side of the ripple.

Fluorescence: brown organic remains in both the Sandstone and the Shale exhibit a dull gold fluorescence with a strong bluish white cut. Although the Sandstone does not exhibit any fluorescence it gives a light green solvent fluorescence. Neither types of fluorescence effect the colour of the solvent.
The solvent with the carbonaceous remains was a very pale yellow but this was probably due to the carbonaceous material, not the fluorescing material.
The fluorescent solvent was left to stand with a piece of absorbent paper immersed in it.
(1) Carbonaceous remains fluorescence. When the $CHCl_3$ had evaporated, a yellow to pale brown sand approximately 1/8 inch thick remained.
(2) Sandstone solvent fluorescence.
This had two indistinct rings. The lower one is brown and approx. 0.4" thick. Above this is a pale yellow band approximately 0.3 inches thick. There is a poorly defined graduation between the two bands. This fluorescence is due to diesel oil from the drilling mud.

23. 10575' - 10583'

Recovered 8 ft. (100%)

10575' - 10581' SANDSTONE; whitish grey, hard, silt to very fine grained, rounded to subrounded, good sorting, almost entirely quartzose, clear grains, up to 20% clear to cloudy siliceous cement, locally kaolinitic, abundant carbonaceous, micaceous laminations usually wavy occasionally current bedded, locally pyritic, one 1 mm. thick coal.

10581' - 10583' Interbedded SANDSTONE as above and SILTSTONE; dark brown, hard, carbonaceous, micaceous, argillaceous.

24. 11024' - 11035'

Recovered 11 ft. (100%)

11024' - 11035' CALCAREOUS SHALE with minor bands of Silty Limestone and Fragmental Fossiliferous Limestone.

SHALE; dark grey, argillaceous, calcareous 20%, slightly micaceous and carbonaceous, non fissile, massive, abundant shelly fossils, minor parallel, transverse and near vertical thin veins of white, finely crystalline calcite - one inch vertical discolations.

SILTY LIMESTONE; light grey, silty, hard; clear quartz, silt grains set in dark grey cryptocrystalline calcareous cement 60%. Uneven discontinuous thin bands, finely laminated, non porous.

FRAGMENTAL FOSSILIFEROUS LIMESTONE; 82% carbonate light grey, finely crystalline, hard, dense, abundant shells, minor black silty Shale laminations contorted due to consolidation, non porous, silty fraction quartzose.

25. 11716' - 11724'

Recovered 8 ft. (100%)

11716' - 11724' SHALE, very dark grey, blocky, compact, non-calcareous, micromicaceous with larger flakes on bedding planes, fine pyrite and pods of pyrite up to ½" thick, carbonaceous throughout, light grey silty laminations and elongated pods of dark brown Shale (? worm borings), thin layers of coal fragments, one mixed with calcite. Laminations are rarely continuous, being mostly wavy, broken and, in one place, slumped. Steep fractures throughout, filled with dolomite from 11,722'3" to 11,722'7", otherwise with no filling.

26. 12060' - 12070'

Recovered 10 ft. (100%)

12060' - 12065' CALCAREOUS SHALE, light grey, very brittle and hard, containing thin discontinuous lighter grey, more calcareous bands, slightly pyritic and dolomitic.
Shelly limestone band at 12061'9".

12065' - 12068' LIMESTONE; light grey, cryptocrystalline, slightly dolomitic with thin discontinuous darker grey, calcareous Shale.

12068' - 12070' Calcareous SHALE as for 12060' - 12065'.

Fracturing.

Minor horizontal and oblique fractures infilled with cream crystalline Calcite; one small druse cavity with dog-tooth-spar calcite.

27. 12423' - 12433'

Recovered 10 ft. (100%)

12423' - 12433' LIMESTONE with thin irregular zones of calcareous SHALE.
LIMESTONE, dark brown, either sublithographic or cryptocrystalline, between 90 and 100% calcareous slightly pyritic, minor black fossil remains all probably the same Brachiopod with a pronounced crenulate ornament, numerous thin veins of calcite and one large vein of dickite(?). The Limestone towards the base has areas rich in clear transparent crystals of dolomite. SHALE; dark grey non-fissile, up to 20% calcareous, partly pyritic,

completely irregularly distributed throughout, slightly fossiliferous. Structure Core is made up of large fragments of Limestone from 6" to 2 feet thick separated by thin Shale zones. These zones generally have a sharp boundary with the Limestone and show quite a marked lineation of fossil and fine Limestone fragments parallel with the borders. However, not all borders are sharp and many are either gradational or extremely disrupted.

SIDE WALL CORE DESCRIPTIONS

Run. No. 1

Depth:		
2638	S.W.C. No.30	Recovery 1½"
	LIMESTONE, marly, cream, fairly soft, foraminiferal.	
2640	S.W.C. No.29	Recovery 1-3/4"
	LIMESTONE, marly, cream, fairly soft, foraminiferal.	
2675	S.W.C. No.28	Recovery 3/4"
	LIMESTONE, marly, light greenish grey, fairly hard, foraminif ral.	
2693	S.W.C. No.27	Recovery 1½"
	LIMESTONE, marly, cream, fairly soft, foraminiferal.	
2695	S.W.C. No.26	Recovery 1½"
	LIMESTONE, marly, cream, fairly soft, foraminiferal.	
2730	S.W.C. No.25	Recovery ½"
	LIMESTONE, marly, light grey, fairly hard.	
3045	S.W.C. No.24	Recovery 1"
	LIMESTONE, marly, bluish grey, fairly hard, foraminiferal.	
3055	S.W.C. No.23	Recovery 1"
	LIMESTONE, marly, bluish grey, fairly hard, foraminiferal.	
3065	S.W.C. No.22	Recovery 1½"
	CLAY, greenish grey, fairly hard, calcareous.	
3095	S.W.C. No.21	Recovery 1½"
	MARL, greenish grey, fairly hard, foraminiferal.	
3250	S.W.C. No.20	Recovery 1¼"
	CLAY, greenish grey, fairly hard, calcareous.	
3252	S.W.C. No.19	Recovery 1-3/4"
	CLAY, greenish grey, fairly hard, calcareous.	
3254	S.W.C. No.18	Recovery 1-3/4"
	CLAY, greenish grey, fairly hard, calcareous.	
3256	S.W.C. No.17	Recovery 2"
	CLAY, greenish grey, fairly hard, calcareous	
3258	S.W.C. No.16	Recovery 1-3/4"
	CLAY, dark grey, 30% calcareous, friable.	
3260	S.W.C. No.15	Recovery 1-3/4"
	CLAY, greenish grey, fairly hard, calcareous.	

Run No.1

3262 S.W.C. No.14 Recovery 2"
CLAY, greenish grey, fairly hard, calcareous.

3264 S.W.C. No.13 Recovery Nil

3266 S.W.C. No.12 Recovery 2"
CLAY, greenish grey, fairly hard, calcareous

20 3268 S.W.C. No.11 Recovery 1½"
CLAY, greenish grey, fairly hard, calcareous.

3270 S.W.C. No.10 Recovery 2"
CLAY, greenish grey, fairly hard, calcareous.

3272 S.W.C. No.9 Recovery 1-3/4"
CLAY, greenish grey, fairly hard, calcareous.

3274 S.W.C. No.8 Recovery 2"
CLAY, greenish grey, fairly hard, calcareous.

3276 S.W.C. No.7 Recovery 1½"
CLAY, greenish grey, fairly hard, calcareous.

25 3278 S.W.C. No.6 Recovery 1-3/4"
CLAY, greenish grey, fairly hard, calcareous.

3280 S.W.C. No.5 Recovery 2"
CLAY, greenish grey, fairly hard, calcareous.

3370 S.W.C. No.4 Recovery 1½"
CLAY, greenish grey, fairly hard, calcareous.

3380 S.W.C. No.3 Recovery 1¼"
CLAY, greenish grey, fairly hard, calcareous.

3453 S.W.C. No.2 Recovery 1½"
CLAY, greenish grey, fairly hard, calcareous.

3455 S.W.C. No.1 Recovery 1½"
CLAY, greenish grey, fairly hard, calcareous.

Run No.2

3895 S.W.C. No.60 Recovery 1-3/4"
CLAY, dark grey, 30% calcareous, friable.

3983 S.W.C. No.59 Recovery 3/4"
CALCILUTITE, grey, slightly argillaceous, friable.

4207 S.W.C. No.58 Recovery ½"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

4637 S.W.C. No.57 Recovery ¼"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

4730 S.W.C. No.56 Recovery ½"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

4886 S.W.C. No.55 Recovery ¼"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

4965 S.W.C. No.54 Recovery 1½"
CALCILUTITE, light grey, argillaceous, friable.

5085 S.W.C. No.53 Recovery 3/4"
CALCILUTITE, whitish grey, non-argillaceous.

5095 S.W.C. No.52 Recovery ½"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

5252 S.W.C. No.51 Recovery 3/4"
CALCILUTITE, whitish grey, non argillaceous.

5682 S.W.C. No.50 Recovery 1"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

5688 S.W.C. No.49 Recovery ½"
CALCILUTITE, whitish grey, slightly argillaceous, friable.

5760 S.W.C. No.48 Recovery ½"
CALCILUTITE, brownish grey, argillaceous, friable.

5770 S.W.C. No.47 Recovery 3/4"
CALCILUTITE, whitish grey, non-argillaceous, friable.

5800 S.W.C. No.46 Recovery 3/4"
CALCILUTITE, whitish grey, non-argillaceous, friable.

6127 S.W.C. No.45 Recovery ½"
CALCILUTITE, brownish grey, 5% argillaceous, rare specks of glauconite, friable.

6140 S.W.C. No.44 Recovery 3/4"

LIMESTONE, brownish grey, cryptocrystalline.

6196 S.W.C. No.43 Recovery ¼"

LIMESTONE, buff, cryptocrystalline, trace argillaceous, fairly hard.

6215 S.W.C. No.42 Recovery ½"

LIMESTONE buff, cryptocrystalline, trace argillaceous, fair to zero porosity.

7135 S.W.C. No.41 Recovery 1½"

MARL, light grey, friable.

7891 S.W.C. No.40 Recovery ¼"

CLAY, with hard fragments, light grey, calcareous, Chert.

7967 S.W.C. No.39 Recovery ½"

CLAY, light grey, fairly soft, plastic.

8045 S.W.C. No.38 Recovery 3/4"

CLAY, dark green, calcareous, plastic.

8050 S.W.C. No.37 Recovery 3/4"

CLAY, dark greenish grey with brown specks, calcareous, plastic.

8070 S.W.C. No.36 Recovery ½"

CALCARENITE, white with subrounded grains (maximum diameter 1mm.) 5% glauconite, 5% light brownish clay, 10% cryptocrystalline calcareous, hard matrix, poor porosity.

8085 S.W.C. No.35 Recovery 3/4"

VOLCANICS, dark greenish grey, slightly calcareous.
LIMESTONE with 30% subangular to subrounded fragments of hard dark greenish grey volcanics 20% subangular hard Calcite fragments, 50% light brown, cryptocrystalline, calcareous matrix. Fragments a maximum of 4mms. across. Porosity poor to zero, ferruginous matrix particularly close to boundary with volcanics.

8106 S.W.C. No.34 Recovery 1½"

VOLCANIC CLAY, dark brown, soft, with a white unknown mineral quit common. This could be kaolin or zeolites and varies from brittle crystals to a noncalcareous powder.

8109 S.W.C. No.33 Recovery 1¼"

VOLCANIC CLAY, dark brown, soft as above.

Run No.2

8154 S.W.C. No.32 Recovery 1½"

VOLCANIC CLAY, light brown, calcareous, soft, with inclusion of the white mineral and minor fragments of only slightly weather d dark grey to black volcanics with maximum diameter of 1 mm.

8160 S.W.C. No.31 Recovery ¼"

VOLCANICS, dark grey, hard, trace calcareous only, slightly weath red.

Runs 3 & 5

8900 S.W.C. No.150 Recovery ½" (broken)

VOLCANICS, light and dark grey, unweathered.

9000 S.W.C. No.149 Bullet lost

9020 S.W.C. No.148 Recovery 3/4" (broken)

VOLCANICS, dark grey, fresh.

9115 S.W.C. No.147 Bullet lost

9138 S.W.C. No.146 Recovery 1"

VOLCANICS, strongly weathered.

9150 S.W.C. No.145 Recovery 1" (shattered)

SANDSTONE, white, fine grained, good sorting, subrounded, clear quartz, siliceous and calcareous cement, friable, fair to good porosity.

9176 S.W.C. No.144 Recovery 3/4" (shattered)

SANDSTONE, white, medium grained, good sorting, subrounded, cl ar quartz, siliceous and slightly calcareous cement, friable, fair to good porosity.

9190 S.W.C. No.143 Recovery 1½"

SHALE, very dark grey, fissile, hard.
SILTSTONE, dark grey, hard, probably siliceous, nil porosity.

9200 S.W.C. No.142 Recovery 3/4"

½ SILTSTONE, dark grey, micaceous, quartzose, pyritic, laminated.
½ SANDSTONE, white, medium grained, subrounded, quartz grains, friable, fair porosity.

9230 S.W.C. No.141 Recovery 3/4" (broken)

SANDSTONE, white, fine to coarse grained, subangular, clear quartz, friable, fair to good porosity.

9270 S.W.C. No.140 Recovery 1" (broken)

SANDSTONE, light to medium grey, fine grained, good sorting, rounded, clear quartz, abundant pyritic cement, friable, fair porosity.

9294 S.W.C. No.139 Recovery 1"

SHALE - 3/4 dark grey, fissile, brittle non calcareous.
¼ light grey, non fissile, brittle, calcareous.

9400 S.W.C. No.78 Recovery 1"

SANDSTONE, white, very fine grained, minor fine grained, moderate sorting, subangular, compact, dominantly quartzose, very minor lithics, up to 10% kaolinitic matrix, poor to moderate porosity (dependent on the amount of matrix).

9434 S.W.C. No.77 Recovery 1"

MUDSTONE, dark grey, slightly micaceous, no obvious fissility.

S.W.C. No.76 Recovery - Misfire.

9485 S.W.C. No.138 Recovery 3/4"

SANDSTONE, light grey, medium grained, good sorting, rounded to subrounded, clear quartz, trace calcareous, thin carbonaceous band, good porosity.

9530 S.W.C. No.75 Recovery 1" (badly fractured)

SANDSTONE, white, 60% fine, 40% medium grained, moderate sorting, subangular to subrounded, almost entirely quartzose, rare kaolinitic matrix, good apparent porosity, friable, minor recrystallization.

9555 S.W.C. No.74 Recovery ½" (badly fractured)

SANDSTONE, white to light grey, very fine and coarse grained, minor medium grained, poorly sorted, subrounded to subangular, mainly quartzose, rarely lithic, often up to 10% kaolinitic matrix, moderate to good porosity, minor recrystallization, semi-consolidated.

9600 S.W.C. No.73 Recovery 1"

SHALE and SANDSTONE. SHALE dark grey to dark brown, non calcareous. SANDSTONE, brown, very fine grained, well sorted, quartzose, slightly calcareous with large amounts of argillaceous matrix, poor porosity.

9620 S.W.C. No.72 Recovery 3/4" (badly fractured)

SANDSTONE, white, very fine grained, semi-consolidated, moderate sorting, subangular, partly recrystallised, almost entirely quartzose with up to 10% kaolinitic matrix, moderate porosity.

9660 S.W.C. No.71 Recovery 3/4"

SILTSTONE and MUDSTONE. SILTSTONE, light grey, hard, dominantly quartzose, argillaceous in part, very kaolinitic, poor porosity. MUDSTONE, dark grey.

9680 S.W.C. No.70 Recovery 1-3/4"

SHALE, dark grey, micromicaceous, partly fissile.

9730 S.W.C. No.69 Recovery 1" (badly fractured)

SILTSTONE, dark grey to black, mainly argillaceous, rare zones of quartzose material, slightly micaceous and carbonaceous.

9843 S.W.C. No.68 Recovery 1"

SANDSTONE, white, almost entirely very fine grained, rarely fine grained, well sorted, friable, subangular to angular, minor recrystallization, dominantly quartzose with rare zones up to 5% kaolinitic.

9918 S.W.C. No.67 Recovery ½"

SANDSTONE, light brown (due to mud filtrate) very fine grained, partly silt sized, moderate sorting, subrounded, quartzose, slightly lithic and micaceous with up to 15% kaolinitic matrix, poor porosity.

9925 S.W.C. No.66 Recovery 3/4" (badly fractured)

SILTSTONE, white, rarely very fine grained, very kaolinitic, mainly quartzose, poor porosity containing thin bands of grey, very micaceous, argillaceous material.

9970 S.W.C. No.65 Recovery 1½"

MUDSTONE, grey, slightly micaceous, very calcareous, very minor amounts of brown Limestone.

10033 S.W.C. No.64 Recovery 1¼"

SILTSTONE, light grey, very slightly very fine grained as before, but containing less matrix. Porosity is fair to good and th sample is friable. There is no evidence of recrystallization.

10120 S.W.C. No.63 Recovery ½" (badly fractured)

SILTSTONE, light grey, slightly very fine grained, dominantly silt sized, moderately sorted, mainly quartzose with large but varying amounts of kaolinitic matrix, poor to moderate porosity. Quartz grains tend to be subrounded to rounded and slightly cloudy.

10138 S.W.C. No.62 Recovery 1"

SANDSTONE, with thin SHALE beds. SANDSTONE, white, light grey to grey, fine to medium grained, moderate sorting, subangular, dominantly quartzose, argillaceous where it contacts Shale, moderate to poor porosity. SHALE dark grey, soft, partly fissile, slightly carbonaceous, micaceous.

10160 S.W.C. No.61 Recovery ½" (badly fractured)

SANDSTONE, white to pale brown, dominantly fine to medium grained, partly very fine and coarse grained, friable, poorly sorted, subangular to subrounded, partly recrystallized, slightly cloudy to cloudy quartz with up to 5% matrix, slightly calcareous, mostly silt sized quartz, good porosity.

11856 S.W.C. No.137 Recovery mud cake only.

11910 S.W.C. No.136 Recovery 1/8" (shattered)

SANDSTONE, light grey, fine grained, moderate sorting, subrounded clear quartz, kaolinitic slightly calcareous matrix, hard, fair porosity.

12048 S.W.C. No.135 Recovery 3/4"

LIMESTONE, grey, silty, friable, nil porosity.

12085 S.W.C. No.134 Recovery ¼" (shattered)

SILTSTONE, dark grey, argillaceous, dense, hard, carbonaceous, CLAY, dark brown, very carbonaceous, calcareous.

12100 S.W.C. No.133 Recovery 1" (shattered)

LIMESTONE, light grey, cryptocrystalline, friable, dense, nil porosity.

12126 S.W.C. No.132 Recovery 2¼"

CLAY, cream, kaolinitic, pyritic, hard, slickensides. Minor SILTSTONE, black and carbonaceous, partly very fine grained, quartzose.

12142 S.W.C. No.131 Bullet lost

12148 S.W.C. No.130 Recovery 3/4" (shattered)

LIMESTONE, white, cryptocrystalline, fractured.

12170 S.W.C. No.129 Recovery ¼" (shattered)

LIMESTONE, cream, cryptocrystalline, dense, nil porosity, fractured, slickensides.

12330 S.W.C. No.128 Recovery ½" (shattered)

LIMESTONE, light grey, cryptocrystalline, hard, brittle, slightly argillaceous, nil porosity.

12418 S.W.C. No.127 Recovery ½" (shattered)

LIMESTONE, light brown, cryptocrystalline, hard, brittle, nil porosity.

12568 S.W.C. No.126 Recovery 2"

LIMESTONE, white and light grey, cryptocrystalline, and microcrystalline, hard, brittle, slickensides, nil porosity, minor very fine grained quartz.

12710 S.W.C. No.125 Recovered mud cake only.

12730 S.W.C. No.124 Recovery ½" (broken)

LIMESTONE, light to dark grey, cryptocrystalline, speckled with light angular fragments, hard, brittle, nil porosity, minor very fine grained quartz.

12760 S.W.C. No.123 Recovered mud cake only.

12786 S.W.C. No.122 Recovered mud cake only.

12795 S.W.C. No.121 Recovery 3/4"

SANDSTONE, white to light grey, fine grained, rare medium grained, moderate sorting, subrounded clear quartz, micaceous, carbonaceous, slightly calcareous, kaolinitic matrix, poor porosity with minor Shale laminations.

Run No.4

12813 S.W.C. No.119 Recovery 1¼"

SHALE, dark grey, fissile, hard and brittle, non-calcareous.

12813¼ S.W.C. No.118 Recovery ½"

SHALE, dark grey, fissile, hard and brittle, non-calcareous.

12813½ S.W.C. No.117 Recovery 1½"

SILTSTONE, medium grey, quartzose, slightly calcareous, dolomitic, micaceous and carbonaceous, very hard.

12813-3/4 S.W.C. No.116 Recovery 3/4"

SHALE, dark grey, non calcareous, hard, fissile. Parting planes parallel to length of core.

S.W.C. No.115 Recovery Nil

S.W.C. No.114 Recovery Nil

S.W.C. No.113 Recovery Nil

12814-3/4 S.W.C. No.112 Recovery ¼" (shattered)

LIMESTONE, light brown, cryptocrystalline, hard and brittle, non porous.

12815 S.W.C. No.111 Recovery Nil

12815 S.W.C. No.110 Recovery 1" (shattered)

LIMESTONE, light brown, cryptocrystalline, hard and brittle with conchoidal fracture, non porous.

12815¼ S.W.C. No.109 Recovery 1" (shattered)

LIMESTONE, light brown, cryptocrystalline, hard, brittle, fractured with thin coatings of white cryptocrystalline calcite. Non porous.

S.W.C. No.108 Misfire

S.W.C. No.107 Misfire

S.W.C. No.106 Misfire

12816 S.W.C. No.105 Recovery 3/4" (shattered)

LIMESTONE, dark grey, cryptocrystalline, micaceous, extremely hard, non porous and SHALE, dark grey, fissile, slightly calcareous, hard.

12818 S.W.C. No.104 Recovery 3/4" (broken)

SHALE, medium grey, fissile, slightly calcareous, hard, LIMESTONE, light brown, earthy, hard, non porous.

12820 S.W.C. No.103 Recovery 1"

LIMESTONE, white, cryptocrystalline, silty, hard, with interbedded SHALE, medium grey, non fissile, very calcareous.

12822 S.W.C. No.102 Recovery 1" (broken)

SHALE, dark grey, fissile, hard, non calcareous, and SILTSTONE, light grey, hard, very calcareous.

12824 S.W.C. No.101 Recovery 1" (broken)

SHALE, medium grey, very fissile, parting planes showing wavy contortion, but are roughly parallel to length of core.

12826 S.W.C. No.100 Recovery 1¼"

SHALE, light grey, non fissile, calcareous. SHALE, dark grey, slightly fissile, non calcareous, SILTSTONE-SHALE laminations, shale dark grey as before, siltstone white, quartzose with calcareous cement.

Alternating beds ¼" thick.

Run No.6

12826 S.W.C. No.151 Recovery 1¼"

SHALE, medium to dark grey, uniform, slightly calcareous, silty, micaceous.

The remaining 29 cores in this run were not cut due to an electrical fault.

Run No.4

12827 S.W.C. No.99 Recovery 1½"

SHALE, dark grey, fissile, non calcareous, hard, slickensided.

12828 S.W.C. No.98 Recovery ½"

SHALE, dark grey, fissile, slightly calcareous with interbedded SILTSTONE, light grey, quartzose, non calcareous cement, hard, poor porosity, thin veinlets of white calcite.

12829 S.W.C. No.97 Recovery 3/4"

SHALE, dark grey, fissile, non calcareous, hard and brittle.

12830 S.W.C. No.96 Recovery 2¼"

SHALE, dark grey slightly silty, non-calcareous, micaceous and carbonaceous, uniform, non fissile, hard, irregular fractures.

12831 S.W.C. No.95 Recovery 1¼"

SHALE, SILTSTONE alternating laminations. SHALE, medium grey, fissile, soft, slightly calcareous, slickensided near parallel to the bedding. SILTSTONE, white, quartzose with calcareous cement. One siltstone/shale contact is gradational, the other is sharp.

12832 S.W.C. No.94 Recovery ½" (shattered)

SHALE, medium grey, fissile and cracked, slightly (4%) calcareous with thin bands to 1/8" thick of white calcite, earthy, extremely fine quartz residue in acid.

12833 S.W.C. No.93 Recovery 1-3/4"

SILTSTONE, white quartzose laminated with light grey, shaley traces of carbon, finely micaceous, 11% calcareous, friable fair porosity.

12834 S.W.C. No.92 Recovery 1½" (shattered)

SHALE, light brown to medium grey 5% calcareous, 5% dolomitic, traces of carbon, irregular fractures, brittle.

12835 S.W.C. No.91 Recovery 1" (shattered)

SILTSTONE, brown to dark grey, very fine grained, shaley, 24% calcareous and 5% dolomitic, traces of carbon, hard, brittle and dense, non porous, irregular cracking and thin bands of white finely crystalline calcite.

PETROLOGY REPORTS

PETROLOGY AND PETROGRAPHY

OF

SELECTED ROCKS

FOR

ASHMORE REEF WELL No.1

BY

J.E. GLOVER

The rocks selected for discussion fall naturally into three groups. Thes are

(1) the sedimentary rocks from 7950 - 8085 feet inclusive,

(2) the volcanic rocks from 8106 - 8841.5 feet inclusive, and

(3) the sedimentary rocks from 9295 - 9316 feet inclusive.

The petrographic descriptions of these rocks are followed by a brief discussion of their petrology and speculation on some of the events to their formation.

A report on Cores 25 and 26 as well as cuttings from the intervals 11830 - 11840' and 11930 - 11940' is also included.

CUTTINGS 9750 - 7960 feet.

Handspecimen

The cuttings include light grey, dark grey and brown, very fine-grained rock fragments, and a few muscovite flakes.

Thin section

Grains included in the thin section range from foraminiferal, argillaceous calcilutite to foraminiferal, calcareous claystone.

SIDEWALL CORE 39, 7967 feet.

Handspecimen

The material in this specimen consists of friable, pale grey and grey-green fragments in which it is difficult to distinguish any texture with the hand lens.

Thin section

The fragments are made up of sedimentary rock particles. One particle is a foraminiferal calcarenite containing a little silt-sized quartz, rare brown fragments of possible collophane, and a sand grain of basalt. Another particle consists of silty, glauconitic, foraminiferal, calcareous claystone.

CUTTINGS 8020 - 8030 feet.

Handspecimen

The specimen consists of cuttings of grey sedimentary rock.

Thin section

These cuttings contain fragments of fine-grained dolomite, and three other sedimentary rock types which are gradational. These are foraminiferal calcilutite, foraminiferal claystone, and silty, foraminiferal, glauconitic claystone containing a littl pyrit .

SIDEWALL CORE 38, 8045 feet.

Handspecimen

The rock is grey-green, very friable, and is composed mainly of dark grey and grey-green sand grains. It effervesces locally in cold dilute hydrochloric acid.

Thin section

The rock is a sandstone in which most of the grains range between 0.12 - 0.50 mm., are angular to subangular and are opaque. The opaque grains are either black or dark grey to red-brown in reflected light. Although the origin of these grains cannot be determined beyond doubt, the presence of some dark grains of undoubted basaltic origin suggests a volcanic derivation for all of them. The clearly basaltic grains contain abundant, minute feldspar laths with intergranular iron oxide grains and a little secondary chlorite. Other material in the rock includes silt-sized quartz, glauconite, argillaceous material, a little calcite and rare fragments which seem to be phosphatic material of organic origin. The rock is a silty, fine to medium grain d, argillaceous, glauconitic, lithic sandstone containing grains of basalt.

SIDEWALL CORE 37, 8050 feet.

Handspecimen

The rock is friable and grey-green, and is made up mainly of sand-sized grains of grey-green and brown minerals. There is faint effervescence in cold dilute hydrochloric acid.

Thin section

The rock is a sandstone containing varied debris, including abundant subangular to subrounded grains of volcanic rock. One volcanic grain is composed mainly of almost colourless glass containing a few laths of feldspar and a little chlorite. Most grains are darker, and many have an intergranular groundmass with opaque iron oxide filling the interstices between minute feldspar laths. Ferromagnesian minerals, including phenocrysts, seem to have been present, but are altered beyond recognition. Chlorite is a common secondary mineral in the volcanic grains. Many of the grains are hemihyaline and contain minute laths of feldspar in grey, brown and dark brown glass. Brown scoriaceous material, sometimes spoken of as thread-lace scoria or reticulite, is particularly common as angular to subangular fragments. The vesicles in this scoria are generally filled with glauconite, which is also common as discrete sandsized pellets. Other sandsized grains in the rock include labrodorite and andesine-feldspar, quartz and very rare analcite-nepheline fragments. The grains range mainly between 0.25 - 0.50 mm in diameter, and are cemented locally by calcite and by an argillaceous matrix. Some of the opaque iron oxide of the volcanic grains has a red-brown stain in reflected light, despite the presence of glauconite, which forms in a neutral to somewhat reducing environment.

Thread-lace scoria is one of the products of lava fountains in some eruptions, but may also form as froth on the crusts of fluid gas-rich pahoehoe lavas. In other words, its presence in this rock sugg sts tuffaceous activity, but is not conclusive. Other material, such as

quartz, argillaceous material, and probably the rounded volcanic grains, are likely to be the products of normal processes of erosion, transportation, sorting and deposition. Glauconite is an authigenic mineral. Some of the contributing volcanic material was alkaline, much of it was obviously basic.

The rock can best be described as a moderately well sorted, medium grained, calcareous, glauconitic, possibly partly tuffaceous, lithic sandstone containing abundant basaltic material.

SIDEWALL CORE 36, 8070 feet.

Handspecimen

The rock is very friable and grey. Under the hand lens it can be seen to be made up mainly of grey-green and brown lithic fragments, green grains and a white to grey mineral. The rock shows a pronounced effervescence in cold dilute hydrochloric acid.

Thin section

The rock contains calcareous fossil material, glauconite, and fragments of volcanic rock. The fossils consist of shell fragments and debris of probable echinodermal origin, and the volcanic fragments are small and consist of minute feldspar laths in an opaque groundmass. The rock is a poorly sorted, glauconitic, fossiliferous calcarenite containing grains of volcanic rock.

SIDEWALL CORE 35, 8085 feet.

Handspecimen

The rock is friable and is made up of poorly sorted grey-green and brown lithic fragments in a grey to white matrix which effervesces strongly in cold, dilute hydrochloric acid.

Thin section

The rock is made up of poorly sorted fossiliferous calcarenite containing abundant grains, granules, and small pebbles, mostly rounded, of volcanic rock. Much of the volcanic rock is porphyritic with phenocrysts of altered plagioclase and pale brown augite in an intergranular groundmass of aligned plagioclase laths, and minute augite and black iron oxide grains. Chlorite and calcite are common secondary minerals and appear to fill vesicles in some grains. A little of the opaque iron oxide has been changed to haematite. One grain of volcanic rock consists of small aligned feldspar laths in dark brown glass. There are thus numerous textural and mineralogical variations in the fragments, but all of them can be referred to basalt. The rock can be described as a fossiliferous calcarenite containing abundant poorly sorted fragments of basalt.

SIDEWALL CORE 34, 8106 feet.

Handspecimen

The rock is dark grey with phenocrysts up to one millimetre long in a dark grey to brown groundmass containing irregularly shaped aggregates of green chlorite and white minerals which resemble amygdales. Some of the minerals effervesce in cold, dilute hydrochloric acid.

Thin section

The rock is porphyritic with highly altered phenocrysts up to one millimetre long in a groundmass of opaque iron oxides and minute altered feldspar laths. The larger phenocrysts were feldspars and have been converted to a mixture of calcite, green chlorite and a colourless mineral, probably a zeolite. Some of the chlorite is brownish, apparently due to iron staining, but there is another brown to brownish-green mineral with slightly higher birefringence which may be a clay mineral. No feldspar is sufficiently unaltered for precise determination. Some of the smaller phenocrysts are shaped like olivine, but are also completely altered, mainly to green chlorite but partly to a brown mineral. The opaque iron oxides of the groundmass include ilmenite, leucoxene and some haematite.

Some minerals in the slide are unusually shaped, and have either filled vesicles or replaced the rock in irregular fashion. These minerals consist of calcite and analcite, but there is also a less common flaring mineral of low birefringence and low relief which may be a zeolite. Many patches of these minerals have a rim of iron-stained mineral, perhaps a clay mineral.

The specimen from sidewall core 33, 8109 feet is similar mineralogically and texturally. The identification of one of the colourless minerals as analcite was confirmed by X-ray powder pattern methods. Much of the secondary material in this rock is colourless to pale brown, and it is particularly common as a rim to the aggregates of analcite. There is probably more than one mineral represented by this material, but investigation by X-ray powder pattern methods reveals the almost certain presence of a montmorillonite.

The two rocks described above are altered analcite-bearing extrusive rocks. The alteration, particularly of the feldspar, precludes precise naming of the rocks. They are likely to be altered analcite basanites.

SIDEWALL CORE 32, 8154 feet.

Handspecimen

The rock ranges from grey to red-brown, and contains pale green, red-brown and white patches which may be alteration products or vesicle fillings. Some of the white material effervesces in cold, dilute hydrochloric acid.

Thin section

The rock is porphyritic and contains phenocrysts of pyroxene and a highly altered mineral (probably feldspar) in a matrix composed of

black iron oxide, haematite and small altered feldspar laths with a preferred orientation. The pyroxene is pale brown and faintly pleochroic with a positive axial angle of about 55° and is a titaniferous augite. The apparent feldspar phenocrysts have been completely altered to a mixture of calcite, chlorite and a zeolite.

There are large, irregularly shaped patches in the rock, some of which are composed of pale brown material of low to moderate birefringence which is likely to be made up, at least in part, by a montmorillonite. Patches of analcite and patches and veins of calcite are common, and a rare flaring mineral, perhaps a zeolite, is also present.

This rock resembles those from sidewall cores 34 and 33 in containing analcite, calcite and other extensive alteration products, but differs from them in containing recognizable pyroxene. No olivine pseudomorphs were observed, perhaps because of chance orientation of the section. The name of this rock must be tentative, for its feldspars are too altered for precise determination. The rock is an analcite-bearing volcanic rock, perhaps an analcite tephrite or analcite basanite.

SIDEWALL CORE 31, 8160 feet.

Handspecimen

The rock is dark grey-green and friable with phenocrysts up to 2 mm. long in a dark grey-green aphanitic groundmass. There is local effervescence in cold, dilute hydrochloric acid.

Thin section

This rock is somewhat altered, but is the freshest of the volcanic rocks to be described so far. It is porphyritic, with phenocrysts of pyroxene, altered feldspar and rare black iron oxide in an intergranular groundmass of plagioclase laths having a generally preferred orientation, and minute pyroxene and black iron oxide grains. In places the groundmass is intersertal with patches of green to brown chlorite (or chlorophaeite) between the feldspar laths. Feldspar is generally alter d to a zeolite and chlorite, and can only be determined in patches. The phenocrysts consist mainly of intermediate labrodorite, and much of the groundmass feldspar is oligoclase-andesine. Most of the pyroxene is pale brown, probably titaniferous augite, but some of the minute, stumpy rods in the groundmass, which also seem from their oblique extinction to be augite, are colourless. The rock is traversed by narrow veins of green chlorite, calcite, and a brown, practically isotropic mineral.

In addition to the minerals described above, there are small phenocrysts, shaped like olivine, altered to a core of green chlorit and a rim, either of a brown mineral that is probably iddingsit , or a green-brown mineral, probably nontronite.

The rock is an altered basalt, almost certainly an altered olivine basalt.

CUTTINGS, 8160 - 8170 feet.

Handspecimen

Many of the cuttings are grey, greenish-grey and purplish-grey, and they thus resemble some of the volcanic rock already described. Some of the more platy, grey, very fine-grained fragments, however, appear to be of sedimentary origin.

Thin section

One of the volcanic fragments contains phenocrysts of highly altered feldspar pale brown, probably titaniferous augite, and pseudomorphs apparently after olivine in an intergranular groundmass of aligned feldspar laths and black iron oxide and pyroxene grains. The pseudomorphs consist of chlorite, calcite and probable nontronite, and the groundmass feldspar is labradorite-andesine. The fragment is a basalt, probably altered olivine basalt. Some other volcanic fragments differ only in minor respects, but a few contain analcite and resemble the rocks from sidewall cores 34, 33 and 32.

One of the sedimentary fragments is a silty, foraminiferal, glauconitic, calcareous siltstone, and contains a few brown, practically isotropic fragments, probably collophane. Another fragment consists of silty, glauconitic claystone with fragments of probable collophane.

CORE 18, 8281 feet.

Handspecimen

The rock is dark grey and aphanitic, and contains dark to light grey, apparently altered phenocrysts up to 3 mm. in diameter. Narrow dark grey and white veins intersect the rock, and the latter effervesce in cold dilute hydrochloric acid.

Thin section

The rock is fairly fresh and contains phenocrysts of pyroxene, plagioclase and yellow-green pseudomorphs of a ferromagnesian mineral in an intergranular groundmass of aligned feldspar laths, and black iron oxide and pyroxene granules. The pyroxene phenocrysts are the largest and range up to 2mm. in length: they are fresh, pale purple-brown, zoned, and have oblique extinction. The axial angle ranges from 50 - 55° (+ve) with r>v strong. The pyroxene is therefore likely to be a titaniferous augite and similar to much of the pyroxene of the groundmass which is also purplish brown. The plagioclase of phenocrysts are commonly zoned from sodic bytownite and calcic labradorite in the core to intermediate and sodic labr adorite near the margin. The yellow-green mineral of the pseudomorphs ranges in structure from fibro-lamellar on the outside to fibrous in the core, has fairly high birefringence, and may be nontronite. It seems to have replaced olivine but is also present as veins and patches in the ground mass, and locally it also replaces feldspar.

Feldspar grains in the groundmass range between 0.05 - 0.4 mm. in length, and between labradorite and andesine in composition. There are also numerous minute, stumpy, colourless rods with high relief in the ground mass. These are too small for certain determination, but their oblique extinction angle suggests an augite lacking titanium. The rock is a basalt, and is almost certainly an olivine basalt in which all olivine has been replaced. Specimens from 8286 and 8290 ft. in Core 18 are similar to that just described.

CORE 19, 8835 feet.

Handspecimen

The rock is grey and aphanitic and contains irregularly shaped white patches up to one mm. long, and narrow white veins of the same mineral. This mineral effervesces in cold dilute hydrochloric acid. Minute dark phenocrysts and irregularly shaped dark patch s are also scattered abundantly through the rock.,

Thin section

This rock is mineralogically a little different from the specimens of Core 18 in that it contains fewer phenocrysts of augite and feldspar. It is porphyritic, with chloritized and carbonated phenocrysts having the characteristic shape of olivine, in a ground mass which ranges from intergranular, with aligned plagioclase laths, and granules of purplish-brown pyroxene and black iron oxide, to the less common intersertal texture, in which the plagioclase laths are separated mainly by chlorite. Most of the phenocrysts lie between 0.1 - 0.6 mm. in length, and they are generally altered to a pale green rim of chlorite with a calcite core. Calcite and chlorite also form veins in the rock, and a few irregularly shaped masses of calcite with chlorite rims resemble amygdales but their nature is uncertain. There are also some green patches which resemble chlorite but seem to be completely isotropic.

Phenocrysts of titaniferous augite and plagioclase are rare and small. Most of the laths of plagioclase in the groundmass range from 0.1 - 0.2 mm. in length, and their composition is apparently mainly in the andesine range. Colourless rods with oblique extinction are too small for determination but seem to be augite.

This rock is a chloritized and carbonated olivine basalt in which all olivine has been replaced, and it resembles rocks from 8839 feet and 8841½ feet in Core 19 in having abundant altered olivine phenocrysts. However, in the last two mentioned rocks the alteration products of the olivine crystals are generally different. A few are changed to a green chlorite, and some are partly changed to calcite, but most are changed to green or yellow-green, fibrous to finely divided material with moderately high birefringence. The slight, apparently gradational variations in colour and texture of this material make it possible that either two minerals, or one mineral with a range of properties, are present. Patches of a green mineral resembling chlorite but seemingly isotropic, like volcanic glass, have also been observed in these rocks.

It is difficult, in view of the range of green and yellow green minerals in this rock, to obtain a pure separation of one mineral. An X-ray powder pattern photograph of green material separated from one of the rocks is somewhat blurred and not conclusive. The dominant pattern resembles nontronite but does not correspond precisely with known patterns of that mineral. To sum up, most of the olivine in the rocks from 8839 feet and 8841½ feet has altered to material that is clos to nontronite in many of its properties, and some of the olivine has altered to chlorite and calcite.

CORE 20, 9298 feet.

Handspecimen

The rock is composed of light grey sandy and pebbly beds separated by dark grey, very fine-grained beds containing irregularly shaped to lenticular bodies of light grey sandstone. There is no effervescence in cold dilute hydrochloric acid.

Thin Section

Some of the sand grains are made up of quartz, and most of the larger grains or pebbles are composed of quartzite and argillaceous quartz sandstone. The matrix of the rock is sandy, muscovitic, pyritic, carbonaceous and argillaceous. This rock cannot be given a simple, all embracing name. It is a poorly sorted, pebbly, argillaceous, quartz sandstone interbdded with dark grey, carbonaceous clayston containing irregularly shaped bodies of light grey quartz sandstone.

CORE 20, 9300 feet.

Handspecimen

The rock is light grey and composed essentially of quartz which glistens in strong light. There are also some thin beds (generally 1 mm. thick) of black claystone showing abundant muscovite on bedding planes. The rock does not effervesce in cold dilute hydrochloric acid.

Thin section

The rock is composed mainly of angular quartz grains between 0.125 - 0.5 mm. in diameter. The angularity of most of the grains is due to their authigenic enlargement, for the cores, where visible, are rounded. Other minerals are rare, and include grey-green tourmaline, muscovite and zircon. There is a little pale brown argillaceous material between some of the clastic grains. None of the bands of claystone seen in handspecimen was retained in the thin section.

The rock is a fine to medium grained, quartz sandstone, containing thin beds of muscovitic, carbonaceous claystone.

CORE 20, 9304 feet.

Handspecimen

The rock is light grey and is made up mainly of sand grains which glisten in strong reflected light because of the development on them of minute authigenic facets. There are also a few thin (1 mm thick) black beds, apparently of muscovitic and carbonaceous claystone. A little pyrite is visible with the hand lens. There is pronounced effervescence in cold dilute hydrochloric acid.

Thin section

The rock is made up mainly of quartz grains between 0.125 - 0.3 mm. in diameter, many of which are authigenically enlarged. Most cores where visible, are rounded to subrounded. Pyrite and black opaque streakes, probably of carbonaceous material, form narrow discontinuous bands in parts of the section. Calcite cement forms about 15% of the rock, but argillaceous cement is sparse. Other rare minerals include tourmaline, chert and muscovite.

The rock is a fine-grained, calcareous, quartz sandstone containing thin beds of muscovitic, carbonaceous claystone.

CORE 20, 9307 feet.

Handspecimen

This rock was selected for examination because it is more strongly indurated than the cross-bedded sandstone above and below. The specimen is about one inch thick, is light grey and does not effervesce in cold dilute hydrochloric acid.

Thin section

The rock is made up of angular quartz grains ranging mainly between 0.125 - 0.5 mm. in diameter, set in a practically colourless, finely divided matrix apparently of a clay mineral. Many of the grains are authigenically enlarged and have rounded cores. Silicification has affected the rock in an unusual way to produce irregularly shaped and locally arcuate and shard-like grains of quartz, some of which resemble shards of volcanic glass in shape. There is no evidence however of any tuffaceous contribution to this rock, and the induration noted in handspecimen has probably been caused by the extensive silicification. Other minerals are rare and include muscovite and minute heavy accessories.

The rock is a partly silicified, strongly indurated, argillaceous, fine to medium grained, quartz sandstone.

CORE 20, 9310 feet.

Handspecimen

The rock is light grey and is made up mainly of quartz grains which glisten in strong reflected light because of the development on them of minute, authigenic facets. The specimen is cross-bedded, and does not effervesce in cold dilute hydrochloric acid.

Thin section

The rock is made up mainly of angular quartz grains showing authigenic enlargement. Interstitial, finely divided, brown argillaceous material grades locally into colourless flakes of a clay mineral. Other minerals are not common, and include quartzite grains and muscovite flakes.

Th rock is an argillaceous, fine to coarse grained, quartz sandstone.

CORE 20, 9313 feet

Handspecimen

The rock is light grey and is composed mainly of quartz grains which glisten in strong light because of the development on them of minute authigenic crystal facets. There is no effervescence in cold dilute hydrochloric acid.

Thin section

The rock is composed mainly of angular quartz grains which range between 0.125 - 0.750 mm. in diameter. The general angularity of the quartz grains is caused by authigenic enlargement, for most cores are rounded. A pale brown argillaceous matrix which grades, perhaps by diagenetic alteration, into colourless flakes of a clay mineral, makes up about 15% of the rock. Other minerals are rare, and include pyrite, green tourmaline, chert grains, and minute accessory minerals.

The rock is an argillaceous, fine to coarse grained, quartz sandstone.

CORE 20, 9316 feet

Handspecimen

The rock is grey, and is composed of irregularly shaped to lenticular bodies of light grey sandstone in dark grey claystone. The sandstone bodies range from a few millimetres in size to bodies greater than the width of the core. Muscovite is visible in the sandstone and pyrite in the claystone. Neither type of rock effervesces in cold dilute hydrochloric acid.

Thin section

The sandstone in this rock is composed of angular, poorly sorted quartz grains ranging in diameter between 0.06 - 0.6 mm., some of which have been enlarged by authigenesis. Other minerals present include patches of argillaceous matrix, muscovite, and irregularly shaped aggregates of pyrite.

The claystone is made up mainly of finely divided, pale brown argillaceous material, but pyrite is abundant and there are numerous minute opaque fragments which are almost certainly carbonaceous.

This rock cannot be given a simple, all embracing name. It is a dark grey pyritic, carbonaceous, claystone containing irregularly shaped bodies of light grey, muscovitic, pyritic, argillaceous, quartz sandston .

PETROLOGY

(1) SEDIMENTARY ROCKS BETWEEN 7950-8085 FEET

The specimens include cuttings and sidewall cores. There is a diversity of sedimentary rock types, including very fine grained, foraminiferal, calcareous and argillaceous sediments. Sand-sized particles of volcanic origin tend to become more important with increasing depth. Some of these grains may have had a tuffaceous origin, but the appearance of most of the volcanic sand grains is consistent with their having been derived by erosion from extrusive rocks like those encountered deeper in the section.

(2) VOLCANIC ROCKS BETWEEN 8106-8841.5 FEET

The material studied includes four sidewall cores (core 34, 8106 feet, core 33, 8109 feet, core 32, 8154 feet, and core 31, 8160 feet), one specimen of cuttings (8160-8170 feet) and six core specimens (core 18 8281 feet, 8286 feet, 8290 feet, core 19 8835 feet, 8839 feet, 8891.5 ft.)

The rocks in sidewall cores 34, 33, and 32 are altered analcite bearing rocks for which the tentative names of analcite basanite and analcite tephrite have been suggested. These rocks also contain some haematite, suggestive of their having been affected by weathering.

Volcanic rocks in sidewall core 31 and cores 18 and 19 are fresher, and their feldspar is better preserved, which greatly assists in their classification. None of the rocks contains olivine, but the shape of many of the altered phenocrysts resembles olivine, and suggests that all the volcanic rocks so far encountered can be assigned to the alkaline olivine-basalt suite. Altered phenocrysts of the supposed olivin are more common in core 19 than in rocks of core 18 above, but no reason is advanced for this at this stage.

(3) SEDIMENTARY ROCKS BETWEEN 9295-9316 FEET

These rocks consist mainly of quartz sandstones with intercalations of dark claystones, and they are lithologically distinct from the sedimentary rocks above the volcanic rocks. Most of the sandstones have undergone some diagenetic silification, but no evidence of tuffaceous contribution has been observed. Final assessment of the environment of deposition of this sequence must await comprehensive and detailed evaluation of their combined lithological, palaeontological and palynological characteristics, but what is at present known of them is not inconsistent with a deltaic origin.

SPECULATION

The succession lends itself to speculation which closer sampling and more detailed work may well modify. It is not unreasonable at this stage, however, to suppose that flows were extruded on a land surface underlain by sediments of deltaic origin. At least three flows may be represented, all derived from an alkaline olivine basalt magma. The upper or analcite-bearing rocks of the volcanic section, the most highly differentiated rocks, seem to have been partly oxidized by exposure. The area may have sunk partly as a result of the adjustment that caused the extrusions in the first place. Alternatively, the flows may have issued from faults which were active during the subsidence. Early-formed sedimentary rocks received extensive contributions due to the erosion of exposed volcanic rocks and perhaps also because of the expulsion of tuffaceous material, but these contributions lessened and eventually ceased with further depression of the area.

ASHMORE REEF NO.1, CORE 25, 11722.5 FT.

Handspecimen

The rock is very fine-grained to aphanitic, and is dark grey. It is cut by veins of a white to pale brown, locally coarse-grained mineral. Effervescence in cold dilute hydrochloric acid is rather patchy.

Thin section

The rock is made up of two main components. One component ranges from silty claystone to argillaceous siltstone and contains abundant pyrite and carbonaceous material. Most of the argillaceous material is brown and finely divided, but there are patches and veins of a well-crystallized mineral of the kaolinite group. This mineral is described separately below. The other main component of the rock is carbonate. A little carbonate is present in the claystone and siltstone but most of it is segregated in veins. Some of it develops as rhomb-shaped grains which do not stain, or stain patchily to turquoise in acid solution of alizarin red S and potassium ferricyanide. Other carbonate stains deep blue, or locally, purple. Grains studied in oils show a wide range of refractive indices, and W in some grains attains 1.71. The unstained carbonate is dolomite, the turquoise carbonate is ferroan dolomite and the remaining carbonate is calcite.

The patches and veins of the well crystallized mineral of the kaolinite group are dark grey in handspecimen, where they easily escape observation. Some of the veins have been partly replaced by carbonate. The mineral is colourless, has pronounced cleavage, oblique extinction and is optically positive with a moderately sized optic axial angle. The optics indicate that the mineral is dickite, and an X-ray powder pattern is consistent with this view. Dickite is not normally a mineral of sedimentary origin, but is generally hydrothermal. It can be reasonably suggested that the veins of this mineral were caused by hydrothermal activity connected with the volcanism responsible for the extrusive rocks higher in the sequence. If so however, the temperatures involved wer low, for high temperatures would have destroyed plant microfossils.

The wide range in composition of this rock prevents its being given a simple name. It ranges from silty claystone to argillaceous siltstone, and contains irregularly shaped veins of carbonate which is coarsely crystalline in places.

ASHMORE REEF NO.1, CUTTINGS 11830-40 FT.

The thin section contains fragments of many rocks. These have be n put in categories as indicated below.

Chloritized analcite-bearing olivine basalt. No olivine is present, but chlorite pseudomorphs are common. Most of the feldspar has also been chloritized. Analcite has either intergrown with some augite, or has locally replaced it. Much of the matrix of the rock seems to have been altered to clay minerals.

Altered olivine basalt. All olivine has been altered to a mineral which is probably nontronite.

Amygdaloidal volcanic rock. The amygdales are calcite, and the groundmass, which is red and opaque, apparently consists mainly of haematit .

Pyritic, carbonaceous, silty claystone.

Sandy argillaceous limestone.

Argillaceous, strongly pyritic limestone.

Pyritic, fossiliferous limestone.

Pyritic, calcareous, silicified medium-grained sandstone (impure orthoquartzite).

ASHMORE REEF NO.1, CUTTINGS, 11930-40 FT.

The thin section contains fragments of many rocks. These have been put in categories as indicated below.

Chloritized analcite-bearing olivine basalt. No olivine remains in the rock but pseudomorphs of chlorite are common. Phenocrysts of titanif rous augite are fresh, but some are intergrown with or partly replaced by analcite. The intergranular groundmass is made up of altered plagioclase laths ranging from bytownite to andesine, and minute grains of pyrox ne and black iron oxide. A little haematite is present.

Scoriaceous and amygdaloidal basalt.

Pelsparite.

Silty claystone.

Calcareous silty claystone.

Sandy claystone.

Lithic sandstone. The rock contains chloritized volcanic fragments and quartz grains.

Pyrite-bearing, highly silicified, medium-grained quartz sandstone (orthoquartzite).

Argillaceous sandstone. The argillaceous material ranges from a practically amorphous paste to well-crystallized flakes. Quartz is medium-grained and authigenically enlarged. Pyrite is present.

Micaceous, pyritic, argillaceous, medium-grained sandstone.

ASHMORE REEF NO.1, CORE 26, 12070 FT.

Handspecimen

The rock is dark grey and very fine grained, and contains a little pyrite. It is cut by irregularly shaped white veins which range in thickness from less than one millimetre to almost two centimetres. The grey matrix and the veins effervesce moderately in cold dilute hydrochloric acid.

Thin section

Much of the rock stains in acid solution of alizarin red S and potassium ferricyanide. Many veins and fossil fragments stain blue to purple and consist of ferroan calcite. Other carbonate areas do not stain (dolomite) and some stain turquoise (ferroan dolomite or ankerite). Additional constituents of the rock are silty quartz, finely divided brown argillaceous material, and pyrite grains.

The fabric and composition of the rock vary from place to place. The best simpl name for that part of the core sectioned is fossiliferous, silty, argillaceous limestone.

Ashmore Reef No. 1, Core 27 (12423'-12433')

Handspecimen

The rock is grey and very fine-grained and contains elongate masses up to 8 cm long of white, coarse-grained material. The straight margins of many of these bodies give the rock a brecciated appearance in places. Thin white veins are also present.

The grey parts of the rock effervesce in cold dilute hydrochloric acid, but effervescence in the white masses is generally limited to their margins. When immersed in an acid solution of alizarin red S and potassium ferricyanide, the grey parts of the rock stain deep purple, the veins and the margins of the white masses stain blue, and the cores of the white masses are not affected.

Thin section

The thin section was also stained before microscopic examination. The fine-grained part of the rock (which stains pink) consists of calcitic limestone in which the original fabric has been blurred by reorganization. Pellets, fragments of brachiopods, crinoids and ostracods can be distinguished in a finely crystalline matrix which also contains narrow bands of dark, apparently carbonaceous material and minute grains of pyrite. Some of the fossils are partly altered to chalcedony, and minute euhedra of authigenic quartz are scattered throughout. The rock is cut by thin veins of ferroan calcite, which stain blue.

Part of the rock near the coarsely crystalline masses consists of dolomite rhombs which stain patchily to blue-green. The coarse material consists of ferroan calcite (stained purple to blue) and a core of mineral that does not stain.

Some of the unstained mineral from the handspecimen was crushed and examined in oils. The mineral is biaxial and optically positive with 2V close to 50° and dispersion $v > r$. The birefringence is low, and the upper and lower indices are close to 1.630 and 1.620 respectively. There are at least two cleavages, and many fragments have straight extinction. The properties listed fit celestite. Its position in the core of the calcite-celestite bodies suggests that it filled cavities lined with calcite, and therefore crystallized after the calcite.

The rock ranges in composition from place to place. It can be described as a grey, fossiliferous, slightly silicified and dolomitized, fine grained limestone containing sparry masses of calcite and celestite.

PALAEONTOLOGIAL REPORTS

PALAEONTOLOGICAL REPORT

ON

ASHMORE REEF WELL NO.1

BY

P.J. COLEMAN

PALAEONTOLOGICAL REPORT ON SAMPLES FROM ASHMORE REEF NO.1 WELL

INTRODUCTION:

This report is a summary of palaeontological results obtained from samples yielded by Ashmore Reef No.1 Well, located on the edge of the continental shelf, northwestern Australia. The samples came mostly from cores, numbered 1 to 27, supplemented by 21 sidewall samples and 33 ditch cuttings.

By and large, the succession revealed by these samples is a relatively complete one, ranging from Quaternary to Upper Triassic, the Jurassic alone being absent, palaeontologically. Importantly, the lower Tertiary appears to be complete and in general, Ashmore Reef No.1 Well offers what may prove to be a standard stratigraphic column for this most important and hitherto unknown region.

THE SUCCESSION:

1. 360 to 1000 feet - Cuttings samples.

There is a restricted but prolific fauna in this organic sediment, from 360 to approximately 550 feet, consisting of an abundance of individuals of Operculina venosa (Fichtel and Moll), with rarer Cycloclypeus carpenteri Brady, Baculogypsina sphaerulata (Parker and Jones) and other still-living benthonic foraminifera. Bryozoan, algae and echinoid remains are present in quantity.

From 600 to 1000 feet there are only scattered foraminifera in a dolomitised biomicrite. The foraminifera are altered but the same genera and species appear to be present. It is possible, nevertheless, that the deeper part of this interval is of Pliocene age, but there is no worthwhile Pliocene section. The environment of deposition would seem to be as it is now, an atoll, although the intense dolomitisation poses a problem in this environment, to which there is no sure answer as yet.

2. 1125 to 2928 feet - Cores 1 through 4 plus selected sidewall samples and cuttings.

The faunas yielded by these cores range in age from late Lower Miocene (the youngest) to early Lower Miocene. To 2300 feet, approximately, the fauna includes Lepidocyclina ("Trybliolepedina") radiata (Martin) Lepidocyclina ("Trybliolepidina") sp cf. L. epigona Schubert, L. ("Nephrolepidina") verrucosa Scheffen, Miogypsina polymorpha (Rutten); Miogypsina sp., Gypsina globula (Reuss), Sporadotrema spp. and Operculina complanata (Defrance). This is a Miocene assemblage, probably late Lower Miocene but possibly early Middle Miocene. The sediment is still a well-washed foraminiferal calcarenite. Below 2300 feet L. sumatrensis (Brady) and Miogypsina cushmani indonesiensis Tan, become dominant, with a species of Cycloclypeus similar to C. indopacificus Tan. Algae fragments are now common. At 2,600 feet, the large Eulepidina badjirraensis Crespin appears and at 2900 feet is the most dominant constituent in the sediment, although Cycloclypeus is common, together with Heterostegina borneensis van der Vlerk, indicating a depth of accumulation exceeding 100 m. This lowest assemblage is early Miocene in age, that is, approximately Aquitanian or Tertiary upper "e". There is no change until about 3050 feet.

3. 3050 to 4000 feet - Sidewall samples plus Core 7.

A change in lithology is marked by the presence of more silt and clay, abundant fine quartz and both benthonic and planktonic foraminifera. Large foraminifera are absent. There is a restricted fauna of planktonics, with species in common with warm-water Oligocene Pacific faunas (Todd, 1966). Species present

include Globigerina sellii (Borsetti) and G. tripartita tapuriensis Banner and Blow.

There are also patchy occurrences of ostracodes which, in this type of sediment, suggest a shallow water environment. The ostracode genera include Trachyleberidea, Clithrocytheridea and ?Alatocythere which on past experience are not found in sediments younger than Oligocene. In Core 7 there is an unusual occurrence - a normal-sized fauna together with a replicate fauna of so-called "dwarfs", which suggests an especially favourable living environment. This part of the well is of special academic interest, because it may well offer a complete grading without hiatus from the Upper Eocene (see below) and similarly, passing into the early Miocene, above 3030 feet.

4. 4000 to 4700 feet - Cores 8, 9 and sidewall sample.

Most of this interval is Upper Eocene, both Core 8 and 9 containing species of Discocylina and Aktinocyclina with Asterocyclina mantanzensis Cole especially common. Both small benthonic and planktonic foraminifera are well represented. There is some glauconite and scatterings of dolomite crystals. As has been the case throughout this succession so far, there is little terrigenous sediment. The evidence continues to favour as an environment of deposition, the notion of an off-shore crown or bank with free access to open-ocean waters.

4. 4700 to 6020 feet - Cores 10 and 11, sidewall samples and cuttings.

The faunal content drops rapidly although there is still abundant organic calcite, most of it in the form of macerated tests - in general terms the sediment is a dolomitised foraminiferal calcilutite. The few benthonic and planktonic foraminifera could not be extracted for identification. The log position and apparent absence of an hiatus suggests a Middle Eocene through Upper Paleocene age for this interval.

5. 6020 to 6700 feet - Cores 12 and 13; sidewall samples.

Planktonic foraminifera are more common and include several species of early Globorotalia. Positive specific identification was not possible but G. sp. cf. G. aequa Cushman and Renz and G. sp. cf. G. acutispira Bolli are very tentatively identified in Core 12, a sidewall sample at 6196, and G. sp. cf. uncinata Bolli in Core 13. It may well be that this is a Middle-Lower Paleocene section.

6. 6730 to 6748 feet - Core 14.

Globotruncana appears in this core, marking the uppermost Cretaceous - the species is not identified positively but is referred to G. citae Bolli: G. sp. cf. G. lugeoni. Tilev may also be present. Both these referals, it should be noted, are based on thin-section study. Core 14 was disaggregated only with difficulty and no diagnostic species could be identified.

7. 7000 to 7690 feet - Cores 15 and 16; sidewall samples.

Over this interval the sediment is a pelagic ooze with carbonaceous material and a little marine manganese and pyrite. The fauna is a Globotruncana-rich Senonian (Maestrichtian) one, dominated by G. tricarinata, that is, G. lapparenti (or linneiana) tricarinata (Quereau), and including G. conica Cushman.

8. 7700 to 7950 feet - Sidewall samples and cuttings.

Over this interval Globotruncana is replaced by a sparse fauna of small globigerinaceans in a calcilutite matrix which may also contain shell fragments, e.g. at 7795 feet. Hedbergella is identified tentatively between 7850 and 7950 feet. No firm age can be assigned to this interval but it is likely that at least the remainder of the Upper Cretaceous is present and possibly part of the Lower Cretaceous as well.

9. 7960 to 8220 feet - Core 17 and sidewall samples and cuttings.

This interval is marked by a sudden increase in quartz, the appearance of repeated bands of coarse shell fragments (echinoderms, molluscs, bryozoans) and, below approximately 8090 feet, stained and probably weathered lava fragments.

10. 8281 to 9143 feet - Cores 18 and 19.

The basalt yielded by these cores is part of a volcanic sequence with unusual petrological features (Company report by J.E. Glover).

11. 9143 to 11000 feet - Cores 20, 21, 22 and 23; sidewall samples and cuttings.

The sediment over this interval is primarily a micaceous, carbonaceous, quartz arenite, usually fine grained but with many coarse and also silty layers, extensively reworked and with greatly varying amounts of calcite. There are no determinable fossils, although occasional scattered fragments of pelecypods, echinderm plates, foraminifera and ostracodes show that much of this interval is marine. In general, the evidence suggests a deltaic environment despite the lack of foresets and other positive delta criteria.

12. 11000 to 12000 feet - Cores 24, 25 and 26.

With Core 24, at 11024 feet, there is no great change in lithology but pelecypod fragments become especially common. They include some identified as the genus Costatoria suggestive of Upper Triassic age. The sediment is extensively cleaved and fractured and over the remainder of the interval is only poorly fossiliferous.

13. 12000 to 12843 feet (completion - Cores 26 and 27; sidewall samples below 12433 feet.

Although quartz is still prominent in the sediment, calcite is the predominant mineral, most of it in the matrix, for fossils are still quite rare and confined to thin bands. The recognizable fauna is molluscan although ostracodes are common but not extractable. In Core 27 the dominant sediment is a calcarenite with microcoquinoidal bands and with scattered whole fossils. The organic content may be up to 80%. The fossils identified include Misolia sp., Nucula sp. cf. N. misolensis Jaworski and ? Myophoria sp. These and similar species occur in Indonesia (Krumbeck 1913, 1923, 1924) and suggest an Upper Triassic age for the containing sediment. The same sediment occurs in sidewall samples to 12843 feet, the completion depth of the well. Quartz is still a significant part of the sediment but the last 850 feet suggest that Ashmore Reef Well No.1 entered more nearly normal shallow water sediments, marginally if at all deltaic and still of Upper Triassic age.

SUMMARY:

In brief the succession given suggests a history for the area which may be outlined as follows:-

Upper Triassic

Near shore shallow water shelf conditions gradually built over by encroaching delta.

Jurassic

Hiatus, brought about by sedimentation being suspended or some part of erosion of accumulated Jurassic sediment. Former alternative favoured. Submarine (?) outpouring of lava(s).

Uppermost Jurassic/early Cretaceous

Persisting shallow water conditions with influx of lava-derived terrigenous material.

Cretaceous

Downfaulting to depth. Accumulation begins (late Lower Cretaceous?) of pelagic oozes in considerable (>1000 m.) depth of water. Subsidence considered to be regional because of relative absence of terrigenous material.

Paleocene-Eocene

Build-up of lutitic sediments in shallowing water, until extensive accumulation of Upper Eocene foraminiferal arenites. Inception of Ashmore as a reef complex.

Miocene

Palaeogene conditions persist into the Lower Middle Miocene. There is then an apparent gap which is encountered also in other Indo-Pacific areas: a problem not yet adequately recognised.

Quaternary

Development of Ashmore Reef into its modern form.

REFERENCES :

Krumbeck L. (1913) : Obere Trias von Burn und Misol. Palaeontogr., Supplement 4, 2 (1), 1 - 161.

(1923) : Brachiopoden, Lamellibranchiaten und Gastropoden aus der oberen Trias der Insel Seran. Ibid., Supplement 4, 3 (5), 186 - 245.

(1924) : Die Brachiopoden, Lamellibranchiaten und Gastropoden der Trias von Timor. 2, Palaontologischer Teil. Palaont. Timor, 4, 143 - 417.

Todd R. (1966) : Smaller Foraminifera from Guam. U.S. Geol. Surv., Prof. Paper 403 - I.

P.J. Coleman

P.J. Coleman

Geology Department

University of Western Australia.

ASHMORE REEF WELL NO.1

CORES AND SIDEWALL SAMPLES.

Core 1	1125 to 1152 feet
Core 2	2286 to 2310 feet
Core 3	2619 to 2632 feet
Core 4	2901 to 2928 feet
Sidewall	3045 feet
Sidewall	3065 feet
Core 7	3622 to 3645 feet
Core 8	4040 to 4063 feet
Sidewall	4207 feet
Core 9	4540 to 4566 feet
Sidewall	4730 feet
Core 10	5020 to 5035 feet
Sidewall	5252 feet
Core 11	5535 to 5553 feet
Core 12	6022 to 6042 feet
Sidewall	6196 feet
Core 13	6520 to 6535 feet
Core 14	6730 to 6748 feet
Core 15	7252 to 7267 feet
Core 16	7575 to 7590 feet
Sidewall	7891 feet
Sidewall	7967 feet
Core 17	8016 to 8023 feet
Sidewall	8045 feet
Sidewall	8050 feet
Sidewall	8070 feet
Sidewall	8085 feet
Core 18	8281 to 8290 feet
Core 19	8835 to 8844 feet
Core 20	9295 to 9317 feet
Core 21	9741 to 9755 feet
Core 22	10048 to 10063 feet
Core 23	10576 to 10583 feet
Core 24	11024 to 11036 feet
Core 25	11716 to 11724 feet
Core 26	12056 to 12067 feet
Core 27	12423 to 12433 feet
Sidewalls	12433 to 12843 feet

PALYNOLOGICAL REPORT

ON

ASHMORE REEF WELL NO.1

BY

B.E. BALME

PALYNOLOGICAL REPORT NO.283

ASHMORE REEF NO.1 WELL - SUMMARY OF RESULTS

INTRODUCTION

This report summarises the palynological results obtained from all the samples examined from Ashmore No.1 Well. It incorporates data included in Palynological Reports Nos. 274 and 297. Samples below Core 20 (9,295-9,317 ft.) have not been previously discussed.

SAMPLES EXAMINED

Depth	Lithology
Core 4, 2901-2928 ft.	Grey calcilutite
Core 7, 3622-3645 ft.	Greenish calcilutite
Core 8, 4036-4063 ft.	Grey, pyritic, calcareous sandstone
Core 15, 7252-7267 ft.	Dark grey calcareous shale
Core 17, 8016-8023 ft.	Black pyritic siltstone
S.W.C. 39, 7967 ft.	Grey calcareous siltstone
S.W.C. 32, 8154 ft.	Brown arkosic sandstone
Core 20, 9295-9317 ft.	Black, pyritic shale
9690-9700 ft.	Cuttings, mainly grey shale
Core 21, 9744 ft.	Grey, micaceous shale
Core 22, 10,061 ft.	Sandy, micaceous shale
Core 23, 10,575-83 ft.	Dark grey shale
Core 24, 11,033 ft.	Dark grey, calcareous shale
Core 25, 11,717 ft.	Black, pyritic shale
12,050-060 ft.	Cuttings, grey, calcareous shale
Core 26, 12,060-70 ft.	Dark grey, calcareous shale
Core 27, 12,428 ft.	Dark grey shale
S.W.C. 12,830 ft.	Dark grey shale.

MICROFLORAL LISTS

Core 4: 2901-2928 ft.

Dicotyledonous pollen grains, possibly assignable to the Casuarinaceae, occurred sparingly and a single specimen of a podocarpaceous conifer pollen grain was identified.

Dinoflagellates were fairly common, but the suite was poorly diversified and consisted of about four species of spinose forms belonging to the genera Hystrichosphaera and Achomosphaera. None of these is known to have a closely restricted range elsewhere, and the most that can be inferred from the palynological evidence is that the sample is Upper Cretaceous or Tertiary.

1104 1111

Core 7: 3622-3645 ft.

Plant microfossils were more common in this sample than in either of the other two cores examined. They included pollen grains and spores, fungal teleutospores, dinoflagellates and acritarchs. The forms identified were as follows:-

Spores and pollen grains:

Cyathidites sp.

cf. Osmundacidites sp.

Tricolporites sp.

Myrteaceidites sp.

Nothofagacidites sp. (N. brassi-type)

Triorites cf. harrisi (Couper)

Podocarpidites sp.

aff. Chenopodium sp.

Dinoflagellates:

Hystrichosphaera sp.

Achomosphaera cf. ramulifera (Deflandre)

Baltisphaeridium (Cleistosphaeridium) sp.

Hystrichosphaeridium spp.

Acritarchs:

Micrhystridium spp.

Leiosphaeridium spp.

An estimate of the frequency of each of the main groups in one gram of sediment, based on counts of representative samples gave the following results:

Spores	13/gm
Angiosperm pollen	343/gm
Dinoflagellates	1286/gm
Fungi	502/gm
Acritarchs	3940/gm
Gymnosperm pollen	13/gm.

Age: The core is dated as Oligocene from foraminiferal evidence and the palynological data are consistent with this estimate, although in themselves not chronologically critical. In southern Australia Nothofagacidites appears to be most common in late Eocene to early Miocene sediments although its complete known range is late Cretaceous to Recent. All the other spore and pollen species range throughout the Cainozoic in Australia, with the exception of the form recorded as aff. Chenopodium sp. This is represented by only two specimens, however, and the possibility that these are modern contaminants cannot be excluded.

Although pollen grains are sparse in the slides, their frequency is fairly high for this type of sediment. Concentrations of over 300/gm suggest that the sediment was laid down fairly close to land. It is perhaps noteworthy, however, that all the angiosperm pollen species are small forms which are likely to have been widely distributed by currents. Not much published data exists on the distribution of dinoflagellates in modern marine sediments, but investigations in the Gulf of Mexico (Traverse and Ginsburg 1966) indicate that they are most abundant in shallow, somewhat off-shore, marine environments.

Core 8: 4036-4063 feet

The total yield of plant microfossils from this sample was lower than that from Core 4 or Core 7. This is likely to be controlled by the lithology of the sediment rather than any notable change in environment of deposition. Forms id ntified are listed below:

Spores and pollen:

Tril te spores of filicalean or bryophyte origin

Triorites harrisi Couper

? Monoporate pollen

Dinoflagellates:

Hystrichosphaeridium spp.

Hystrichosphaera spp.

Achomosphaera cf. ramulifera (Deflandre)

Gonyaulacysta sp.

Acritarchs:

Micrhystridium spp.

Leiosphaeridia sp.

Comments:

The assemblage is too poorly diversified to enable the sediment to be dated more precisely than late Cretaceous or Tertiary. It differs in no obvious fundamental way from that occurring in Core 7, allowing for the greater diversity of angiosperm pollen grains in the higher core.

Core 15: 7252-7267 ft.

Although its content of acid-insoluble microfossils was low, the sample yielded a fairly diverse suite of dinoflagellates and acritarchs, much more so than any of the assemblages from cores higher in the well.

Spores and pollen grains of presumed terrestrial origin were extremely rare.

Spores and pollen:

Cyathidites sp.

Disaccate pollen grains gen. indet.

Triorites sp.

Dinoflagellates and acritarchs:

Micrhystridium spp.

Cymatiosphaera sp. ? C. pterota Cookson & Eisenack

Veryhachium sp.

Hystrichosphaeridium spp.

H. recurvatum (White)

H. sp. aff. H. readei Davey and Williams

Areoligera sp.

Systemophora sp.

Achomosphaera ramulifera (Deflandre)

Odontochitina operculata (O. Wetzel)

Hystrichosphaera spp.

H. cf. cingulata (O. Wetzel)

Fungal teleutospores occurred occasionally.

Age: Although many of the forms recorded resemble species previously identified from Europe and Australia, it is not easy to assess their stratigraphic significance except within broad limits. Odontochitina operculata is a distinctive species which is common in the Cenomanian in Australia, although its complete range is probably Neocomian to late Cretaceous.

Many of the species of Hystrichosphaeridium and Hystrichosphaera resemble forms from the European Senonian and there is no doubt that, as a whole, the assemblage has a distinctly Upper Cretaceous aspect. However, documentation of the stratigraphic ranges of dinoflagellate species is still at a rudimentary stage and it would be premature to base firm biostratigraphic conclusions on a single assemblage from a geographically isolated area.

Environment of deposition

Marine with little evidence of terrestrially derived organic material. Quartz grains of presumably clastic origin are, however, fairly plentiful in the residue.

Core 17: 8016-8023 ft.

Dinoflagellates, acritarchs and plant tissue were abundant in the maceration residue. Occasional spores and pollen grains also occurred.

Spores and pollen:

Cyathidites minor Cossper

Classopollis torosus (Reissinger)

Disaccites gen. indet.

Dinoflagellates and acritarchs:

Micrhystridium spp.

M. stellatum Deflandre

Leiosphaeridium spp.

Veryhachium sp.

Gonyaulax spp.

Gonyaulax sp. ? G. scotti Cookson & Eisenack

G. cf. ambigua Deflandre

Systemophora cf. areolata Klement

Systemophora sp.

Pareodina cf. ceratophora Deflandre

Hystrichosphaeridium spp.

Hystrichosphaeridium sp. H. torynum-type

H. cf. costatum Davey and Williams

Scriniodinium sp. cf. S. attadalense Cookson & Eisenack

Age: This assemblage is quite different in the abundance of plant microfossils from any recovered from cores higher in the well. Its composition is also unusual and distinct from the assemblage listed from Core 15.

The spore and pollen species are of no critical chronological significance, although the presence of Classopollis torosus suggests a Jurassic or Lower Cretaceous age.

The microplankton recorded resembled forms known to be widely distributed in late Jurassic and early Cretaceous sediments in Australia and elsewhere. It lacks, however, the species which have been used in Australia as a "zonal" indices for that part of the geological column. A possible exception is Scriniodinium cf. attadalense, a Neocomian-early Aptian form in Australia. Forms normally associated with S. attadalense (e.g. Dingodinium cerviculum) were not found in the present assemblage and this fact, together with the slight doubt concerning its identification, makes one cautious about proposing a firm age.

I favour a Lower Cretaceous (Neocomian) age, but cannot exclude the possibility that the sample is late Jurassic i.e. "Tithonian" in the rather loose sense in which this Stage name has been used by Australian microplankton workers.

Environment of deposition: Marine with a low content of terrestrially derived microfossils.

Core 20: 9295-9317 ft.

Spores, pollen grains and vascular plant fragments abundant. Rare spinose acritarchs.

Spores and pollen:

Lundbladiospora sp.

Leiotriletes sp.

Dictyophyllidites mortoni (de Jersey)

D. cf. harrisi (Couper)

Osmundacidites cf. fissus (Leschik)

Polypodiumsporites ipsvichensis (de Jersey)

Duplexisporites sp.

Sulcatisporites sp.

Falcisporites australis (de Jersey)

Platysaccus queenslandi (de Jersey_

Alisporites sp.

Acritarchs:

Schizosporis sp.

Micrhystridium sp.

Large fragments of cuticle were abundant and some of these showed c ll outlines of the Dicroidium type.

Age: Th assemblage is of Triassic age and its gross composition compares closely with those encountered in Upper Triassic d posits in Tasmania, South Australia, Queensland and New South Wales. In common with many Australian Triassic assemblages, this one is not very diverse

and is dominated by pollen grains of the Falcisporites type. These almost certainly derive from corystosperms, a group of Triassic plants which bore leaves referred to Dicroidium (= Thinnfeldia of some workers).

Upper Triassic strata are not known from surface exposures in Western Australia although they probably occur in bores at Onslow and Long Island in the Carnarvon Basin. The associated volcanics in Ashmore Reef may be contemporaneous with intrusives encountered in Barlee No.1 well in the Canning Basin, although there is a substantial discrepancy in the radiometric ages attributed to the two suites.

Environment of deposition:

Acritarchs occurring in the siltier lithologies in Core 20 suggest marine influences, although the bulk of the microfossils and the organic debris are of terrestrial origin. This suggests a paralic succession with alternating near-shore/marine and non-marine deposits.

Cuttings, 9690-9700 ft.

Abundant semi-fusinised wood tissues and fibres, cuticular fragments common. Spores and pollen grains fairly rare. Occasional small leiospheres.

Spores and pollen:

Leiotriletes sp.

Cycadopites follicularis Wilson & Webster

Sulcatisporites sp.

Alisporites parvus de Jersey

Falcisporites australis (de Jersey)

Platysaccus sp. cf. P. queenslandi de Jersey

Age: From the abundance of Falcisporites australis the assemblage is undoubtedly Triassic. It is not diverse enough to enable a more precise dating although it is not likely to be older than Middle Triassic.

Environment of deposition: The relative abundance of coarse plant tissues, together with the gross lithology of the core sample, suggest a shallow water environment not far removed from the site of plant growth.

Core 21: 9744 ft.

Woody tissues and large cuticular fragments plentiful, spores and pollen grains common and fairly well preserved.

Spores and pollen:

Cyclogranisporites sp.

Neoraistrickia taylori Playford and Dettmann

Leiotriletes sp.

Dictyophyllidites mortoni (de Jersey)

Polypodiumsporites ipsvichensis (de Jersey)

Lophotriletes sp.

Falcisporites australis (de Jersey)

Sulcatisporites sp.

Alisporites sp.

Alisporites parvus de Jersey

Cycadopites follicularis Wilson & Webster

cf. Striatopodocarpites sp.

Cuticle fragments of the Dicroidium-type common.

Age: Probably Upper Triassic. Although the sequence of Triassic spore assemblages in Australia is not yet known in detail, the elements listed above all occur in Upper Triassic sediments in Queensland and South Australia (de Jersey 1962; Playford & Dettmann 1965). In its quantitative composition the assemblage from Core 21 resembles those from the Ipswich Coal Measures. It has less in common with those from the Mungaroo Beds in the Carnarvon Basin. These are also probably of Upper Triassic age, but contain species known from the late Triassic of Madagascar, which have not so far been found in eastern Australia.

Environment of deposition: All the plant microfossils identified appear to derive from vascular plants and the assemblage contains no obviously marine elements. It is consistent with a non-marine origin and the sediment is probably a deltaic swamp accumulation.

Core 22: 10,061 ft.

Spores and pollen grains fairly common but, in general, poorly preserv d and showing little diversity. Large cuticular fragments and woody tissues abundant.

Spores and pollen:

Lophotriletes sp.

Kraeuselisporites sp.

Dictyophyllidites mortoni (de Jersey)

Ephedripites sp.

Falcisporites australis (de Jersey)

Fragments of Dicroidium-type cuticles, together with pieces of thick, papillate cuticle, were also common.

Age: Probably Upper Triassic.

Environment of deposition: No evidence for a marine origin and assemblage of plant microfossils basically similar to that occurring in Core 21.

Core 23: 10,575-10,583 ft.

Assemblage diverse and generally well-preserved. Cuticular fragments common.

Spores and pollen:

Leiotriletes sp.

Annulispora folliculosa (Rogalska)

Guthoerlisporites cancellosus Playford & Dettmann

Apiculatisporis globosus (Leschik)

Polypodiumsporites ipsvichensis (de Jersey)

Punctatosporites walkomi de Jersey

Dictyophyllidites mortoni de Jersey

Kraeuselisporites sp.

Punctatisporites sp.

Duplexisporites gyratus Playford & Dettman

Cycadopites follicularis Wilson & Webster

Cycadopites sp.

Falcisporites australis (de Jersey)

Platysaccus queenslandi de Jersey

Sulcatisporites sp.

Alisporites parvus de Jersey

Age: The assemblage is dominated by Falcisporites australis, a form which appears to range throughout the Triassic in Australia, but is most abundant in Middle and Upper Triassic deposits. All the other elements in the assemblage are consistent with an Upper Triassic age, and the association of Annulispora folliculosa, Guthoerlisporites cancellosus, Duplexisporites gyratus, and Platysaccus queenslandi, suggests a correlation with part of the Leigh Creek Coal Measures in South Australia, the Ipswich Coal Measures in Queensland and perhaps the Brady Formation in central Tasmania (see de Jersey 1962, Playford and Dettmann 1965, Playford 1965).

Environment of deposition: Probably non-marine, reducing, environment from the abundance of well-preserved vascular plant fragments and the absence of spinose acritarchs.

Core 24: 11,033 ft.

Abundant fusinised woody debris. Spores and pollen grains fairly common but poorly preserved and mostly difficult to identify at specific level. Some spinose acritarchs.

Spores and pollen:

Leiotriletes sp.

Dictyophyllidites mortoni (de Jersey)

Cyclogranisporites sp.

Cycadopites follicularis Wilson & Webster

Sulcatisporites sp.

Falcisporites australis (de Jersey)

Alisporites parvus de Jersey

Platysaccus queenslandi de Jersey

Dicroidium-type cuticles common.

Acritarchs:

Leiosphaeridia sp.

Micrhystridium sp.

An unusual apparently undescribed acritarch also occurred fairly commonly. This has a spheroidal test about 40u in diameter, its surface divided into rounded polygonal fields (about 5u in diameter) by rows of closely packed fine spines. The form is distinctive and does not fit easily into any existing form genus of the Acritarcha.

Age: Apart from its content of acritarchs, the assemblage does not differ essentially from that listed from Core 23. It is also Triassic and probably Upper Triassic in age.

Environment of deposition: The presence of spinose acritarchs suggests marine influences and the sediment may represent a marine incursion across low-lying delta swamps. Fragments of land plants are nevertheless dominant in the assemblage.

Core 25: 11,717 ft.

Dark fusinised plant tissues abundant. Spores and pollen grains common, but seldom well-preserved.

Spores and pollen:

Lophotriletes sp.

Leiotriletes spp.

Kraeuselisporites sp.

Polypodiumsporites sp. cf. P. ipsvichensis (de Jersey)

Punctatisporites sp.

Punctatosporites walkomi de Jersey

Annulispora folliculosa (Rogalska)

Nevesisporites sp.

Ephedripites sp.

Falcisporites australis (de Jersey)

Alisporites sp. cf. A. opii Daugherty

Platysaccus queenslandi de Jersey

cf. Fimbriaesporites sp.

Age: The assemblage differs slightly from those recorded from the higher Triassic cores, particularly in its fairly high content of the costate pollen grain Ephedripites. This form genus has a long geological range and, although it is common in Upper Triassic sediments elsewhere in the world, no precise stratigraphic significance can be attributed to the species r presented here. The assemblage is not older than Middle Triassic and the evidence favours an Upper Triassic age.

Environment of deposition: No evidence of marine organisms and assemblage similar to those from Triassic sediments higher in the well, for which a deltaic swamp origin was suggested.

Cuttings: 12,050-12,060 ft.

Abundant fusinised woody tissues, spores and pollen fairly common, but poorly preserv d. Spinose and other acritarchs present.

Spor s and pollen:

Leiotriletes sp.

Kraeuselisporites sp.

Dictyophyllidites mortoni (de Jersey)

Concavisporites sp.

Punctatisporites sp. cf. P. tumidus Playford

? Densoisporites nejburghii (Schulz)

Falcisporites australis (de Jersey)

Alisporites parvus de Jersey

Alisporites spp.

Platysaccus queenslandi (de Jersey)

Protohaploxypinus sp.

Acritarchs:

Micrhystridium spp.

Leiosphaeridia spp.

Acritarch described from Core 24 also present in this sample.

Age: Middle or Upper Triassic.

Environment of deposition: Common spinose acritarchs may indicate a marine phase in the sampled interval, but the possibility of contamination of cuttings must always be considered.

Core 26: 12,060-12,070 ft.

Total yield of plant microfossils very low. Spores and pollen rare and poorly preserved. Spinose acritarchs present.

Spores and pollen:

Falcisporites australis (de Jersey)

Alisporites and other disaccate pollen grains

Leiotriletes sp.

Acritarchs:

Micrhystridium spp.

Leiosphaeridia sp.

Reticulate spinose acritarchs identified in Core 24 and cuttings from 12,050-12,060 ft. also present.

Age: Triassic.

Environment of deposition: Marine influences indicated by spinose acritarchs.

Core 27: 12,428 ft.

Abundant fusinised woody tissues. Spores and pollen rare and poorly preserved. Acritarchs fairly common.

Spores and pollen:

Falcisporites australis (de Jersey)

Alisporites spp.

cf. Densoisporites nejburghii (Schulz)

Acritarchs:

Leiosphaeridia sp.

Micrhystridium spp.

Veryhachium reductum Deunff

Reticulate spinose form noted above also present.

Age: Triassic.

Environment of deposition: Probably near-shore marine from association of spinose acritarchs with abundant vascular plant fragments.

S.W.C.: 12,830 ft.

Spores, pollen grains and fragmentary plant tissues abundant but poorly preserved, dark in colour and usually impossible to identify with confidence.

Spores and pollen:

Foveosporites sp.

Dictyophyllidites sp. cf. D. mortoni(de Jersey)

? Lundbladispora sp.

Alisporites spp.

Falcisporites australis (de Jersey)

Acritarchs:

Leiosphaeridia sp.

Micrhystridium spp.

Age: Triassic.

Environment of deposition: Probably shallow marine.

SUMMARY

Plant microfossils were recovered from sixteen samples from Ashmore Reef No.1 Well. The assemblages described fall into one of four broad categories:

1. Cores 4, 7 and 8 yielded sparse assemblages, mainly of dinoflagellates, but containing occasional spores and dicotyledonous pollen grains. They are not diverse enough to attempt close dating, but are consistent with a Tertiary ag .

2. Core 15 (7252-67 ft.) contained fairly diverse microplankton and very rare spores and pollen. It is assigned to the Upper Cretaceous.

3. Core 17 (8016-23 ft.) was the highest sample to yield abundant acid-insoluble microfossils. These were mainly acritarchs and dinoflagellates. The association is rather unusual but suggests an uppermost Jurassic or early Cretaceous age.

4. Samples between 9295 ft. and 12,830 ft. contain essentially similar assemblages. There is evidence for a minor 'break' between 10,583 ft. and 11,033 ft. and the lower samples show evidence of marine influences during deposition. All the assemblages are of Triassic age and those between 9295 ft. and 10,583 ft. are considered to be Upper Triassic. Below the latter depth the assemblages are insufficiently diverse and too poorly preserved to enable any attempt at refined dating, but there is nothing which suggests that they are older than Middle Triassic and the whole sequence could be Upper Triassic.

Plant tissues were abundant in all the Triassic samples, and it is likely that they were laid down in an environment not far removed from the site of plant growth. Considering the palynological evidence, and the gross lithology of the succession, a deltaic coastal plain appears the most likely depositional environment for the Triassic rocks.

Although plant microfossils were not usually well preserved below about 9000 feet, they were still identifiable at 12,830 ft. From this it is concluded that the sediments have not been subjected to tectonism or affected by igneous activity.

REFERENCES

de Jersey, N.J. (1962). - Triassic spores and pollen grains from the Ipswich coalfield. Publs. geol. Surv. Qld. 307: p.1-18.

Playford, G. (1965). - Plant microfossils from Triassic sediments near Poatina, Tasmania. J. geol. Soc. Aust. 12: p.173-210.

Playford, G. and Dettmann, Mary E. (1965). - Rhaeto-Liassic plant microfossils from the Leigh Creek Coal Measures, South Australia. Senckenberg. Leth. 46: p.127-181.

Traverse, A. and Ginsburg, R.N. (1966). - Palynology of the surface sediments of Great Bahama Bank, as related to the water movement and sedimentation. Marine Geol. 4: 417-459.

(Signed)...B.E. Balme

8.4.68

Copy 2 67/4264

NOTE ON FORAMINIFERA FROM ASHMORE No. 1 WELL: CORES 7 TO 16 INCLUSIVE

CORE 7: Abundant well-preserved planktonic foraminifera, including:

Globigerinoides quadrilobatus primordius Blow and Banner
Group of Globigerina praebulloides Blow, including G. praebulloides praebulloides Blow and G. praebulloides occlusa Blow and Banner
Globigerina angustiumbilicata Bolli
Globigerina unicava (Bolli, Loeblich and Tappan), subspp.
Globigerina ouachitaensis Howe and Wallace, subsp.?
Globorotalia mayeri Cushman and Ellisor
Globorotalia obesa Bolli
Globoquadrina sp. cf. G. dehiscens praedehiscens Blow and Banner

A significant feature of this fauna is the presence of specimens referable to Globigerinoides quadrilobatus primordius Blow and Banner. This form developed from Globigerina praebulloides occlusa in the middle part of the Globorotalia kugleri zone of the Trinidad sequence, by the addition of a single dorsal supplementary aperture, and is stated to be an index form for this zone (Blow and Banner 1962). The other species recorded are longer ranging, but the fauna is considered to be referable to the Globorotalia kugleri zone. Recent investigations suggest that this zone is at the Oligocene-Aquitanian boundary.

CORE 8: Larger foraminifera and rare poorly preserved planktonic foraminifera.

Discocyclina (s.l.) spp.

Globorotalia sp.cf.G.centralis Cushman and Bermudez

CORE 9: Larger foraminifera.

Discocyclina (s.l.) spp.

Cores 8 and 9 are regarded as Upper Eocene in age.

CORES 10 and 11: No identifiable foraminifera have been obtained from, or observed in, these cores. Their position in the sequence suggests a lower to middle Eocene age.

CORE 12: No identifiable free specimens of foraminifera have been obtained. Examination of polished surfaces of the core shows species of Globigerina and Globorotalia of a type thought to be basal Eocene in age, although they may be uppermost Paleocene.

Copy 2
67/4264

CORE 13: Abundant, moderately well-preserved planktonic foraminifera.

Subbotina triloculinoides (Plummer) - S.linaperta (Finlay) group

Keeled species of Globorotalia, including G.aequa aequa

Cushman and Renz.

This core is regarded a Upper Paleocene in age.

CORE 14: Abundant, well-preserved planktonic and benthonic smaller foraminifera; the planktonic foraminifera include:

Subbotina triloculinoides (Plummer)
Globorotalia aequa aequa Cushman and Renz
Globorotalia sp.of the group of G.velascoensis (Cushman)
Globorotalia spp.

This core is Upper Paleocene in age.

CORE 15: Poorly preserved planktonic and benthonic smaller foraminifera; the planktonic foraminifera include:

Globotruncana sp.cf.G.contusa (Cushman)
G.sp.cf.G conica White

Benthonic genera include Anomalinoides, Gyroidina, Bolivina and Massilina.

Core 15 is Upper Cretaceous (Maestrichtian) in age.

CORE 16: No free specimens of foraminifera have been obtained. Examination of polished surfaces of the core reveals abundant speciments of Globotruncana, mainly double-keeled forms apparently referable to the G.lapparenti group. The age of this core is considered to be Upper Cretaceous (Senonian: Santonian or Campanian) in age.

D J Belford

D.J. Belford
25.6.68

REFERENCE

BLOW,W.H., and BANNER, F.T., 1962. - The mid-Tertiary (Upper Eocene to Aquitanian) Globigerinaceae. Part 2 in EAMES, F.E., BANNER, F.T., BLOW, W.H., and CLARKE, W.J., Fundamentals of mid-Tertiary stratigraphical correlation. Cambridge, Cambridge University Press.

RE RCH SCHOOL OF PHYSICAL SCIENCES
THE AUSTRALIAN NATIONAL UNIVERSITY
Department of Geophysics and Geochemistry

TELEPHONE: CANBERRA 49 5111
TELEGRAMS: NATUNIV, CANBERRA

BOX 4, P.O.
CANBERRA
A.C.T.
2600

Your ref: 213/5/1a
PLEASE QUOTE REF.

22nd April, 1968

The Managing Director,
B.O.C. of Australia Ltd.,
8-12 Bridge Street,
Sydney. N.S.W. 2000

Attention: Mr R.W. Craig
Senior Geologist

Dear Sir,

K-Ar Dating of Core 19, 8835-8844 feet, Ashmore Reef No.1

From the two pieces of core 19 supplied, thin sections were cut for preliminary examination as to the suitability of the rocks for dating. In both basalts microphenocrysts of completely altered olivine (0.3-1 mm in size) and rare clinopyroxene phenocrysts occur in a fine grained groundmass (0.02-0.2 mm) consisting of fresh clinopyroxene prisms, iron oxide, plagioclase laths (sometimes altered), and a considerable amount of nearly isotropic, poorly crystallized material. In addition chlorite is present in the groundmass and as veins through the rocks. In the sample from 8841½ feet the amount of plagioclase is small, whereas in 8842½ feet plagioclase is abundant and is aligned to give the rock a fluidal texture. These basalts show considerable evidence of alteration, which, however, maybe mainly deuteric. The rocks are similar to that in core 18, examined previously; the degree of alteration being comparable.

Because of the fine grain size of the alteration products, together with the higher temperatures at depths of the order of 9000 feet, it was realized that some leakage of radiogenic argon may have occurred since the basalts crystallized. Nevertheless both samples were processed and the results are given in the enclosed table. The indicated ages agree to within experimental error, at 129.4 ± 3.0 m.y. This is a reliable minimum age, and the results show that both samples have retained radiogenic argon equally well. However, the dates are significantly younger than that obtained on basalt from core 18, 600 feet higher in the well. Clearly there has been greater leakage of radiogenic argon from the core 19 samples than from the core 18 basalt. This may be due to different degrees of alteration, and/or to the greater depth and hence higher temperatures that the core 19 basalts have experienced. The amount of loss of radiogenic argon is impossible to estimate. Because of the petrographic similarity between the basalts from cores 18 and 19, together with the comparable (if reversed) dates, my personal interpretation is that the basalts were erupted during one main volcanic episode, possibly of relatively short duration (say several million years).

Because of the demonstration that some leakage of radiogenic argon has occurred from the basalts these data unfortunately do not allow an unequivocal interpretation as to how much of the Jurassic is represented at Ashmore Reef. My opinion is that there may be an appreciable period of time not represented by deposition or volcanism.

Yours faithfully,

Ian McDougall

Dr Ian McDougall

RESEARCH SCHOOL OF PHYSICAL SCIENCES
THE AUSTRALIAN NATIONAL UNIVERSITY
Department of Geophysics and Geochemistry

TELEPHONE: CANBERRA 49 5111
TELEGRAMS: NATUNIV, CANBERRA

BOX 4, P.O.
CANBERRA
A.C.T.
2600

PLEASE QUOTE REF.

19th January, 1968.

The Exploration Manager,
B.O.C. of Australia Limited,
8-12 Bridge Street,
Sydney, N.S.W. 2000

Dear Mr Martison,

Further to our phone conversation today I enclose details of the potassium-argon age results on the basalt core at 8281'-8290' in the Ashmore Reef No.1 well.

The thin section we cut of the basalt showed it to contain phenocrysts of clinopyroxene and altered olivine in a fluidal groundmass consisting of plagioclase laths, small prisms of clinopyroxene, iron oxide, and a distinct poorly crystallized, low birefringent feldspathic (?) phase together with considerable chloritic material. The rock is reasonably fresh and what alteration is present is probably deuteric.

The details of the K-Ar measurements are given in the attached table. Both K and Ar were measured in duplicate with most satisfactory reproducibility. The probable error for the final calculated age is about ∓ 2.5 per cent. The age obtained, 137.3 ± 3 m.y., can be regarded as a reliable minimum estimate for the time of crystallization. Owing to the deuteric alteration in the rock some diffusive loss of radiogenic argon may have occurred, so that the true age may be a few per cent older.

On the presently accepted physical time scale (cf. Quart. Jour. Geol. Soc. London, v.120 S, special volume, p.260) the indicated age is equivalent to the top of the Jurassic, as the Jurassic-Cretaceous boundary is estimated to lie at an age of about 136 m.y. Such an age is reasonably consistent with the palaeontological determination obtained sediments 260' higher up the core, and clearly indicates that the basalts are in conformable sequence with the overlying sediments.

Yours sincerely,

Ian McDougall

(Dr.) Ian McDougall

K-Ar Age Measurements on Basalt from Ashmore Reef No.1 Well, core 18, depth 8281'-8290'

Sample No.	K%	$x_{Ar^{40}/K^{40}}$	Atm. Ar^{40} %	Indicated Age (m.y.)
GA2899	1.186) 1.190 1.193)	0.00831 0.00834	4.2 9.6	137.1 137.6

$\lambda_e = 0.585 \times 10^{-10} yr^{-1}$ $\lambda_\beta = 4.72 \times 10^{-10} yr^{-1}$

$K^{40} = 0.019$ atom per cent

CORE ANALYSIS

All Core Analyses were carried out on the Wellsite by Geoservices Australia.

Core No. 1 (1125 - 1152 ft.) Recovery 3/4" (3%)

Core No. 2 (2286 - 2310 ft.) Recovery 14-1/2" (60%)

Depth	Porosity	Permeability	Water Saturation	Density
2287	21.33	907	N.T.	2.11
2290	27.50	27		1.98
2292	29.74	15		1.93
2293	35.15	1134		2.16
2295	24.0	19		2.06
2296½	24.25	51		2.07
2300	28.28	177		1.96

Core No. 3 (2619 - 2644 ft.) Recovery 13' (52.4%)

Depth	Porosity	Permeability	Water Saturation	Density
2619½	19.96	2.18	N.T.	2.17
2621	23.20	5.44		2.03
2622	20.99	4.65		2.12
2624	24.12	1.36		2.06
2625	20.58	2.73		2.13
2626	23.44	2.18		2.04
2627	18.70	1.02		2.20
2628	22.79	1.72		2.10
2629	20.40	0.96		2.14
2630	20.44	0.99		2.14
2631	19.31	1.64		2.12
2632	22.00	1.93		2.11

Core No. 4 (2901 - 2928 ft.) Recovery 22' (81%)

Depth	Porosity	Permeability	Water Saturation	Density
2902	16.22	0.21	62	2.26
2905	20.99	1.65	80	2.23
2908	16.75	0.76	82	2.31
2911	14.12	0.21	70	2.32
2916	16.49	0.27	69	2.32

Core No. 5 (3212 - 3240 ft.) Recovery Nil

Core No. 6 (3245 - 3270 ft.) Recovery Nil

Core No. 7 (3622 - 3645 ft.) Recovery 16 ft. (69%)

No samples taken.

Core No. 8 (4036 - 4063 ft.) Recovery 26 ft. (97%)

Depth	Porosity	Permeability	Water Saturation	Density
4036	21.3	110	100	2.16
4038	20.9	65.4	100	2.19
4040	18.6	98.4	100	2.14
4041½	20.5	81.2	100	2.19
4043	22.2	98.9	96	2.16
4044½	18.6	95.7	100	2.16
4046	17.9	91.5	100	2.20
4048	23.0	141.5	100	2.12
4049½	28.2	124.3	97	2.13
4051	22.2	68	100	2.17
4052½	30.4	312	90	2.14
4054½	21.2	145.8	98	2.14
4055½	21.3	122	100	2.19
4057	24.2	120.3	99	2.16
4058½	23.8	42.4	100	2.18
4060	26.2	94.5	100	2.19
4061	25.8	19.7	91	2.16
4062	18.4	21.4	100	2.18

Core No. 9 (4540 - 4566 ft.) Recovery 25½ ft. (98%)

Depth	Porosity	Permeability	Water Saturation	Density
4542½	13.0	0.14	88.9	
4546	12.5	0.10	85.2	
4549	7.0	0.03	96	
4553	13.5	0.14	86.6	
4556	13.5	0.20	99.3	
4559	13.0	0.15	99	
4562	13.5	0.32	99.6	
4564	6.0	0.01	88.6	

Core No. 10 (5020 - 5035 ft.) Recovery 15 ft. (100%) (Wet)

Depth	Porosity	Permeability	Water Saturation	Density
5022	15.1	0.39	82.0	2.41
5025½	16.1	0.86	95.9	2.38
5028	21.4	1.79	76.5	2.35
5031	15.7	0.25	59.0	2.41
5034	16.2	0.68	96.2	2.40

Core No. 11 (5535 - 5553 ft.) Recovery 14 ft. (78%)

Depth	Porosity	Permeability	Water Saturation	Density
5536	20.6	10.93	98	2.04
5538½	19.2	4.69	93	2.06
5542½	19.1	3.28	88	2.10
5546	12.0	1.21	87	2.16
5548	11.2	1.10	80	2.17

Core No. 12 (6022 - 6042 ft.) Recovery 20 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
6025	4.0	0.01		2.52
6028	18.0	0.48	73	2.14
6031½	18.7	0.72	73	2.12
6035½	10.9	0.37	88	2.32
6038½	19.4	0.74	83	2.13

Core No. 13 (6520 - 6533 ft.) Recovery 10 ft. (77%)

No samples taken.

Core No. 14 (6730 - 6748 ft.) Recovery 18 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density (Wet)
6732				2.45
6745				2.53

Core No. 15 (7252 - 7267 ft.) Recovery 13½ ft. (90%)

Depth	Porosity	Permeability	Water Saturation	Density (Wet)
7253				2.49
7254				2.52
7260				2.52
7261				2.50

Core No. 16 (7575 - 7590 ft.) Recovery 15 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
7580	4.7	0	N.T.	2.40
7583½	4.75	0		2.40
7585	4.9	0		2.40
7589	9.3	0.1		2.35

Core No. 17 (8016 - 8023 ft.) Recovery 4 ft. (57%)

No samples taken.

Core No. 18 (8281 - 8290 ft.) Recovery 9 ft. (100%)

Density range 2.80 - 2.85

Core No. 19 (8835 - 8844 ft.) Recovery 7½ ft. (83%)

Depth	Porosity	Permeability	Water Saturation	Density
8836¼				2.88
8837½				2.86
8839				2.88
8842				3.49
8842½				3.51

Core No. 20 (9295 - 9317 ft.) Recovery 22 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
9296	12.3	81	92	2.23
9297	11.2	80	85	2.22
9298	11.0	75	69	2.31
9299	11.9	57	71	2.25
9299	11.7	55		2.23
9300	14	36	74	2.24
9300	13.6	33		2.23
9301	11.6	58	73	2.26
9301	11.9	60		2.23
9302	7.3	1.7	86	2.35
9302	8.7	4.6		2.34
9303	9.0	10	75	2.34
9304	14.0	6.0	48	2.41
9304	14.2	5.17		2.33
9305				
9306	11.5	63	56	2.24
9306	11.7	67		2.25
9307	9.4	72	77	2.32
9308	16.4	546	64	2.17
9308	17	608		2.16
9309	17	617	61	2.16
9309	16.7	651		2.16
9310	16.9	63.7	48	2.17
9310	16.6	58.2		2.16
9311	16.5	501	63	2.17
9311	15.8	464		2.16
9312	15.5	401	68	2.18
9313	19.5	857		2.11
9313	19.2	956	82	2.09
9314	13.2	192		2.20
9314	13.9	188	81	2.16
9315	14.3	131		2.24
9315	14.4	254	82	2.22

Core No. 20

Depth	Porosity	Permeability	Water Saturation	Density
9316	12.4	281		2.26
9316	13.3	248	76	2.24
9317	11.2	30		2.35
9317	10	27	65	2.32

Core No. 21 (9741 - 9755 ft.) Recovery 14 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
9741½				2.71
9742				2.56
9743				2.65
9744				2.84
9745½	11.9	20.2	85	2.37
9746	11.9	16.4	72	2.38
9746½	11.7	27.1	84	2.36
9747	12.2	24.0	80	2.34
9747½	12.2	27.1	80	2.34
9748	12.4	32.6	70	2.34
9748½	12.4	24.8	68.5	2.34
9749	12.3	1.38	64	2.34
9749½	11	1.29	83	2.44
9750	11.2	1.08	79	2.41
9750½	11.4	1.99	68	2.37
9751	11.3	30.0	69	2.29
9751½	12.3	0.44	66	2.35
9752	12.1	1.79	79	2.35
9752½	9.6	0.11	88	2.72
9753	8.0	0.05	87	2.82
9755				2.58

Core No. 22 (10048 - 10063 ft.) Recovery 15 ft. (100%)

10049	16.5	31.4	72	2.23
10050	13.5	7.8	72	2.27
10051	15.0	11.6	70	2.25
10052	12.9	7.0	83	2.29
10053	12.7	4.6	74	2.30
10054	12.8	9.6	74	2.27
10055	13.5	14.7	78.9	2.26
10056	11.7	11.6	89	2.27
10057	10.5	4.8	77	2.31
10058	12.5	7.0	74	2.29
10059	11.5	7.4	90	2.25
10060	11.5	7.5	82	2.27

Core No. 22

Depth	Porosity	Permeability	Water Saturation	Density
10061	16	23.3	75	2.19
10062				2.57
10063				2.69

Core No. 23 (10575 - 10583 ft.) Recovery 8 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
10575½	2.1	0.2	100	2.43
10576½	3.4	0.25	100	2.51
10577	5.5	0.30	91	2.44
10577½	5.0	0.4	95	2.45
10578	4.3	0.3	100	2.46
10578½	4.8	0.34	100	2.48
10579	0.6	0.25		2.06
10580	Tr.	0.1		2.65
10581				2.56
10582	.1			2.54
10582½	Tr.	0.09		2.67
10583				2.52

Core No. 24 (11024 - 11035 ft.) Recovery 11 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
11024				2.63
11026				2.55
11026½				2.58
11028				2.67
11030				2.52
11032				2.63
11034				2.62

Core No. 25 (11716 - 11724 ft.) Recovery 8 ft. (100%)

11717	2.61
11718	2.64
11719	2.62
11720	2.62
11721	2.74
11722	2.65
11723	2.64

Core No. 26 (12060 - 12070 ft.) Recovery 10 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
10061				2.70
10062				2.67
10063				2.69
10064				2.71
10065				2.72
10066				2.73
10067				2.72
10068				2.72
10069				2.70
10070				2.72

Core No. 27 (12423 - 12433 ft.) Recovery 10 ft. (100%)

Depth	Porosity	Permeability	Water Saturation	Density
12423				2.71
12425				2.72
12427				2.73
12429				2.71
12431				2.72
12432				2.71

Unless otherwise stated, all density figures are for completely dry sampl s.

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

WATER ANALYSIS

File AP3-WA-53

Company BURMAH OIL CO. of A. Well Name ASHMORE REEF No. 1 Sample No. 1

Formation _____ Depth 9230' Sampled From MAIN CHAMBER

Location _____ Field WILDCAT County W.A. State AUST.

Date Sampled 21 MARCH 1968 Date Analyzed 28 MARCH 1968 Engineer GAK

Total Dissolved Solids 20,600 / 18000 mg/L Evap. / Calc.

Sp. Gr. 1.013 @ 75 °F.

Resistivity 0.27 ohm-meters @ 77 °F. Meas.

Hydrogen Sulfide Absent

pH 8.0

Constituents	meq/L	mg/L	Constituents	meq/L	mg/L
Sodium	273	6290	Chloride	219	7750
Calcium	13.6	272	Bicarbonate	30.0	1830
Magnesium	3.59	43.7	Sulfate	31.5	1520
Iron	0.40	11.2	Carbonate	10.8	324
Barium	0.0	0.0	Hydroxide	0.0	0.0

All analyses except iron determination performed on a filtered sample.

K-Ar Age Measurements on Altered Basalts from Ashmore Reef
No.1 Well

Core 19, Depth 8835-8844 Feet

Sample No.	Depth (ft.)	K%	$x_{Ar^{40}/K^{40}}$	Atm Ar^{40} %	Indicated Age (m.y.)
GA 3189	8841½	1.041, 1.042 → 1.041	0.00778	28.3	128.7 ± 3.0
GA 3190	8842½	1.087, 1.089 → 1.088	0.00787	14.3	130.1 ± 3.0

$\lambda_e = 0.585 \times 10^{-10} yr^{-1}$ $\lambda_\beta = 4.72 \times 10^{-10} yr^{-1}$ $K^{40} = 1.19 \times 10^{-2}$ atom %

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

WATER ANALYSIS

File AP3-WA-53

Company BURMAH OIL CO. of A. Well Name ASHMORE REEF No. 1 Sample No. 2

Formation _____ Depth 9230' Sampled From SMALL CHAMBER

Location _____ Field WILDCAT County W.A. State AUST.

Date Sampled 21 MARCH 1968 Date Analyzed 28 MARCH 1968 Engineer GAK

Total Dissolved Solids 28300 Evap. / 26700 mg/L Calc.

Sp. Gr. 1.020 @ 74 °F.

Resistivity 0.19 ohm-meters @ 74 °F. Meas.

Hydrogen Sulfide Absent

pH 7.8

Constituents	meq/L	mg/L	Constituents	meq/L	mg/L
Sodium	388	8930	Chloride	372	13200
Calcium	40.7	816	Bicarbonate	36.0	2200
Magnesium	2.79	34.0	Sulfate	28.0	1350
Iron	4.76	133	Carbonate	0.0	0.0
Barium	0.0	0.0	Hydroxide	0.0	0.0

All analyses except iron determination performed on a filtered sample.

ASHMORE REEF NO. 1 - STRATIGRAPHIC TABLE

	AGE	LITHOLOGY	DEPTH IN FEET Below RT	THICKNESS IN FEET
				40 12
		SEA LEVEL	40 12	120 36
		SEA BED	160 48	
CAINOZOIC		No samples	100 330	170 52
CAINOZOIC	QUATERNARY - PLIOCENE	Foraminiferal limestone and calcarenite	319 1,053	893 271
CAINOZOIC	LATE LOWER TO EARLY MIDDLE MIOCENE	Increasingly foraminiferal limestone, with minor mudstone, some crystalline limestone	798 2,635	1,582 479
CAINOZOIC	EARLY LOWER MIOCENE	Crystalline to foraminiferal limestone, argillaceous calcilutite	929 3,062	427 129
CAINOZOIC	OLIGOCENE	Marl, shale	1215 4,009	947 287
CAINOZOIC	EOCENE-PALAEOCENE	Calcarenite, calcilutite, calcisiltite, limestone, minor chert and marl	1983 6,543	2,534 768
MESOZOIC	PALAEOCENE-UPPER CRETACEOUS	Marl, limestone, calcilutite, minor shale	2411 7,956	1,413 428
MESOZOIC	UPPER JURASSIC	Shale, sandstone, calcarenite	2455 8,102	146 44
MESOZOIC	UPPER JURASSIC	Basic volcanics, with minor claystone	2771 9,143	1,041 315
MESOZOIC	UPPER TRIASSIC	Sandstone, siltstone, calcilutite, limestone, shale, quartzite	3630 11,980	2,837 860
MESOZOIC	UPPER TRIASSIC	Limestone, siltstone, minor chert and shale	3849 12,703	723 219
MESOZOIC	UPPER TRIASSIC	Siltstone, sandstone, limestone, shale	3892 12,843 (T.D.)	143+ 43

NAME OF SECTION: ASHMORE REEF N° 1 AREA: ASHMORE BLOCK BASIN: BROWSE/BONAPARTE LOCATION: 12° 10' 49.7" S 123° 05' 10.6" E

Sea Floor – 48m.

THICKNESS (m)	UNIT NAME	LITHOLOGICAL SYMBOL	GRAIN SIZE (clay, silt, v.f., f., m., c., v.c., gr.)	LATERAL EXTENT, GEOMETRY	LITHOLOGICAL DESCRIPTION	SEDIMENTARY STRUCTURES	SYN-SEDIMENTARY DEFORMATION	FOSSIL ASSEMBLAGE	BIOCHRONOLOGY	RADIOMETRIC AGE (m.y.)	TIME INTERVAL	REMARKS
272 (49 ↓ 321)	Unnamed limestone				White foraminiferal limestone, poorly consolidated. White to cream calcarenite, poorly sorted, angular CO_2 fragments, unconsolidated thin beds of xt. limestone	—	—	forams, lamelli branch, coral fragments.	Pliocene/Quaternary			Good intergranular porosity dolomitisation? Unconformity at base.
82 (321 ↓ 803)	Unnamed limestone (recrystallised) pkst.				White to cream foraminiferal limestone, fine to very fine grained recrystallized, partly dolomitic. Good intergranular and vugular porosity with very minor beds of greyish, green, calcareous mudstone	—	—	forams increasing with depth. Lepidocyclina (N.) howchini howchini N8? N6-7 Bryozoans Coralline algae	Late Early to Middle? Miocene Burdigalian. Langhian			Recrystallised/leached boundary. Disconformity placed at 803m due to litho/geophysics. ③ No faunal change – Disconformity. Rexry due to secondary diagen.
103 (803 ↓ 933)	Unnamed limestone (unaltered) pkst				White to cream limestone crypto-microcrystalline locally soft foraminiferal. Calclutite white to greenish grey, up to 40% orgillaceous material, poor intergranular porosity. Light grey to light green calclutite slightly pyritic, locally tending to marl 30-40% CO_3. Interbedded bluish grey marly limestone, fairly hard, probably gradational with overlying limestone. Basal contact last occurance of marl.		—	Forams abundant higher in unit. Lepidocyclina (E) badjirrensis (lower part) L (Nephrolepidina) howchini Echinoids Coralline algae N5 → N6-7	Late Early Miocene Aquitanian Burdigalian			Gradational change to underlying unit
1222 (933 ↓ 1222)	'Cartier Beds' pkst/wkst				Light grey to light green marl, slightly pyritic, calcareous, more compact than previous unit fossiliferous. Light grey to light green shale, locally silty, partly pyritic. Pyrite replacing forams. Less than 35% CO_3, very slightly glauconitic and micaceous, with occasional beds of marl	—	—	Forams, pollen/spores Operculina complanata Cycloclypeus eidae L (Eulepidina) badjirraensis N3/4 N5 base 1100m	*Late Cligocene → Early Miocene Chattian Aquitanian			③ Correlation Cape Range Group Mandu calcarenite. Disconformity Contact with underlying unit sharp
72 (1222 ↓ 1294)	'Hibernia Beds' Eocene 5800' 1768m				White to cream calcarenite, slightly dolomitic, rarely fossiliferous, fair to good intergran. porosity, rare interbeds of micrite. Abundant chert. White to cream calclutite, slightly pyritic, chert nodules, interbedded with calcsiltite minor fossiliferous, minor dark grey shale, Calclutite grades to marl at base. m glauconite	—	—	Forams, pollen-spores dinoflagellates.	Late Eocene → Late Palaeocene			Base marked by marl appearance gradual change.
431 (1994 ↓ 2425)	'Woodbine Beds'				Lt to dk green marl, soft, minor glauconite, Cream to light grey micrite, fossiliferous, sl. pyritic. Alternating beds of marl and micrite. Brown limestone, microcrystalline minor ferruginous/manganiferous material. Limonitic stylolites with iron rich chert at base	—	—	Forams, spores-pollen Globorotalia uncinata P2	Early Palaeocene → Middle Cretaceous			Unconformity litho/sharp contact. (seismic unconformity). regionally.
					Shale							

GENERAL REMARKS: Similar to lithology Sahul Shoals 1. – sands in 'Cartier Beds' and Miocene section.

* Spores Pollen age.

2) Pop. 300 ~~260~~ ? ? 300 m.

3)

ASHMORE REEF NO1. Ashmore Reef, NT 2902' NEOGENE to RECENT [NT/P10]

Limestone.
Calcarenites.
calcilutite.

NAME OF SECTION ASHMORE REEF N° 1 (1) AREA ASHMORE BLOCK (2) BASIN BROWSE/BONAPARTE (2) LAT./LONG.

UNIT NAME	DEPOSITIONAL ENVIRONMENT	TECTONIC ENVIRONMENT AND PROVENANCE	OROGENY (Quiescent – Active)	SEA-LEVEL (Cont. – Deep m.)	ENERGY LEVEL (v. low – v. high)	CLIMATE	PALAEOCURRENT DIRECTION		REMARKS
Unnamed limestone	(1) Reef (atoll) as is present day.								
Unnamed limestone (recrystallised)		Antiform formation.	?						(1) Uplift to produce the Ashmore Reef anticlinal structure was post-early Middle Miocene base on dipmeter interpret. (Semi-consolidated seds may record spurious data).
Unnamed limestone (unaltered)		Synclinal							
'Cartier Beds'	(1) Shallow, somewhat offshore marine base, on lithology, pollen conc. >300/gm.	Synclinal	?						(1) Early Miocene → Palaeocene sequence is regionally thick (regional low).
'Libernia Beds'	(1) Off shore bank with free access to open-ocean waters.	Synclinal							
'Goodline Beds'		Synclinal.	?						

REFERENCES:
(1) Ashmore Reef N°1 W.C.R.
(2) Chaproniere

NAME OF SECTION: Ashmore Reef No. 1 2. AREA: Ashmore Block BASIN: Browse / Bonaparte LOCATION: 12° 10' 49.7" S / 123° 05' 10.6" E

THICKNESS (m)	UNIT NAME	LITHOLOGICAL SYMBOL	GRAIN SIZE	LATERAL EXTENT, GEOMETRY	LITHOLOGICAL DESCRIPTION	SEDIMENTARY STRUCTURES	SYN-SEDIMENTARY DEFORMATION	FOSSIL ASSEMBLAGE	BIOCHRONOLOGY	RADIOMETRIC AGE (m.y.)	TIME INTERVAL	REMARKS
44					shale, sandstone, calcarenite				UPPER JURASSIC			
315					Basic volcanics, with minor claystone							
860					sandstone, siltstone, calcilutite, limestone, shale, quartzite				TRIASSIC			
219					Limestone, siltstone, minor chert and shale							
43					siltstone, sandstone, limestone, shale				UPPER			

GENERAL REMARKS:

TD = 3892 m

KB = 12 m

NAME OF SECTION Ashmore Reef No.1 2. AREA Ashmore Block BASIN Browse / Bonaparte LAT./LONG. 12° 10' 49·7"S/123° 05' 10·6"E

UNIT NAME	DEPOSITIONAL ENVIRONMENT	TECTONIC ENVIRONMENT AND PROVENANCE	OROGENY		SEA-LEVEL	ENERGY LEVEL		CLIMATE	PALAEOCURRENT DIRECTION		REMARKS
			Quiescent	Active	Cont. Shelf / Shallow Shelf / Deep Shelf / Slope / Deep Sea	v. low	v. high				
44											
315											
860											
219											
43											

ERENCES:

NAME OF SECTION ASHMORE REEF 1 AREA BONAPARTE BASIN LAT./LONG. 12 10 49.7 ; 123 05 10.6

THICKNESS (m)	UNIT NAME	LITHOLOGICAL SYMBOL	GRAIN SIZE (clay, silt, v.f., f., m., c., v.c., pebbly)	LATERAL EXTENT	LITHOLOGICAL DESCRIPTION	SEDIMENTARY STRUCTURES	SYN-SEDIMENTARY DEFORMATION	FOSSIL ASSEMBLAGE	BIOCHRONOLOGY	RADIO-METRIC AGE (m.y.)	REMARKS
276					Foraminiferal limestone, calcarenite	Unconformity at base			Quaternary / Pliocene		
482					Foraminiferal & crypstalline limestone	Disconformity at base			Early middle to late lower Miocene		
130					Limestone, crypstalline to foraminiferal. Calcilutite, argillaceous				Early L. Miocene		
289	'Cartier Beds'				Marl and shale	Disconformity at base			Oligocene [? late]		
772	'Hibernia Beds'				Calcarenite, calcilutite, calcisiltite. Chert nodules throughout, marl near base				Eocene – Palaeocene		
431	'Woodbine Beds'				Marl, cream microcrystalline lst, calcareous shale	Unconformity at base			Palaeocene – Upper Cret.		Top 150 m probably Palaeocene
UPPER JURASSIC											

GENERAL REMARKS:

ASHMORE REEF (NO.1) Ashmore reef. NT. 3481' PALAEOCENE. [NT/PO]

limestones / calcarenites / calcilutites.
marls
shales

Ma
Epoch
6
Ashmore Platform
5
Basin
Vulcan Sub-Basin
4
onaparte
Petrel Sub-Basin
3
Bc
Sahul Platform
2
Bonaparte/ Money Shoal Basin - North
1
Money Shoal Basin - South
Pleistocene
Pliocene
Miocene
Oligocene
Eocene
Paleocene
Pre-Cainozoic
L
E
M
10
20
30
40
50
60
Unnamed
120
Unnamed
200-400m
Unnamed
300-500m
Cartier beds 60-200m
Hibernia Formation Beds 150-800m
Woodbine beds 100-600m
Unnamed
600-1000m
Unnamed
Cartier beds equiv.
Hibernia beds equivalent 400-600m
Woodbine beds equivalent 350-500m
Bathurst Island Formation
Unnamed
100-400m
Unnamed
30-200m
Bathurst Island Formation
Unnamed
100-1000m
Cartier beds 20-250m
Hibernia Beds 200-500m
Woodbine beds 200-500m
Bathurst Island Formation
Unnamed
Unnamed 100-500m
Unnamed 100-300m
Unnamed
Bathurst Is Formation
Van Diemen Sandstone 30-250m
Bathurst Is Formation