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ESSO PRAWN A-1

WELL COMPLETION REPORT

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ESSO PRAWN A-1 WELL, TASMANIA

FINAL WELL REPORT

B.L. CULP

I. SUMMARY

(1) Drilling

Esso Prawn A-1 spudded December 29, 1967, in the Tasmanian portion of the offshore Otway Basin (Figure 1). There were two unsuccessful attempts made to begin drilling the well. After drilling the original hole to 599 feet both guide lines to the rig were broken while opening the 17½ inch hole to 36 inches. The well base became covered with cuttings and the hole could not be located. The rig was moved over and a second attempt made to commence drilling. The second hole was drilled to 1000 feet but had to be abandoned when the well head base became damaged beyond repair while attempting to install and test the blowout preventer equipment. The rig was again moved and a third hole begun. This third attempt was successful and Prawn A-1C actually spudded January 19, 1968. The well was drilled to a total depth of 10,477 feet and abandoned April 9, 1968. (Figure 5).

(2) Geologic (Figures 1, 2, 3 & 4)

The well was drilled on the crest of a north-south trending anticline approximately 37 miles long and 12 miles wide. Vertical closure mapped on pre-Tertiary strata exceeded 2000 feet.

The sedimentary section penetrated by Prawn A-1 conformed reasonably close to the pre-drill prognosis down through strata of Tertiary age. Below the base of the Tertiary section however, an unexpectedly thick sequence of Upper Cretaceous strata was encountered overlying the Otway Group of Lower Cretaceous age.

Strata from 367 feet to 3024 feet (-278 to -2935 feet subsea) ranged from Miocene to Upper Eocene in age. These beds consist primarily of grey to greenish grey, soft marl interbedded with thin beds of skeletal to sandy limestone.

Sediments of Pre-Upper Eocene and Paleocene age were penetrated from 3024 feet to 4150 feet (-2935 to -4061 feet subsea). This sequence consisted of predominantly quartz sandstones which were slightly pyritic and carbonaceous.

The Upper Cretaceous Sherbrook Group was encountered from 4150 feet to 9660 feet (-4061 to -9571 feet subsea). This interval consisted primarily of quartz sandstones with occasional thin interbedded silty carbonaceous shales. These sandstones were for the most part porous but were occasionally very calcareous and impermeable. A massive basal conglomerate of siliceous material was penetrated at the base of this section from 9372-9660 feet (-9283 to -9571 feet subsea).

The Otway Group of Lower Cretaceous age was penetrated from 9660 feet to a total depth of 10,477 feet (9571 to 10,388 feet subsea). The Otway beds consisted of impermeable greyish green lithic sandstones with an occasional thin interbed of shale.

The original structural picture of a closed pre-Tertiary anticline appears to be valid. The absence of hydrocarbons is believed to result from an insufficient amount of shale throughout the overall stratigraphic section which could have formed a seal over any of the porous pre-Tertiary sandstones. The area also appears to be complicated by faulting.

II. INTRODUCTION

The Otway Basin occupies approximately 33,000 square miles and extends about 400 miles in a west-northwest to east-southeast direction both onshore and offshore of South Australia, Victoria and offshore Tasmania. (Figure 1). In the area of Prawn A-1 seismic data had indicated the presence of a deep anticline below the base of the Tertiary section with the possibility of closure extending up into basal Tertiary strata (Figure 4a). Prior to the drilling of the well seismic data was interpreted as indicating about 650 feet of Upper Cretaceous strata to be present above the Lower Cretaceous Otway Group. It was also tentatively believed that only very old Otway sediments would be encountered. Sandstones of Upper and Lower Cretaceous ages were considered to be the primary objectives of the well.

Upon drilling Prawn A-1 the base of the Tertiary was encountered at 4150 feet (-4061 subsea) which agreed reasonably well with a predicted depth of 3989 feet (-3900 feet subsea). Below the base of the Tertiary however, 5510 feet of Upper Cretaceous strata were penetrated before encountering the Otway Group at 9660 feet (-9571 feet subsea). The difficulty of constructing seismic correlations below the base of the Tertiary had long been recognized and was further confirmed.

Porous and permeable sandstones were encountered within the Tertiary and Upper Cretaceous sequences. Structural closure apparently did not extend far enough up into Tertiary strata to form a trap and the absence of sufficient shales above and within the Upper Cretaceous section apparently prevented the entrapment of hydrocarbons in the Sherbrook Group. Lower Cretaceous sandstones were found to be impermeable in the same manner as those encountered by Shell Oil Co. in their Pecten and Nerita wells. Prawn A-1 was designated a stratigraphic test in the Drilling Prospectus submitted for Commonwealth Subsidy and evaluated the following:-

1. Regional and stratigraphic control in the undrilled offshore area south of Cape Otway and northwest of King Island, Tasmania.

2. Lithology of the offshore section.

3. A partial evaluation of the hydrocarbon potential of the Otway Basin.

4. The presence or absence of hydrocarbons in the proposed well.

III. WELL HISTORY

1. General Data

i) Well name and number: Prawn A-1

ii) Name and address of Operator:

Esso Exploration & Production Australia Inc.
A.N.Z. Bank Building
71 Collins Street
Hobart
Tasmania 7000

iii) Name and address of Tenement Holder:

Hematite Petroleum Pty. Ltd.
G.P.O. Box 2752
Melbourne
Victoria 3001

440 Collins Street
Melbourne
Victoria 3000

iv) Details of Petroleum Tenement — Petroleum Exploration Permit 1/60 issued by the State of Tasmania Farmed-in by Esso Exploration and Production Australia Inc. from Hematite Petroleum Pty. Ltd.

v) District: — Offshore Tasmania and northwest of King Island.

vi) Location Drilled: — Latitude: 39° 21' 23-42" south
Longitude: 143° 06' 41-89" east
Co-ordinates: x =599,059
y =147,612

(Approximately 1170' North, East of shot point 8030, EO-24)

vii) Elevation Permanent Datum: — Mean sea level. Rotary table 89 feet above mean sea level.

viii) Total Depth: — 10,477

ix) Date Drilling Commenced: — December 29, 1967.

x) Date Drilling Completed: — March 30, 1968.

xi) Date Well Suspended: — April 9, 1968

xii) Date Rig Released: — April 9, 1968

xiii) Drilling Time to T.D: — 73 days (excludes initial two unsuccessful attempts)

xiv) Status: — Plugged and abandoned

xv) Total Cost: — Final cost not yet available, but will be submitted as soon as the final audit is completed.

2. Drilling Data

i) Name and Address of Drilling Contractor — Ocean Drilling & Exploration Co.(Aust)Ltd.
180 Russell Street,
Melbourne, Victoria, 3000.

ii) Drilling Plant:

Make:	EMSCO
Type:	A1500E
Rated Capacity:	20,000 feet with 5" D.P.
Motors:	2-1000 HP D.C.electric motors, also Dynamatic 6032 brake.

iii) Mast/Derrick: — Lee C.Moore 40' x 40' x 142' Cantilever mast, 1,000,000 lbs hook load capacity.

iv) Pumps: (4)

Make:	EMSCO
Type:	D-1350
Size:	8" x 18"
Motor:	D.C.electric direct drive, 1350 HP.

Electric Power: — Two (2) Fairbanks-Morse Model 38 D-8-1/8 O.P. diesel engines, each rated 1800 HP at 720 RPM each driving 2-1200 KW D.C. generators and one 300 KVA volt alternator. One (1) Fairbanks-Morse Model 38 D-8-1/8 O.P. diesel engine rated at 1800 HP at 720 RPM driving 3-1200 KW D.C. generators and one 300 KVA 440 volt alternator.

v) B.O.P. Equipment:

Make: Hydril Cameron Triple "U".
Size: 16-3/4" (G.K.)
Working Pressure: 5000 psi.

vi) Hole Sizes and Depths:

		Size	Depth
Original Hole		36 inches	589 feet
		17½ "	599 "
Second Hole		36 "	584 "
		26 "	935 "
		17½ "	1000 "
Third Hole (Successful)		36 "	638 "
		26 "	1010 "
		17½ "	2784 "
		12¼ "	8200 "
		8½ "	10468 "
	(Core)	8.5/16"	10477 " Total Depth

vii) Casing and Liner and Cementing Details:

First Hole

None

Second Hole

Size	30 inches	20 inches
Weight	196 & 310	105 & 167
Grade	SSLP	SSLP
Range	2 & 3	2 & 3
Setting Depth	566'	943'
Location of Shoe	560'	933'
Collars	None	None
and Centralizers	None	None
Cement Used (sacks)	535	800
Cemented to	Ocean floor	Ocean floor
Method Used	Displacement through Drill Pipe	Displacement through Drill Pipe

Third Hole (Successful)

Size	30"	20"	13.3/8"	9.5/8"
Weight	196 & 310	105 & 167	54.5	40 & 47
Grade	SSLP	SSLP	J-55	N-80
Range	2 & 3	2 & 3	3	3
Setting Depth	560'	933'	2683'	8154'
Location of Shoe	560'	933'	2683'	8154'
Collars	None	None	-	Float collar 8067
and Centralizers	None	None	2643) 2603) 2563)	None
Cement Used (sacks)	500	950	1775	400
Cemented to	Ocean floor	Ocean floor	Ocean floor	7200 calculated
Method used	Displacement through Drill Pipe	Displacement through Drill Pipe	Displacement through Drill Pipe	Displacement through Drill Pipe

viii) Drilling Fluid

XP Spersene Mud - Average Weekly Properties

Week ending:	March 11	March 18	March 25	March 29
Wt	10.5	10.4	10.6	10.8
Vis	44	44	47.0	51.0
Filtrate Loss	6.6	6.6	4.9	4.5
Filter Cake	2/32	1/32	2.0	1.0
% Sand	1%	3/4	½	1.0
% Solid	14%	14%	16%	16%
PH	10	11	9	9.3
NaCl	5700	4950	6435	6440
AlKal	0.35	.72	0.1	0.13

Mud Used on Prawn A-1

1. 2600-50 lb sx wt material.
2. 170,000 lb bulk wt. material
3. 656 - 50 lb sx Spersene
4. 524 - 50 lb. sx XP-20
5. 13,360 lbs caustic soda
6. 2,060 - 100 lb sx Gel
7. 21 - 100 lb sx C.M.C. (water loss additive)
8. 23 Phosphate sx
9. 30 sx lost circulation material.

ix). Water Supply: Fresh water was transported by Smit-Lloyd vessels Nos. 12 and 14 from Portland.

x) Perforation and Shooting Record: None attempted.

xi) Plugging Back and Squeeze Cement Jobs:

First Hole

None

Second Hole

Plugs:

Depth	497'-747'
Cement (sacks)	280
Type	Aust "N" with 6% Gel.
Checked	No

Third Hole

Depth	8147'-10477'	7805'-8105'	970'-1349'
Cement (sacks)	140	80	110
Type	Aust. "N"	Aust. "N"	Aust."N"
Checked	Yes	No	No.

xii) Fishing Operations: None

xiii) Side-tracked Hole: None

3. Formation Sampling

1) Ditch Cuttings: (Appendix 2) Samples of cuttings were taken over a shale shaker every ten feet to total depth. Samples were caught by Exploration Logging Co. mud loggers under the supervision of a Company geologist. Four sets of samples were dried, bagged, labelled and packed in boxes. One set of samples was sent to the Bureau of Mineral Resources in Canberra; one set to the Tasmanian Mines Department, one set to Hematite Petroleum Pty. Ltd. and the remaining set kept by Esso in Melbourne.

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ii) Coring Programme: (Appendix 3)

The coring programme had planned cores at 3900, 4200, 4550, 4800, 5100 and 5500 feet subsea. Below 5500 feet cores were to be taken at 500 foot intervals to total depth with one core at total depth. The coring programme was flexible with a total of 20 cores tentatively planned. Sixteen conventional cores were actually cut totalling 330'.

Core No.	Interval (Drillers Depth) (in feet)	Feet Cut	Recovery (feet)	Recovery (%)
1	3621-3623	2	0	0
2	3938-3957	19	3	15.8
3	4254-4284	30	30	100.0
4	4581-4597	16	9	55.6
5	4935-4963	28	27	96.5
6	5621-5649	28	26	92.9
7	6145-6155	10	4	40.0
8	6651-6677	26	22½	86.6
9	7147-7177	30	30	100.0
10	7684-7694	10	6	60.0
11	8217-8247	30	30	100.0
12	8697-8727	30	30	100.0
13	9289-9294	5	4½	90.0
14	9850-9873	23	23	100.0
15	10168-10184	16	16	100.0
16	10450-10477	27	27	100.0
	Total	330	288	87.3% average

Continuous slabs of these cores are stored at the Bureau of Mineral Resources laboratory in Canberra, the Tasmanian Mines Department in Hobart, and at Esso's Spotswood Warehouse in Melbourne.

iii) Sidewall Sampling:

A total of 117 sidewall cores were taken on Prawn A-1 to supplement the conventional drill cores. These cores were used by Esso for age dating. Sidewall cores which were not destroyed in the process of analysis are stored with the Bureau of Mineral Resources in Canberra and at Esso's Spotswood warehouse. A description of the sidewall cores is included in this report as appendix (4).

4. Logging and Surveys

i) Electric and other Logging:

Induction-electrical, sonic, formation-density-gamma ray, and continuous dipmeter logs were run to a total depth of 10477 feet. A cement bond log was also run from 5500-7300 feet. A summary of the various logging runs is included in Appendix (5).

ii) Penetration Rate & Gas Logs:

Drilling time and gas logs are included as appendices to the report (Figures 3 & 5).

iii) Deviation Surveys:

The surveys were conducted with a Totco instrument and results are plotted on the Mud Log (Figure 3).

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iv) Temperature Surveys: No individual temperature surveys were run however thermometers were run on Schlumberger logs.

v) Other Well Surveys: None.

vi) Velocity Surveys: A velocity survey was run at 8200 feet on March 9, 1968. The survey was run by United Geophysical Corporation and the results are included as an appendix.

5. :. Testing None performed.

IV. GEOLOGY

(1) Summary of Previous Work:

a) Petroleum Indications:

Commercial accumulations of oil and/or natural gas have not yet been discovered in either the onshore or offshore portions of the Otway Basin. Numerous oil and gas shows have been recorded in wells from Upper and Lower Cretaceous sediments. Frome-Broken Hill Pty. Ltd. Port Campbell No. 1 for example, had a strong initial gas flow (4.2 MMCD) with condensate from the Upper Cretaceous Waarre Formation, however the pressure declined rapidly and the interval proved to be non-commercial.

b) Existing Geophysical Data:

The following is a summary of the offshore geophysical surveys completed by both Hematite and Esso.

c) Hematite Petroleum Pty. Ltd.

1) Aeromagnetic Survey completed in 1962.

2) 743 miles of single fold seismic coverage in 1963.

3) 1554 miles of 3-fold CDP and 321 miles of single fold seismic coverage completed in 1965.

d) Esso Exploration and Production Aust. Inc.

2364 miles of 6-fold seismic coverage completed in 1966 and 1967.
970 miles of 6-fold seismic coverage September 67-Janury 68

e) Existing Geological Work

A considerable amount of geological work has been done onshore in the Otway Basin (see list of selected references). Offshore information has been compiled primarily from seismic control in conjunction with geological and geophysical data from the Pecten 1A, Nerita 1A and Voluta 1A wells drilled by Shell Development (Aust.) Ltd. and the Esso Crayfish A-1 well.

(2) Regional and Historical Geology

The Otway Basin, of Mesozoic and Cainozoic age, is located in the southern part of the old Paleozoic Tasman Geosyncline and encompasses about 33,000 square miles. The Paleozoic sequence probably exceeds 25,000 feet in thickness in the Mornington Peninsula on the southeast side of the Otway Basin. The strata range in age from Cambrian to Carboniferous and consist of complexly folded, faulted, metamorphosed sedimentary, extrusive and intrusive igneous rocks. The Tasman Geosyncline was terminated in late Carboniferous to early Permian time by the Hunter-Bowen Orogeny. The Otway Basin was probably initiated in Jurassic or Lower Cretaceous time, although it is probable that Triassic deposition occurred. Clastic sediments derived from the old Paleozoic landmass are believed to have been deposited in a west to east trending trough which extended from offshore South Australia south of Cape Jaffa to western Victoria near Casterton. These sediments are thought to have consisted predominantly of coarse sandstones, interbedded with siltstone and carbonaceous shale. During Lower Cretaceous time these clastics were uplifted and truncated.

The Lower Cretaceous Otway Group unconformably overlies thick clastic Lower Cretaceous or older sediments. The Otway Group consists of non-marine greywackes, mudstones and coal deposited in a northwest-southeast trending trough which was parallel to the present coast of Victoria and South Australia from Gippsland to Cape Jaffa. These clastics were probably derived from the uplifted Mesozoic and Paleozoic highlands then present to the north and south of the depositional trough. The Otway Group is generally unconformably overlain by paralic clastics of the Sherbrook Group of Upper Cretaceous age. The Upper Cretaceous basin was probably open to the Southern Ocean and becomes more open marine in a southerly direction.

At the close of Upper Cretaceous time the pre-Tertiary rocks were subjected to uplift and erosion and a widespread regional unconformity developed in the Otway Basin.

During Paleocene time gentle subsidence took place in the Otway Basin and about 4000 feet of clastic sediments were deposited in an environment ranging from paralic to neritic. This clastic sedimentation continued on into Upper Eocene time, although there was structural uplift and erosion during the Middle Eocene.

In Oligocene and Miocene time marls and limestones were deposited in the Otway Basin by a transgressive sea. These marine conditions persisted on into late Miocene time when the marine transgression reached its fullest extent. During middle Pliocene time the Otway Basin was subjected to uplift, probably accompanied by some gentle folding and faulting. Volcanism was widespread in this period in Tasmania and west-central Victoria. In late Pliocene and Pleistocene time the sea in general retreated to its present level.

(3) Stratigraphy: (Figure 2)

Stratigraphic Table

Stratigraphic section penetrated by Prawn A-1
Water depth 354' water
Depths are relative to R.T. (subtract 89 feet for M.S.L.)

Age and Formation	Depth	Thickness	Lithology
Miocene-Oligocene:			
Gellibrand Marl	354'-2410'	2056'	Marl interbedded with limestone; calcareous sandstones and siltstones.
Oligocene:			
Clifton limestone	10-2467'	57'	Skeletal limestone; slightly sandy.
Upper Eocene:			
Narrawaturk Marl	2467-3024'	557'	Marl interbedded with limestone.

*Note: Samples recovered below 1030'

Eocene-Paleocene:			
Mepunga and Dilwyn	3024-3890'	866'	Sand and sandstone; pyritic, carbonaceous.
Paleocene:			
Rivernook	3890-3957'	67'	Silty mudstone
Pebble Point	3957-4150'	193'	Sand and conglomerate
Unconformity			
Upper Cretaceous:			
Sherbrook Group			
Curdies-Paaratte	4150-7137'	2987'	Sandstone with occasional thin interbeds of shale.
Belfast	7137-7310'	173'	Shale
Belfast-Flaxmans	7310-9372'	2062'	Calcareous sandstones
Waarre	9372-9660'	288'	Conglomerate
Unconformity			
Lower Cretaceous:			
Otway Group	9660-10477'+	817'+	Lithic sandstones

Note: Samples not recovered above 934 feet.

Generalized Lithology

Gellibrand Marl (Miocene-Oligocene) 354'-2410'

354-1590' Calcarenite: light grey, medium hard, 2-3% glauconite grains abundant fossils (corals, bryozoans, foraminifera). Interbedded with thin beds of white to yellow skeletal limestone which is micritic to granular with a trace of clear medium-grained sub-angular quartz. Orange yellow to rust red chert fragments are also present.

1590-2410 Marl and limestone: marl is light grey, soft, very fossiliferous. Interbedded with thin beds of yellow to white skeletal limestone which is micritic to granular, non porous and hard.

Clifton limestone (Oligocene) 2410-2467'

2410-2467 Carcarenite: Rust red (ferruginous staining), skeletal, non porous, fine to coarse-grained, and slightly glauconitic. Contains about 10% matrix.

Narrawaturk Marl (Upper Eocene) 2467'-3024'

2467-3024' Marl and limestone: Marl is medium light to light grey, medium hard with abundant fossils. Interbeds of limestone are light brown to grey, micritic and fossiliferous, very hard, dense and non porous.

Mepunga and Dilwyn (Eocene-Paleocene) 3024-3890'

3957-4150' Sand: quartzose, light brown to clear and milky quartz grains, unconsolidated, fine to very coarse-grained, with occasional pebble-sized grains, subangular to subrounded, very pyritic with a trace of glauconite. Occasional lithic grains present (siliceous).

Sherbrook Group (Upper Cretaceous) 4150-9660'

Curdies-Paaratte (Undifferentiated) 4150-7137'

4150-7045'	Sandstone interbedded with occasional shale beds: sandstone is quartzose, fine to very coarse-grained, pyritic and slightly carbonaceous, subangular to subrounded, predominantly unconsolidated with occasional fragments of hard silty-fine grained sandstone being present. Thin interbeds of calcareous, hard fine-grained sandstone occasionally occur throughout the interval. The occasional and "rare" thin beds of shale present are brown to light grey, carbonaceous, slightly micaceous and brittle to soft.
7045-7051	Shale: medium grey to grey-brown, carbonaceous, moderately hard, non calcareous, and slightly pyritic.
7075-7137'	Sandstone: quartzose, light tan, very fine to medium-grained with occasional coarse grains, calcareous, slightly glauconitic, and subangular to subrounded.

Belfast Shale 7137-7310'

7137-7250'	Shale: medium grey, non calcareous to slightly calcareous silty, medium hard, carbonaceous and slightly pyritic.
7250-7258'	Sandstone; quartzose, fine to medium-grained, subangular to subrounded, calcareous cement, slightly pyritic and carbonaceous.
7258-7310'	Shale and sandstone: Sand is quartzose, clear, fine to medium grained, and subrounded to well-rounded. Shale is grey, carbonaceous, slightly micaceous and pyritic.

Belfast-Flaxmans (Undifferentiated) 7310-9372'

7310-9372'	Sandstone: quartzose, white to light grey, fine to coarse-grained, unconsolidated to hard. Predominant increase in calcareous matrix. Occasional interbeds of thin hard dark grey slightly chloritic and carbonaceous shale present. The sandstone also has scattered lithic (siliceous) grains.

Waarre 9372-9660'

9372-9660'	Conglomerate: siliceous, very coarse to gravel sized imbedded in fine grained very calcareous sandstone matrix, very hard and impermeable.

Otway Group (Lower Cretaceous) 9660-10477'

9660-10477'	Sandstone: lithic (siliceous and basic-olivine, chlorite) very fine to fine-grained, and hard. Sandstone fragments have slightly calcareous to siliceous cement and are slightly carbonaceous and micaceous. Occasional thin interbeds of dark grey to black hard micaceous carbonaceous and pyritic shale present.

(4) Generalized Stratigraphy of the Otway Basin

Paleozoic Rocks

Paleozoic sediments consisting of marine and non-marine metasediments, metamorphics, and intrusive and extrusive igneous rocks are believed to comprise "economic basement" within the Otway Basin.

In the Otway Basin of Mesozoic-Tertiary age, four onshore wells drilled into Paleozoic strata (Ferguson's Hill-1, Pretty Hill-1, Kalangadoo-1 and Casterton-1). These wells found the Paleozoic rocks to be unproductive and non-prospective for hydrocarbons. Paleozoic strata were not encountered in Prawn A-1.

Mesozoic Rocks

The earliest Mesozoic rocks in the Otway Basin are represented by over 5000 feet of Lower Cretaceous sands which were encountered in the Esso Crayfish A-1. The areal extent of this sandstone sequence is not known but it does appear to correlate with the thick quartose sandstones present in the lower part of the onshore wells Frome-Broken Hill Pty. Ltd. Pretty Hill-1 and Planet Oil Casterton-1. The overlying Lower Cretaceous Otway Group may attain a maximum thickness of about 15,000 feet. This section is predominantly non-marine and consists of greywackes subgreywackes, carbonaceous siltstones and chloritic mudstones. The sandstones usually contain abundant matrix material resulting in very low permabilities. The Otway Group is represented in Prawn A-1 by 817 feet of impermeably lithic sandstones.

The Upper Cretaceous sequence in the Otway Basin is represented by the Sherbrook Group. This section was apparently deposited by a major marine transgression followed by a subsequent regression. Locally the base of the Sherbrook Group is represented by a quartz sandstone known as the Waarre Formation which is overlain by a ferruginous sandstone called the Flaxmans Formation. The Waarre Formation is well developed in the Port Campbell area. Overlying the Flaxmans Formation are the carbonaceous mudstones of the Belfast Formation which grade upward into shallow water sandstones and siltstones of the Paaratte Formation which is in turn, overlain by non-marine sandstones of the Curdies Formation.

Esso Prawn A-1 penetrated an Upper Cretaceous section having a thickness of 5510 feet. The undifferentiated Curdies-Paaratte Formation had a thickness of 2987 feet and consisted predominantly of massive porous and permeable quartz sandstones with occasional thin interbedded carbonaceous shales. The Belfast Formation consisted of silty carbonaceous shale approximately 173 feet thick. The Flaxmans-Lower Belfast section was comprised of 2062 feet of calcareous and relatively impermeably quartz sandstones. The basal Upper Cretaceous Waarre Formation was represented by 288 feet of massive impermeable siliceous conglomerate in a calcareous sandstone matrix.

Tertiary Rocks

Paleocene-Eocene (Wangerrip and Browns Creek Groups)

A transgressive sea deposited lagoonal to shallow neritic mudstones, sandstones and conglomerates in the Otway Basin during Paleocene-Eocene time. A total aggregate thickness for this sequence is about 4000 feet, based on seismic data.

The Paleocene section at Prawn A-1 consisted of 193 feet of conglomerate referred to as the Pebble Point which was overlain by about 67 feet of silty mudstone known as the Rivernook Formation. The uppermost Paleocene Dilwyn and Eocene Mepunga Formations consisted of massive carbonaceous porous quartz sandstone. Uppermost Eocene time was represented by 557 feet of Narrawaturk marl.

Oligocene-Miocene

During Oligocene-Miocene time the sea continued to transgress the Otway Basin depositing marl, limestone and calcareous siltstones and sandstones The toal composite thickness of thissection is about 3500 feet from seismic data.

Oligocene time is represented in Prawn A-1 by 57 feet of sandy limestone known as the Clifton limestone and part of the overlying Gellibrand marl. The Gellibrand marl which ranges up into Miocene time had a thickness of 2056 feet. (Samples were not recovered in Prawn A-1 above 934 feet).

Pliocene

During Pliocene time a tectonic movement uplifted southeastern Australia and the sea began to regress. Extensive volcanism also occurred resulting in extensive basaltic lava flows which now cover large areas of the onshore Otway Basin.

(5) Structure

Esso Prawn A-1 was located on the crest of a north-south trending anticline approximately 37 miles long and 12 miles wide. Maximum structural closure was mapped in excess of 2000 feet on the "Phantom Horizon" based on deep discontinuous seismic reflections which had been thought to be within pre-Upper Cretaceous strata. Thinning of beds represented by these reflections can be observed on pertinent seismic lines suggesting that most of the structural movement occurred during that time.

The drilling of Prawn A-1 revealed however that beds which were originally believed to be "pre-Upper Cretaceous" in age were actually Upper Cretaceous Strata of the Lower Cretaceous Otway Group were not encountered until a depth of 9660 feet.

In the Eocene-Paleocene interval the Prawn A-1 structure had been mapped as a broad southwest plunging nose. There was little evidence of thinning over structure in this interval.

(6) Relevance to the Occurrence of Petroleum

The primary objective of Prawn A-1, apart from stratigraphic evaluation was to determine the hydrocarbon potential of reservoir sands below the base of the Tertiary related to an anticlinal feature. The possibility of closure extending up into the basal Tertiary strata was also to be tested.

Pre-Tertiary strata below the basal Tertiary unconformity were found to be massive sandstones of Upper Cretaceous age and water saturated. Strata of Lower Cretaceous age, below 9660 feet, were impermeable. Basal Tertiary sands although porous were also water-saturated.

The absence of hydrocarbons in the Upper Cretaceous section is attributed to the absence of sufficient shale sections over structure which could have formed a "seal". The contact between the Tertiary and Upper Cretaceous sections was essentially a "sand over sand" contact with structural closure not present within the Tertiary section thereby eliminating trap possibilities at the top of the Upper Cretaceous sequence. The only shale within the Upper Cretaceous section of any consequence was the Belfast formation from 7137-7310 feet. The underlying Flaxmans-Belfast sandstones vary from impermeable to water-saturated. This might suggest the Belfast shale did not extend far enough over structure to entrap hydrocarbons.

The Waarre Formation and underlying Otway Group were impermeable.. Similar Otway sediments were encountered by Shell Oil in their Pecten 1A and Nerita 1A wells.

(7) Porosity and Permeability of Section Penetrated

Porosity and permeability measurements were made on core samples by Exploration Logging. The results of these analyses are included as an appendix. The Upper Cretaceous sands exhibit good permeabilities and porosities. Values up to 1450 millidarcies permeability and 29.2% porosity were measured in this section. Porosity values calculated from logs also indicate the Upper Cretaceous sands to have good porosities. (Appendix 5). Porosity and permeabilities values could not be measured within the Tertiary section because of the porous and unconsolidated nature of the sand.

The Waarre Formation in Prawn A-1 as mentioned above consisted of an impermeable conglomerate in a calcareous sandstone matrix. The underlying Otway section was also impermeable.

(8) Contribution to Geological Concepts Resulting from Drilling

The most significant contribution of Prawn A-1 to geological concepts is the information derived from strata encountered below the base of the Tertiary section. An unexpectedly thick (5510 feet) Upper Cretaceous section was penetrated above the Lower Cretaceous Otway Group. This section was comprised of very thick quartz sandstones with the amount of shale present being negligible. The occurrence of a massive basal conglomerate of Upper Cretaceous age is also interesting.

The great thickness of sand and basal conglomerate encountered of Upper Cretaceous age would probably indicate a nearby sand source. The King Island "high" might be postulated to have furnished this sand. (See figure 1)

Prawn A-1 evaluated the hydrocarbon potential for the drillsite and a portion of the Otway Basin. The test is believed to have been drilled "on-structure" with the absence of hydrocarbons attributed to the lack of a sufficient amount of shale capable of forming a seal within the interval of closure.

SELECTED REFERENCES

Brown G.A.	1965	New Geological concepts, Casterton area, Otway Basin, Victoria. The APEA Journals 1965 pp 27-33
Dettmann, M.E.		Upper Mesozoic Microfloras from southeastern Australia. Proc. Roy. Soc. Vic. 77
Esso Standard Oil Australia Ltd.	1968	Esso Crayfish A-1. Final Well Report.
Leslie, R.B.	1965	Petroleum Exploration in the Otway Basin Eighth Comm. Min. and Met. Cong. Aust. & N.Z. 34th Technical Session in Petroleum.
Shell Development (Australia) Pty. Ltd.	1967	Pecten 1 and 1A Well Completion Report
Shell Development (Australia) Pty. Ltd.	1967	Nerita 1 Well Completion Report
Shell Development (Australia) Pty. Ltd.	1968	Voluta 1 Well Completion Report
Sprigg, R.C.	1962	Progress Exploration in southern Australia Tertiary Basins. The APEA Journal 1962
Taylor, D.J.	1964	The Depositional Environment of the Marine Cretaceous Sediments of the Otway Basin. The APEA Journal 1964. pp 140-144.
Woolley, J.B. & Laws R.A.	1964	Geltwood Beach - A case history. The APEA Journal pp 14-20.
Wiggin, R.W. etal	1967	Offshore Otway Basin marine seismic survey Esso Exploration (Subsidy Report to the Bureau of Mineral Resources).

BIOSTRATIGRAPHIC SUMMARY

PRAWN A-1 WELL

OTWAY BASIN

D. J. Taylor

Melbourne
April, 1968.

BIOSTRATIGRAPHIC SUMMARY - PRAWN A-1 WELL - OTWAY BASIN

ZONULE		FACIES	AGE
D	? - 1120	inner shelf sediment	MIOCENE
E	1120 - 1250		
F	1250 - 1420	very shallow water	
G	1420 - 1800	inner shelf sediment	
H	1800 - 2310		
I-1	2310 - 2460	very shallow water.	OLIGOCENE
I-2	N.P.	Hiatus	
J-1	N.P.		
J-2	2460 - 2550		
K	2550 - 2780	transgressive marine	UPPER EOCENE
L	2780 - 3020 - ?		
M		? deltaic or ? hiatus.	
N			
			MIDDLE TO LOWER EOCENE
S & T	3890	marine ingression into marginal marine	PALEOCENE
U & V	? 3890 - ? 4263?		
Z & XA	5020 - 7310	marine ingression into marginal marine.	UPPER CRETACEOUS
XB	N.I.		

N.P. = not present.

N.I. = not identified.

Note: Zonule M to R and W to Y are not identified in the section. It is not necessarily inferred that these are absent from the section. Their time interval may be occupied by non-marine sediment.

FORAMINIFERAL SEQUENCE - PRAWN A-1 WELL - OTWAY BASIN

by David Taylor.

INTRODUCTION

Prawn A-1 Well was drilled in the south eastern extension of the Otway Basin some 49 miles north-west of King Island and some 42 miles south-west of Cape Otway. Most cores and side wall cores were examined. Rotary cutting samples were examined at 100 foot intervals down to 8300 feet. This 100 ft sampling interval was reduced to 10 ft at some horizons. Contamination in rotary cuttings was sporadic and fluctuated in intensity.

In this report the sequence has been divided into three parts for convenience in discussion. In each part the biostratigraphy, environments of deposition and geological conclusions are discussed. In order, the parts are :-

PART A - UPPER TERTIARY (with abstracted distribution chart)

PART B - LOWER TERTIARY

PART C - UPPER CRETACEOUS.

In discussion of the Prawn A-1 section and other sections within the Otway Basin, a two-fold division of the Tertiary has been adopted for convenience in discussion, as each division forms an integral biostratigraphic and environmental unit.

(A) The upper Tertiary - predominantly calcareous sediments with a planktonic foraminiferal sequence from upper Eocene to lower Pliocene, which may be complete or interrupted.

(B) The lower Tertiary - predominantly clastic sediments with sporadic foraminiferal assemblages of Paleocene to middle Eocene age.

The time connection of such a division is vague as the base of Unit A is diachronous within 6 planktonic foraminiferal zones extending from basal upper Eocene (Zonule N) to late Oligocene (Zonule I-1). This diachronism is due to either a hiatus in some sections or to later arrival of marine conditions in other sections. Thus the division is in reality a mega-facies one.

PART A - THE UPPER-TERTIARY FORAMINIFERAL SEQUENCE

The biostratigraphic terminology is that of Taylor (1966) who proposed a scheme for the Gippsland Basin extending from the uppermost Eocene (Zonule K) to the upper Miocene/lower Pliocene (Zonule A). A similar sequence has been described for the three Esso wells in the Bass Basin. In the case of the Otway Basin, the calcareous sediments commenced at the base of the upper Eocene in the Brown's Creek outcrop section and in some of the sub-surface section in the Port Campbell embayment. For this reason Taylor (unpubl.) has extended the scheme adding three zonules (L, M & N). In the Gambier Embayment (South Australia) Ludbrook (1967) has distinguished a planktonic assemblage which preceeds Zonule N and which could be designated Zonule O, but has not been recognised in Victorian sections either on-shore or in off-shore wells drilled by Shell Development.

The upper Tertiary foraminiferal sequence in Prawn A-1 is summarised on fig. 1. The calcareous section commences in the upper Eocene (Zonule L) and continues up to at leastthe middle Miocene. The first drilled sample was a side wall core at 955 feet which contained a Zonule D planktonic fauna.

MIOCENE - ? - 2310.

The basis of the biostratigraphic subdivision is the distribution of planktonic species which are the first group on fig. 1; distribution nos. 1 - 22. Little comment need be made as they follow the anticipated sequence. The combination of the various members of the Orbulina bioseries (distribution nos. 1 - 8) differentiates the Zonules D to H of the Miocene. This evidence is reinforced by the distribution of certain species of Globorotalia (nos. 15 - 17). Associated with the larger benthonic species Gypsina howchini, Hofkerina semiornata and Planodiscus irregularis is an elongate Globigerinoides trilobus with a large umbilical aperture and 4 spiral sutural apertures. Both this G. trilobus morphotype and the larger benthonics listed are restricted to Zonule F. Carter (1964, pl. 9, figs 185 - 187) illustrated this morphotype and states (l.c., p.106) that it is restricted to his Faunal Unit 9 (= part of Zonule F) and associated with Lepidocyclina and the larger benthonic forms listed above. This G. trilobus morphotype may be referable to G. trilobus altiapertura Bolli, but Jenkins (1960, p.353) illustrates a different variant as representing this taxon in the Lakes Entrance Oil Shaft. To save confusion I have listed the Zonule F form as Globigerinoides trilobus morphotype B (distribution no. 6). It may be only of local biostratigraphic significance, though Carter (l.c.) reports it from both the Gippsland and Otway Basins. In all probability it is a warm water morphotype which migrated into southern Australian Miocene seas during a short period of elevated temperatures which is evident from the sudden and limited distribution of the larger benthonic (discussed above) and from the oxygen isotope work of Dorman (1966, fig. 1).

Distribution of benthonic foraminifera is similar to that in the Gippsland Basin, especially with regard to the change in Cibicides spp content (distribution nos. 23 - 27) above Zonule G. Appearance of the heavily costate Uvigerina sp. 9 is noted in Zonule H. As noted above the presence of Gypsina howchini, Hofkerina semiornata and Planodiscus irregularis confirms the presence of Zonule F.

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OLIGOCENE:- 2310 - 2550.

A distinct change in planktonic content is noted in rotary cuttings at and below 2310 feet. This is confirmed in the side wall core at 2412 feet where Globigerina euapertura is present, instead of the G. apertura and G. woodi association of the side wall core at 2225 feet which contains a typical lowermost Miocene (Zonule H) fauna. The orange, iron-rich, calcarenite of side wall core at 2440 feet and rotary cuttings below 2410 feet, contain a poor fauna which includes the index "Janjukian Stage" benthonic species Victoriella conoidea (refer Carter, 1964).

At the base of the orange calcarenite facies, at 2460 feet the cuttings are of grey marl and contain a rich planktonic fauna with abundant uvigerinid element (nos. 50 - 52). The highest appearance, in combination, of Globigerina angioporoides, Cassigerinella chipolensis Chiloguembelina cubensis and Guembelitra sp. (distribution nos. 12 & 20 - 22) indicates Zonule J. This is confirmed by side wall core at 2508 feet which contains the above species as well as transition morphotypes between Globigerina ampliapertura and G. euapertura as well as transitions between G. linaperta and G. angioporoides. The presence of Bolivina pontis in the side wall core is significant. The whole aspect of the fauna between 2460 and 2550 feet is that it is low in Zonule J and has a strong upper Eocene aspect. The absence of Globorotalia testarugosa and Bolivina anastomosa may also be of significance as these species are present at the top of Zonule J in the Gippsland Basin (= base of Lakes Entrance marl) and in the Bass Basin. Generally speaking the change from Zonule J to Zonule I faunas is abrupt and without species overlap in the Prawn section. This is not merely due to the abrupt litho-facies change as Chiloguembelina cubensis and Globigerina angioporoides persists into the base of the orange calcarenite facies (i.e. the Clifton Formation) in some sections in the Port Campbell Embayment of the Otway Basin; e.g. Narrawaturk-2. Also Guembelitra sp. and Cassigerinella chipolensis extends into the base of Zonule I in Bass-3, Narrawaturk-2 and other sections; i.e. above Globigerina angioroides Globorotalia testaruqosa and Chiloquembelina cubensis. I refer to this species overlap as Zonule I-2. Lindsay (1967) discusses similar distribution for the St. Vincent Basin (South Australia) and his Chiloquembelina cubensis and Guembelitra stavensis Zones can be correlated with Zonule J and Zonule I-2 respectively.

It is concluded that the top of Zonule J and the base of Zonule I (= I-2) is probably missing in the Prawn section. Therefore a hiatus is postulated between the base of the orange calcarenite (= Clifton Formation) and the top of the underlying marls (= Narrawaturk Marls). This hiatus is within the Oligocene, but not at the base of the Oligocene.

UPPER EOCENE:- 2550 - 3020 feet - ?

Cuttings samples at 2550 feet contain the highest definite appearance of Globigerina ampliapertura and G. linaperta indicating the top of Zonule K. The presence of closely related morphotypes in Zonule J indicates that the sequence is continuous between the Eocene and Oligocene. Side wall core at 2764 feet contains a similar fauna.

An undeveloped form of Globigerapsis index is reported in cuttings at 2780 feet. This "starved form" is typical of the upper part of the range of G. index and is used to mark the top of Zonule L. Such an extinction is possibly an unreliable marker, but is believed to indicate an isochronous horizon in the Otway Basin. Lindsay (1967) shows that the top of the range of Turborotalia aculeata (Jenkins) corresponds with the extinction of G. index. Lindsay places more credence on the former event. Specimens at and below 2780 feet in Prawn could be referred to T. aculeata, but for the fact that they are pustulose rather than spinose. This form is small and inconspicuous to a point that its range requires further verification. At 2950 feet there is a species which is probably

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Globorotalia increbescens. No new Eocene species are recorded from below this level in either cuttings or side wall cores.

The base of the marl section, at 3020 feet, appears to correspond with the base of the Eocene foraminiferal sequence in Prawn. Well developed, robust Globigerapsis index were not recorded in the sequence, so that the lower part of Zonule L was apparently not present. Therefore marine upper Tertiary sedimentation commenced in the middle of upper Eocene times in the Prawn section.

Depositional History:

Both the planktonic foraminiferal sequence and the distribution of benthonic elements (shown as 4 groups on distribution chart) shows that upper Tertiary sedimentation was neither continuous stratigraphically nor of the same facies throughout.
Event 1 - Marine transgression in the middle part of the upper Eocene with apparently a rich planktonic and uverigerinid fauna (of Group C) at the base of the sequence. Most specimens are of a small size. Such species as Uvigerina canariensis and Trifarina otatara would suggest deep water together with the high planktonic ratio. This fauna directly follows an iron stained unfossiliferous sand (as shown in side wall 3038 feet) which suggests deltaic or near shore conditions. Similar foraminiferal biofacies are noted at the base of this upper Eocene transgressive sequence throughout the Otway Basin. As in Prawn the sediments always contains bryozoa and in surface and sub-surface section, Notostrea and Tuttitella are present, These mollusca are indicative of shallow water and appear to contradict the foraminiferal evidence. Studies of on-shore sections have shown that the same biofacies sequence occurs in different planktonic zones from section to section indicating that the transgression was diachronous. Structural downwarping is indicated by the upper Eocene distribution pattern, with a narrow embayment extending north from Port Campbell to Carpendeit-1. This down-warping was apparently accompanied by a gradual sea level rise. Such a sea level rise could have resulted in marine upwelling bringing in small deep water benthonic

species suspended with the plankton. This marine transgression reached the Prawn site at least 2 zones later than it did in some sections of the Port Campbell Embayment or along the Aire Coast to Apollo Bay (sea floor outcrops). Upper Eocene marine sedimentation was never properly established at Princetown, so that a high must have existed between Port Campbell and the Aire coast, with a sea way between the present coast line and the Prawn site. Structural control of upper Eocene sedimentation is evident.

Event 2 - A similar biofacies persisted from upper Eocene into earliest Oligocene as is discussed above. In the Prawn section there is a hiatus within the Oligocene (top of Zonule J and Zonule I-2 are missing). Above the hiatus the orange limonitic calcarenite (i.e. the Clifton Formation) contains a sparse benthonic fauna with very few planktonic species. The benthonic species *Victoriella conoidea* is characteristic of this facies throughout the basin. Like other members of the Victoriellidae (included in Group B on chart), this species was apparently abherent on sea weed. Other species in this biofacies support a very shallow water origin for the sediment. Evidently at the beginning of Oligocene times there was structural activity in the eastern part of the Otway Basin which resulted in exposure of some areas leading to a sudden regression. The regressive intensity varies from area to area, as there is no indication of a hiatus in some sections (e.g. Narrawaturk-2). However, in all sections examined both the biofacies and lithofacies are identical, suggesting very shallow water conditions and sudden break up of a laterized land surface resulting in the limonitic rich sediment. To the west of Warrnambool, an identical facies is present (i.e. the Nelson Formation), but is slightly older as it contains Zonule K or J faunas. Thus the facies was diachronous moving west to east across the Basin, suggesting that the structural activity moved in the same direction.

Event 3 - Marl sedimentation followed the shallow water conditions, although several lenses of limonitic calcarenite were noted within the base of the marl. The benthonic fauna is mainly of Group A with some arenaceous species. Inner shelf sedimentation is suggested.

Event 4 - At the top of the Lower Miocene (Zonule F) there is a sudden appearance and disappearance of Group B benthonics, including members of the family Victoriellidae, such genera as Operculina and Amphistegina and bryozoa, suggesting very shallow water, at or above the sea weed zone. Above this facies conditions revert to that of Event 3 (inner shelf). Thus there was a sudden regression. This biofacies is common in on-shore Otway Basin sections. At this time there is a hiatus in some Gippsland sequences and volcanic activity in the Bass Basin (e.g. Bass-1). Once again, the apparent regression may be linked with structural adjustment.

PART B - LOWER TERTIARY SEQUENCE

Throughout the Otway Basin, this clastic sequence cannot be described as a marine one, although it contained marine ingressive horizons. My analysis of the continuously cored La Trobe-1 (at Princetown) shows that the 1000 feet of this sequence (i.e. below the Clifton Formation) contained only 80 feet of sediment where the foraminiferal counts were greater than 100 specimens per 200 gms, and that the maximum thickness of a foraminiferal interval was 20 feet. Only in 2 samples was the count above 1000 specimens and these were in a 5 foot interval of the Rivernook beds. Thus statistics are against random coring or side wall coring in any sub-surface section and chances of picking up a fauna in rotary cuttings are remote.

The above statement applies to Prawn. No fauna was obtained in side wall cores or conventional coresbetween 3020 feet and 4263 feet (core-3). No new fauna was noted in cutting samples till 3890 feet, where the following species were isolated:- Cibicides spiropunctatus, C. umbonifer, C. praecursorius and Stilostomella plummerae. These species are present in the Rivernook fauna described by McGowran (1965) and the former two are not recorded above the Rivernook level in the La Trobe bore. The Paleocene planktonic species Globorotalia chapmani and

Globigerina esnaensis were noted in cutting samples as low as 6000 feet, so, although they are obviously down-hole contamination they do substantiate the presence of Paleocene faunas. Contaminants also include Nodosaria latejugata, Vaginulina longiformis and Marginulina atlantisae, which are common Rivernook nodosarids. The Rivernook beds are probably present at 3890 feet, although a side wall core 3893 feet was barren. The distinct Pebble Point foraminiferal fauna was not isolated, though on lithology it should have been present below 3950 feet.

Core-3 at 4257 feet contained one valve of a pelecypod which could be assigned to the species Nuculana paucigradata Singleton. This species was described from and is common in the type outcrop of the Pebble Point Formation and thus by inference is of middle Paleocene age (McGowran). However, the time range of the species is unknown. It may well extend into the Upper Cretaceous. A sample from the same core, at 4263 feet, contained a few specimens of Haplophragmoides sp. which defy specific identification because of poor preservation.

On faunal evidence, no attempt can be made to establish the position of the Tertiary/Cretaceous boundary in Prawn, although, on current knowledge, the core sample at 4257 feet would still be placed in the Tertiary.

Little comment can be made on the depositional history of the lower Tertiary sequence, save that at least one marine ingression is present in the Prawn section. This ingression is the Rivernook horizon which is Paleocene marine ingression in the Basin. Probably the Pebble Point marine horizon is also present.

PART C - UPPER CRETACEOUS SEQUENCE

The faunal evidence in Prawn does not assist in designating the top of the Upper Cretaceous. As already stated the fauna at 4257 feet is not clearly diagnostic. The highest appearance of probably Upper Cretaceous foraminifera is in a cutting sample at 5020 feet which contains a few specimens of Haplophragmoides sp.B

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and sp.C with a possible Inoceramus prism. Taylor (1964) has commented that there is always a "barren interval" between the lowest Tertiary fauna and the highest Cretaceous one, in the Otway Basin. This interval varies from 200 feet to upwards of 2000 feet. Taylor explains the disappearance of Cretaceous foraminifera as being due to the inundation by terrestial detritus and dilution of marginal marine environments.

Sparse Haplophraqmoides faunas were noted in cuttings samples around 5800 feet, 6200 feet and 7220 feet. It was not until 7250 feet that a more diverse Upper Cretaceous arenaceous fauna was isolated. Cutting samples were picked every 10 feet from 7250 feet to 7320 feet. Side wall cores were taken at 7310, 7298, 7278, 7253, 7340 and 7220 feet. Only those at 7310 feet and 7278 feet contained a fauna. It appears that there is a Cretaceous micro-fauna present between 7253 and 7310 feet. The combined fauna from this interval is as follows:-

Haplophraqmoides sp. A, H. sp.B, H. sp.C (50 spec. in all)
Dorothia filiformis (2 spec.)
Marssonella oxycona (2 spec.)
Textularia semicomplanata, T. anceps. (2 spec. each)
Bathysiphon sp. (2 spec.)
Inoceramus prisms.

This fauna would be placed within Taylor's (l.c.) Upper Cretaceous Zonule A of Sennonian Age. No calcareous species were noted. The fauna is indeed a sparse one and from Taylor's diagnosis one would regard it as either representing marginal marine facies or a marine environment of restricted water circulation. The faunal elements are too sparse and not specifically diverse enough to state conclusively, yet this is the best developed Upper Cretaceous fauna in the entire section.

No fauna was found in cores or side wall cores below 7310 feet and no new species were reported in cuttings below this level.

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Upper Cretaceous marine sedimentation was never properly established at the Prawn site, where the Upper Cretaceous environment is best described as marginal marine. There is no evidence of extensive marine, dark mudstone deposition as in the Port Campbell embayment.

REFERENCES

CARTER, A.N. 1964. Geol. Surv. Vict., Mem. 23.

DORMAN, F.H., 1966, J. Geol., 74 (1); 49-61.

JENKINS, D.G., 1960, Micropaleontology.

LINDSAY, J.M., 1967. Trans. Roy. Soc. South Aust., 91; 94-109.

LUDBROOK, Nelly H., 1967, in Symp. 25-
11th Pacific Sci. Congress, Sendai Japan; P. 7-19.

McGOWRAN, B., 1965. Proc. Roy. Soc. Vict., 79 (1); 9-74.

TAYLOR, D.G., 1964. ibid, 77 (2); 535-602.

TAYLOR, D.J., 1966. Appendix 2 in Comm. Aust. Petrol. Subsidy Acts Publ. 76; 31-46.

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Appendix (1)

PALEONTOLOGICAL REPORTS

Paleontological Report - D. Taylor

Palynological Report - Dr. Mary Dettmann

PALYNOLOGICAL REPORT ON ESSO PRAWN A-1 WELL, 3204 - 10,477 FEET

This account incorporates a summary of results obtained from a palynological investigation of almost sixty core (conventional and sidewall) samples taken from Prawn A-1 well between 3204 feet and 10,477 feet. The majority of samples yielded plant microfossils and some well preserved and abundant spore-pollen assemblages were obtained from sediments between 3938 feet and 6651 feet. Palynological residues extracted from samples at and below 7060 feet exhibit a decrease in preservation quality from fair at 7060 feet to poor and fragmented below 9500 feet. Moreover, few of the samples below 7060 feet provided good concentrations of spores, pollen, and microplankton although wood and cuticular fragments are usually abundant.

The palynological evidence cited below indicates that Eocene sediments were encountered between 3938 - 57 feet and that the remainder of the section examined between 4120 feet and 10,477 feet is of Cretaceous age(Upper Aptian/Albian - uppermost Cretaceous).

DISTRIBUTION OF MICROFLORAL ASSEMBLAGES AND AGE OF SEDIMENTS

3204 feet and 3680 feet: Samples from these levels failed to yield spores, pollen, and microplankton.

3938-57 feet: These horizons provided a well preserved microflora in which Duplopollis orthoteichus, Proteacidites incurvatus, P. grandis, and Nothofagidites cinctus were observed. The spore-pollen flora is referred to the Duplopollis orthoteichus Assemblage of Eocene age.

4120 feet - 4962 feet: Well preserved spores and pollen extracted from the sediments include Tricolpites pachyexinus, T. sabulosus, Nothofagidites senectus, Proteacidites amolosexinus, Triorites edwardsii (4120 - 4590 feet) and Tricolpites lillei (4120-4145 feet). These features indicate that the assemblages are representative of the Nothofagidites Microflora which is of Santonian and uppermost Cretaceous age (Dettmann and Playford 1968).

Microplankton were observed in several of the samples. Epicephalopyxsis indentata and Deflandrea cf. pellucida occur at 4120 feet and the horixon may be referable to Evans's (1966) "Deflandrea pellucida" Zone. The index of Evans's Xenikoon australis Zone was recoverêd from a sample at 4254-83 feet, whilst underlying horizons yielded Baltischaeridium heteracanthum and occassional representatives of Nelsoniella aceras.

5297 feet - 7177 feet: Spore-pollen floras extracted from the horizons include Tricolpites pachyexinus, Proteacidites scaboratus, Camarozonosporites amplus and Ornamentifera sentosa. The presence of these species and the absence of diagnostic forms of the Nothofagidites Microflora indicates that the strata may be referred to the Tricolpites pachyexinus Zone of Santonian age (Dettmann and Playford 1968). Microplankton occur infrequently throughout this part of the sequence, the most commonly occurring species being Baltisphaeridium heteracanthum. Species having stratigraphical significance with respect to Evans's Deflandrea cretacea and Nelsoniella aceras Zones were also observed and include Deflandrea cretacea (6145 feet) and Hexagonifera vermiculata (5621-49 feet). However, insufficient data has been obtained to establish the precise limits of the microplankton zones.

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7278 feet - 7293 feet: Spore-pollen assemblages containing doubtful representatives of *Tricolpites pachyexinus* were recovered from the samples which are tentatively assigned to the *Tricolpites pachyexinus* Zone. Microplankton represented include *Baltisphaeridium heteracanthum*, *B. striatoconus*, and *Deflandrea* cf. *victoriensis*.

7342 feet - 8307 feet: The lowest horizon examined from this interval yielded the oldest occurrences of *Clavifera triplex* and *Phyllocladidites mawsonii*. These species are associated with *Kraeuselisporites jubatus*, which completes its range at 7342 feet, *Cicatricosisporites cuneiformis*, *Balmeisporites glenelgensis* and *Amosopollis cruciformis*. This evidence suggests that the sediments belong to the *Clavifera triplex* Zone of Turonian -?Coniacian age (Dettmann and Playford 1968). Microplankton occur infrequently and include *Baltisphaeridium heteracanthum* and *Gonyaulax* sp. (7694 feet). The latter type is an associate of Evans's *Ascodinium parvum* Zone.

8697 feet - 9560 feet: The poorly preserved spore-pollen assemblages extracted from the section suggest that the sediments belong to the *Appendicisporites distocarinatus* Zone of ?Cenomanian - Turonian age. Species identified include *Appendicisporites distocarinatus* *Cicatricosisporites cuneiformis*, *Balmeisporites glenelgensis*, and *Tricolpites pannosus*. Microplankton observed comprise *Baltisphaeridium complex* and *Gonyaulax* sp.

9869 feet - 10,037 feet: The upper sample yielded the oldest observed occurrence of *Tricolpites pannosus* together with the last appearance of *Foraminisporis asymmetricus*. The horizon is accordingly assigned to the *Tricolpites pannosus* Zone of Upper Albian - ?Cenomanian age (Dettmann and Playford 1968). The sample at 10,037 feet provided a sparse microflora in which diagnostic species appear to be lacking. Microplankton were not observed in the samples.

10,450 - 77 feet: A poorly preserved spore-pollen assemblage containing *Pilosisporites grandis*, *Arcellites reticulatus*, *Trilobosporites trioreticulosus*, and *Crybelosporites striatus* was recovered from the sample. The association of the above-named species demonstrates that the strata belong to the Upper Aptian - Upper Albian *Coptospora paradoxa* Zone(Dettmann and Playford 1968). Microplankton were not identified in the assemblage.

REFERENCES

Dettmann, M.E. and Playford, G. 1968. Palynology of the Australian Cretaceous - a review. A.N.U. Press, Canberra (in press).
Evans, P.R. 1966. Mesozoic stratigraphic palynology of the Otway Basin Rec. Bur. Miner. Resourc. Geol. Geophys. Aust. 1966/69 (unpubl).

10th July, 1968.

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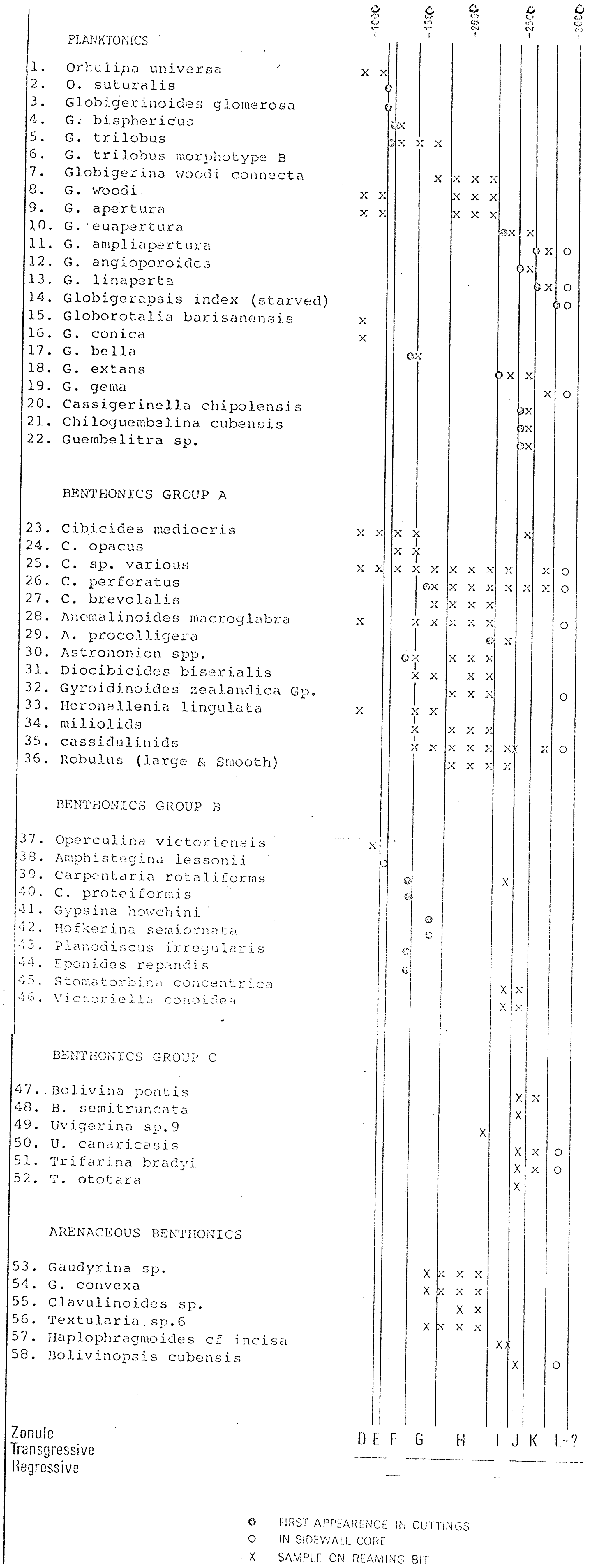


Fig.1 - ABSTRACTED FORAMINIFERAL DISTRIBUTION CHART - UPPER-TERTIARY - PRAWN-A-1

Appendix (2)

DESCRIPTION OF CUTTINGS SAMPLES

PRAWN A-1

SAMPLE DESCRIPTIONS

1030-1040	90% skeletal, silty calcarenite; light grey, non porous, medium hard, with 2-3% glauconite grains (very fine to fine), abundant loose fossils in tray (corals, bryozoans, spicules, foraminifera). 10% skeletal limestone; yellow-white, micritic-granular, trace of quartz; clear, medium grained, sub angular, frequent chert (orange-yellow to rust red), argillaceous.
1040-1150	As above.
1150-1170	90% skeletal, silty calcarenite; as above. 10% silty, granular to micritic skeletal limestone; light grey, hard - transition from calcarenite as above, fossils as above, abundant echinoid.
1170-1200	As above.
1200-1210	80% calcarenite; as above. 20% skeletal, silty limestone; as above. Trace of quartz; trace chert as above.
1210-1220	100% calcarenite; as above. Trace fine grained coal fragments; trace quartz as above.
1220-1290	As above.
1290-1310	As above, with trace pyrite.
1310-1320	100% calcarenite; as above, very fossiliferous with 1-2% glauconite as above, trace coal as above, with occasional fragments glauconite sand, hard, fine grained.
1320-1330	As above.
1330-1340	As above with increase in pyrite 1-2%
1340-1360	As above, with very little (trace) pyrite.
1360-1370	80% unconsolidated fossil remains (coquina?) (Bryozoans, coral, forams, spicules) 20% skeletel, silty calcarenite, as above.
1370-1380	50% coquina, as above. 50% calcarenite; as above, slight trace glauconite, slight coal.
1380-1390	70% coquina; as above. 30% calcarenite; trace pyrite.
1390-1410	As above.
1410-1420	80% coquina; as above. 20% calcarenite; as above.
1420-1430	As above.
1430-1450	100% coquina; as above. No glauconite, coal, pyrite.
1450-1470	90% coquina; as above. 10% calcarenite; as above.

1470-1480	50% coquina as above. 50% calcarenite; as above, slight trace glauconite.
1480-1490	30% coquina; as above. 70% calcarenite; as above.
1490-1500	10% coquina; as above. 90% calcarenite; as above.
1500-1520	As above.
1520-1530	100% skeletal, silty, micritic, very fine grained, non porous, calcarenite; light grey, medium soft-medium hard.
1530-1550	As above.
1550-1570	80% calcarenite; as above, with trace glauconite. 20% skeletal, granular - micritic limestone; light grey, hard, non porous.
1570-1580	80% calcarenite; as above. 20% skeletal, granular-micritic limestone; yellow-white, hard, abundant loose fossils in tray mainly bryozoans and foraminifera.
1580-1590	70% calcarenite; as above. 20% loose fossil fragments as above. 10% limestone; as above.
1590-1600	40% calcarenite; as above, no glauconite, no pyrite. 10% limestone; as above. 50% clayey marl; medium light grey, very fossiliferous (as above.)
1600-1610	As above.
1610-1620	30% calcarenite; as above. 10% skeletal, granular-micritic limestone as above. 60% marl; as above.
1620-1630	40% limestone; as above. 60% marl; as above.
1630-1660	As above.
1660-1670	20% limestone; as above. 80% marl; as above, frequent loose unconsolidated fossils.
1670-1680	As above (amount of fossils decreasing).
1680-1770	As above.
1770-1780	10% limestone; medium light grey, granular skeletal, very fine grain, hard. 90% marl; as above.
1780-1880	As above.
1880-1900	20% limestone; light grey and yellow-white, granular-micritic, and micritic, hard, non porous. 80% marlstone; as above.
1900-1910	As above, abundant loose fossils, as above.
1910-1920	As above, marlstone, soft-firm.
1920-1950	As above.
1950-1960	30% limestone; as above. 70% marl; as above, loose fossils, as above, abundant.

1960-2010	As above.
2010-2060	20% limestone; as above. 80% marl; light grey, soft-firm, fossiliferous, as above.
2020-2060	As above.
2060-2070	40% limestone; as above. 60% marl; as above.
2070-2080	As above.
2080-2090	40% limestone; yellow-white, granular-micritic, skeletal, hard non porous. 60% marl; as above, frequent fossils, as above. with strong trace of glauconite.
2090-2110	As above.
2110-2120	As above, fossils frequent with glauconite.
2120-2130	40% limestone; as above, light yellow-white, skeletal, granular-micritic, non porous, hard. 60% marl; as above, light grey, very granular-micritic, non porous, medium hard.
2130-2140	As above.
2140-2150	40% limestone; as above. 60% marl; medium light grey to blue-green, fossils frequent.
2150-2160	30% limestone; as above. 70% marl; as above.
2160-2170	20% limestone; as above. 80% marl; as above, very fossiliferous; trace quartz, medium grain, clear, sub angular, frequent glauconitic grains, very fine-fine grained.
2170-2180	10% limestone; as above. 90% marl; as above, trace of quartz as above, very fossiliferous as above.
2180-2190	100% marl; light grey and light blue-green as above, very fossiliferous, trace quartz and glauconite as above.
2190-2220	As above.
2220-2230	90% marl; as above. 10% shale; medium blue-grey, non calcareous.
2230-2240	80% marl; as above. 20% calcareous shale as above, trace of quartz, clear medium grained, sub angular.
2240-2250	70% marl; as above. 30% calcareous shale; as above.
2250-2280	As above.
2280-2290	70% marl; light grey and olive green, very fossiliferous. 30% calcareous shale; as above.
2290-2300	As above.
2300-2310	60% marl; as above, trace of quartz as above, trace calcite. 40% calcareous shale as above.
2310-2330	As above.
2330-2340	80% marl; as above, trace quartz as above, trace calcite. 20% calcareous shale; blue-grey as above.

2340-2350	60% <u>marl</u>; as above. 40% blue-grey calcareous <u>shale</u>; as above, trace calcite.
2350-2360	As above.
2360-2370	As above; trace <u>limestone</u>, light brown-grey.
2370-2380	As above; trace <u>limestone</u>; light brown-grey.
2380-2390	As above.
2390-2400	100% <u>marl</u>; as above.
2400-2410	As above.
2410-2420	90% <u>marl</u>; as above. 10% <u>calcareous shale</u>; as above.
2420-2430	100% <u>calcarenite</u>; very fine-fine grain, rust red (due to ferruginous staining), detrital, non-porous, fine-coarse grains, skeletal remains (echinoid plates (?) bryozoa), glauconitic, (fine grains). 10% <u>matrix</u>.
2430-2450	As above.
2450-2460	As above, trace of pyrite in and between grains, (brachiopod, small 6 cm).
2460-2500	As above.
2500-2510	50% <u>calcarenite</u>; rust red, detrital, non porous, fine-coarse grains, skeletal as above. 20% <u>limestone</u>; light grey, micritic, oolitic, hard, dense, non porous. 30% <u>shale</u>; dark grey, calcareous, with fossiliferous fragments.
2510-2520	50% <u>limestone</u>; light brown-grey, micritic, fossiliferous, glauconitic (less than 1%), hard, dense, non porous. 25% <u>calcarenite</u>; rust red-brown, very fine-fine grains, with coarse fossiliferous fragments, hard, non porous with greater than 10% matrix. 25% <u>shale</u>; dark grey, calcareous, with fragments of fossiliferous remains.
2520-2530	60% <u>limestone</u>; as above. 20% <u>shale</u>; as above. 20% <u>marl</u>; medium light grey, medium hard, with frequent fossiliferous fragments.
2530-2540	50% <u>limestone</u>; as above. 10% <u>shale</u>; as above. 10% <u>calcarenite</u>; as above. 30% <u>marl</u>; as above.
2540-2550	As above.
2550-2560	40% <u>limestone</u>; as above. 10% <u>shale</u>; as above. 50% <u>marl</u>; as above, loose fossils decreasing in number.
2560-2580	No samples.
2580-2590	20% <u>limestone</u>; as above. 80% <u>marl</u>; as above, with frequent bryozoans (forams and frequent small brachiopods observed).
2590-2600	As above.
2600-2610	10% <u>limestone</u>; as above. 90% <u>marl</u>; as above, with glauconitic, fine grained fossils. not abundant.

2610-2680	As above.
2680-2690	20% limestone; as above. 80% marl; as above, with stray traces of pyrite, fine-medium grain size.
2690-2700	As above, marked increase in fossils, assemblage as above.
2700-2710	100% marl; medium light grey, medium hard, fossiliferous.
2710-2780	As above.
2780-2790	75% marl; grey, firm, very fossiliferous, forams, bryozoa, coral fragments, grades to skeletal mudstone, slightly glauconitic. 25% conglomerate; grey, very coarse, sub angular quartz grains. in very hard matrix of marl, also orange angular lithic grains of siliceous material.
2790-2800	100% marl; as above, with occasional fragments of grey micritic skeletal limestone.
2800-2810	90% marl; as above, 10% fragments of buff-brown, skeletal-micritic limestone, rich forams, bryozoa, echinoid spines.
2810-2820	100% marl; as above, occasional clear, sub angular quartz grains.
2820-2830	100% marl; as above.
2830-2840	100% marl; grey, very fossiliferous, firm to soft, slightly glauconitic, scattered crystals of smokey grey calcite with rhombic structure.
2840-2850	100% marl; grey, very fossiliferous, grades to skeletal mudstone, one large very coarse sub angular quartz grain, 1 piece of pyrite.
2850-2860	100% marl; as above.
2860-2870	100% marl; grey, very fossiliferous, grades to micritic mudstone, occasional cream to white fragment of calcite.
2870-2880	100% marl; grey, very fossiliferous, grades to micritic mudstone, slightly glauconitic, firm to hard.
2880-2890	100% marl; @/@ with occasional fragments of detrital skeletal micritic, white-buff limestone.
2890-2900	100% marl; @/@.
2900-2910	100% marl; @/@ grades to micritic mudstone, slightly silty.
2910-2920	100% marl; @/@.
2920-2930	As above - light grey, very fossiliferous.
2930-2940	As above.
2940-2950	As above.
2950-2960	100% marl; light grey, very silty, very fossiliferous, (forams, bryzoa?, corals?) medium hard, approximately 50% calcareous material, 50% non-calcareous silt.
2960-2970	As above.
2970-2980	As above.
2890-2990	100% marly mudstone; medium-dark grey, medium hard, with abundant fossils as above, (25% calcareous material, 75% siltstone, traces minute carbonaceous material).

2990-3000 As above.

3000-3010 As above.

3010-3020 As above.

3020-3030 50% calcareous mudstone; medium-grey, fossiliferous as above.
50% sand; brown-beige, coarse-pebble grains (gravel), fair sorting, round-subrounded, unconsolidated with abundant pyrite, frequent glauconite pellets.

3030-3040 90% sand; as above.
10% sandstone; light grey, very find-medium grain, calcareous hard, with glauconite.

3040-3050 90% sand; as above, except no glauconite (possibly washed through shakers) and subangular - subrounded. Some clear quartz.
10% calcareous mudstone; as above, traces of sandstone as above.

3050-3060 90% sand; as above.
10% calcareous mudstone; as above.

3060-3070 As above; except trace coal.

3070-3080 As above; pyrite trace, no coal.

3080-3090 As above; calcareous mudstone in fossils, trace very tan mudstone, pebble size. Note powdered lignite added to mud.

3090-3100 As above; trace coal, abundant mica (muscovite).

3100-3110 As for 3090-3100, larger pebbles are rounded.

3110-3120 As above.

3120-3130 As above.

3130-3140 As above.

3140-3150 As above, but grain size from very fine to pebble sized. Pebbles are rounded, trace red silica, very coarse grain (jasper?).

3150-3160 As above, no jasper.

3160-3170 As above but increase in very fine fraction to 50%, traces of jasper as above.

3170-3180 As above.

(Due to rapid drilling able only to catch samples at 40' intervals).

3180-3220 100% sand; beige - light brown as above, fair sorting, very fine - coarse, occasional pebble, subangular - subrounded, trace lignite from mud, trace pyrite, trace mica.

3220-3260 As above plus trace calcareous mudstone.

3260-3300 As above.

3300-3320 As above.

3320-3360 As above, bryozoans from the mudstone?

3360-3400 As above, bryozoans from the mudstone?

3400-3440 As above, very fine-pebble size grains.

3440-3480 As above.

3480-3500	As above, very fine-pebble size grains, sand becoming finer overall.
3500-3530	As above.
3530-3540	As above, very fine to coarse, occasional pebbles.
3540-3580	As above.
3580-3600	As above.
3600-3620	As above.
3620-3630	<u>Sand</u>; beige to light brown, fair sorting, fine to very coarse, grained, occasional pebble, subangular - subrounded, traces of pyrite.
3630-3640	As above, trace jasper?, pyrite seen embedded quartz.
3640-3670	As above, trace sandstone, trace coal.
3670-3690	As above, abundant medium - coarse grained milky opaline quartz, strong traces of very fine to fine grained siliceous cement (10% cement approximately) sandstone hard, well sorted, subangular-subrounded, composed of clear to translucent light yellow brown quartz, pyrite in the sandstone.
3690-3710	As for 3670-3690.
3710-3720	As above, abundant pyrite.
3720-3750	As above, trace pyrite, distinct colour change to light grey.
3750-3780	As above, abundant pyrite often embedded in the quartz, trace of glauconite.
3780-3840	As above.
3840-3860	As above, possible rutile needles in some of the blue quartz?
3860-3900	As above.
3900-3920	As above, 10% sandstone, pebbles more frequent (approximately 25%).
3920-3930	As above, trace sandstone.
3930-3938	As above.
3938-3957	See Core No.2
3957-3990	<u>Sand</u> - unconsolidated, fine to very coarse grained, occasional pebble, light brown, predominantly quartz from clear to milky to light brown. 10% lithics (mainly cherty material and jasper) angular to sub rounded, abundant pyrite, trace of glauconite.
3990-4010	As above.
4010-4020	As above, strong trace sandstone, light brown, clear quartz, siliceous cement, fine to medium grained.
4020-4030	As above.
4030-4040	As above, with 10% sandstone, white to light brown, hard, non porous, fine to medium grained siliceous cement, fair sorting.
4040-4070	As above, coarse quartz is stained brown, sand is medium brown colour.
4070-4090	As above.

4090-4110	As above, 15% lithics.
4110-4120	As above.
4120-4140	As above, 40-50% lithics, mostly siliceous (cherts and chalcedony), angular, coarse to very coarse, unconsolidated grains, strong traces of quartzite.
4140-4150	As above, approximately 10% of lithics are quartzite, light brown, hard, medium-very coarse.
4150-4170	As above, increase in pebble size grains to about 10%.
4170-4190	As above, lithics approximately 60% as above.
4190-4230	As above, up to 40% pebble size grains.
4230-4250	As above.
4250-4284	Core No.3; see description.
4290-4320	100% Siltstone; dark grey, medium hard, predominantly silt particles, with some very fine grain, sand well sorted, slightly calcareous, carbonaceous, pyrite, mica, slightly fossiliferous, sample quality poor, very muddy.
4320-4330	As for 4290-4320 with occasional fine sand grains (sand approximately 10%).
4330-4350	As above with fine to medium grain quartz, and lithic sand grains approximately 20%.
4350-4370	As above.
4370-4380	As above.
4380-4390	As above, with 20% sandstone; light grey, very fine to fine grained, non porous, calcareous, (approximately 20% cement), fair sorting, composed of clear quartz grains and approximately 10% black silicates and occasional chert, with glauconite, abundant pyrite, (lignite placed in mud system).
4390-4400	As above, with 50% sandstone; as above. Occasional fossiliferous fragments in tray.
4400-4410	As above.
4410-4420	50% siltstone; as above. 50% sandstone; as above, with abundant black silicate grains (unidentified) in some sandstone grains.
4420-4430	20% siltstone; as above. 80% sandstone; light grey, very fine to fine grained, non porous, calcareous, with pyrite and traces of glauconite as above.
4430-4440	100% sandstone; as above, abundant pyrite, frequent glauconite, some mica, very few lithics.
4440-4540	As above.
4540-4550	As above, with about 10% medium hard, brownish grey siltstone.
4550-4570	As above, about 30%-40% medium hard siltstone; light grey, brown-grey.
4570-4580	Approximately 50% - 60% siltstone; as above.
4581-4597	See Core No.4.

4597-4610	Silty sandstone; medium grey, soft, loose, silty, fine grained, to coarse grained, occasional very coarse grain, fair sorting, predominantly quartz (mostly clear), abundant glauconite, trace of pyrite. Micaceous (dark and light micas) abundant medium to pebble size, rounded quartz and angular lithic grains (cavings).
4610-4620	As above.
4620-4630	As above, but with black carbonaceous streaks and medium hard.
4630-4640	As above, pyrite more abundant (finely disseminated) chloritic siltstone fragments. Abundant very fine-medium occasional quartz grains in tray.
4640-4650	As for 4630.
4650-4660	As above.
4660-4690	100% sand, very fine-fine grain, loosed sand (quartz) grains, much caving (fine-very coarse grain + lithic grains).
4690-4700	90% sand; as above. 10% siltstone; medium brown grey, medium hard.
4700-4710	60% sand; as above. 20% sandstone; light grey, very fine to fine grain, hard, calcareous. 20% siltstone; as above,brown grey with abundant carbonaceous material.
4710-4720	As above, abundant loose fine to medium occasional coarse grains quartz, in tray as above.
4720-4740	As above.
4740-4750	50% sandstone; light grey and light green, very fine to fine grain, calcareous, medium hard sandstone. 50% light green + medium dark brown chloritic mudstone with carbonaceous material, non calcareous.
4750-4760	As above.
4760-4770	80% sandstone; as above, light grey and light brown grey, very calcareous. 20% brown, green and light grey siltstone; as above.
4770-4780	As above, with strong trace yellow cream colour limestone, dense, re-crystallized.
4780-4790	100% sandstone, continuing abundance of loose quartz grains in tray indicate sand or sandstone from which grains have been found loose.
4790-4800	As above.
4800-4820	100% light grey, very calcareous sandstone, as above.
4820-4830	80% light grey and light green chloritic pyritic sandstone; as above, calcareous. 10% medium dark green chloritic mudstone; as above. 10% medium dark brown carbonaceous siltstone; as above.
4830-4840	As above, pyrite very abundant, fossiliferous cavings, loose fine-coarse clear, white and tan stained quartz grains abundant.
4840-4860	As above.
4860-4870	90% sandstone; as above. 10% medium dark brown grey siltstone; as above.

4870-4880	As above.
4880-4890	100% sand; light grey, fine-coarse grain, sub angular to rounded well consolidated quartz, very few lithics, pyrite.
4890-4900	90% sand; as above. 10% light tan grey, very calcareous mudstone with fossiliferous fragments.
4900-4910	As above.
4910-4920	70% sand; as above. 20% sandstone; light grey and light green very calcareous as above. 10% medium dark green-grey, non calcareous mudstone (cavings)?
4920-4930	70% sandstone; as above. 30% light medium grey sandstone, very calcareous, very fine to fine grains as above.
4935-63	See Core No.5
4963-4970	100% silty sandstone; light brownish grey, moderately soft, moderately friable, silty to medium grained, well sorted, sandy fraction is mainly quartzose (clear to light brown), chloritic, carbonaceous, micaceous (light and dark mica), slightly carbonaceous.
4970-4990	As above.
4990-5000	As above, abundant chlorite.
5000-5010	As above, trace chlorite.
5010-5030	As above.
5030-5040	As above, with 50% of another similar sandstone; buff, moderately soft, moderately friable, silty to medium grained, well sorted, sandy fraction mainly quartzose, calcareous.
5040-5050	As above.
5050-5060	Sandstone; (appears) a mixture of types of similar grain size, friability and sorting, all types silty and basically quartzose, colour varies. 60% light grey, very chloritic and micaceous, carbonaceous. 30% buff colour, slightly calcareous. 10% light brown-grey, calcareous, carbonaceous, trace of chlorite.
5060-5070	30% light grey sandstone; as above. 40% buff sandstone as above. 30% light brown grey sandstone; as above.
5070-5090	50% light brown-grey sandstone; as above. 20% light grey sandstone as above. 30% buff sandstone; as above.
5090-5110	Approximately equal amounts of each type as above. Also 10% shale; dark grey, carbonaceous chlorite, medium hard.
5110-5120	As above, samples becoming more silty.
5120-5200	As above.
5200-5210	100% sandstone; fine -very coarse grain s consisting of loose unconsolidated grains, mud very thick, therefore assume that abundant silty-mudstone material is being washed out of a porous friable sandstone.
5210-5220	as above.

5220-5230	As for 5210-5220.
5230-5340	As above.
5340-5350	As above, with abundant silt and very fine grain material in tray.
5350-5370	As above.
5370-5380	70% sandstone; as above, 30% muddy calcareous siltstone (estimated from condition of balled up muddy samples).
5380-5390	As above.
5390-5400	As above, very frequent black fine, to medium grained, very hard rounded chert grain, some reddish-yellow chert.
5400-5410	As above, strong trace limestone; white-buff.
5410-5450	As above.
5450-5460	40% siltstone; light grey, light tan, very fine to medium grain, consolidated with 20-25% calcareous cement; some sandstone; non calcareous with quartz chlorite, pyrite, some lithics. 20% siltstone; light brown-grey, calcareous with abundant bryozoans (cavings?) 40% sandstone as loose unconsolidated very fine-coarse grains of quartz and some dark grey-back rounded chert. Fossiliferous fragments abundant in siltstone, strong tace limestone; buff
5460-5470	As above
5470-5480	As above
5480-5490	As above
5490-5500	50% consolidated sandstone; as above with some dark lithics. 20% calcareous light brown-grey siltstone as above with fossiliferous fragments (cavings?) 30% unconsolidated very fine-coarse quartz grains as above, trace limestone, white-buff
5500-5510	30% unconsolidated quartz grains as above 70% silty mudstone, inferred from poor muddy samples
5510-5520	100% sandstone, light grey and light brown, very fine-fine grained, very calcareous with increase in lithics, 10-20% with abundant chlorite, some pyrite
5520-5530	100% clayey siltstone, medium dark grey, non calcareous very soft.
5530-5540	As above, very poor samples - difficult to interpret
5540-5550	40% clayey siltstone, as for 5530-5540. 30% sandstone, unconsolidated quartz grains, as above with 5-10% dark grey and orange yellow chert, 30% sandstone; light grey and light brown, very calcareous with abundant dark lithics, pyrite, chlorite abundant as above
5550-5560	40% sandstone light-medium brown, very fossiliferous, very calcareous (cavings?) 30% sandstone; consolidated as above 10% sandstone, unconsolidated quartz and black chert, as above 20% clayey siltstone; light grey, as above
5560-5570	As above
5570-5580	As above
5580-5590	As above

5600-5610 Grinding junk in hole, samples very poor coming over shaker in thick clayey mud.
50% siltstone light brown grey, very sandy, (very fine - medium grain) calcareous.
50% sandstone, very fine - occasional coarse grain quartz occurring as unconsolidated grains in tray, with trace chlorite.
Strong trace white-yellow limestone (frequent bryozoans, occasional forams in tray) (cavings)

5610-5620 20% siltstone as above
80% sandstone as above

5620-5630)
5630-5640)
5640-5650) See Core No. 6

5650-5660 75% Sand - lithic and quartz grains, clear white - light yellow, coarse-very coarse grain, siliceous lithic grains angular-subangular, quartz grains, subangular - subrounded, poorly sorted, pyritic, scattered dark basic minerals.
25% sandstone and mudstone, white-light grey, glauconite, very calcareous, silty, fine grain.

5660-5670 75% sandstone - as at above with fragments of fine grain calcareous sandstone
25% mudstone - light grey, calcareous (marly), fossil

5670-5680 75% sandstone - as at above
25% mudstone - at at above

5680-5690 100% sandstone - quartzose to lithic, fine to very coarse grain clear to buff, slightly calcareous, subangular-subrounded, poorly sorted, pyritic.

5690-5700 100% sandstone - as at above, very pyritic, occasional aggregates of silty fine, calcareous, sandstone.present

5700-5710 100% sandstone - as at above

5710-5720 100% sandstone - as at above but fine-coarse grains

5720-5730 100% sand - wuartzose to lithic (siliceous) fine grain - medium grain, subangular to subrounded, slightly calcareous, white clay matrix.

5730-5740 100% sand - quartzose, fine-coarse grain, poorly sorted, subangular to subrounded, occasional aggregate of silty fine grain, calcareous sandstone, very pyritic, occasional siliceous angular fragments.

5740-5750 80% sand - including coarse and sandstone aggregates, rounded - subrounded, very pyritic.
20% mudstone - light grey to brown, calcareous.

5750-5760 80% sand. - as above with less coarse material, occasional black chert. Fossils, forams, and echinoid spine.
20% mudstone - as above

5760-5770 80% sand as above, very coarse but dominantly coarse, rounded to subrounded, occasional black chert and yellow quartz fragments, bryozoa?
20% mudstone, becoming coarser grained

5770-5780 75% sandstone - quartz grains, coarse grain - very coarse grain, subrounded, subangular, clear white to tan, aggregates of fine grain, calcareous sandstone present, very pyritic, occasional yellow angular siliceous grains and dark black mineral.
25% mudstone - brown light grey, calcareous.

5780-5790 As at above

5790-5800 60% sandstone - as at above
40% mudstone - as at above

5800-5810 60% sandstone -white-light grey, very calcareous, silty medium grain, slightly glauconitic, very pyritic occasional to scattered very coarse quartz grains, subangular.
40% mudstone - grey-brown, calcareous, non-calcareous, slightly fossiliferous.

5810-5820 60% sandstone - as at above numerous very coarse grained quartz grains
40% mudstone - as at above

5820-5830 90% sandstone - quartzose unconsolidated grains, very coarse to pebble size grains, subrounded-subangular, scattered aggregates of fine grained grey-white calcareous sandstone also present, scattered. angular grains of chert and occasional dark mineral.
10% mudstone - grey-brown, calcareous, scattered fossils.

5830-5840 100% sandstone - as at above with numerous angular-subangular yellow siliceous grains.

5840-5850 100% sandstone - as at above quartz grains, unconsolidated, scattered very coarse, orange-yellow, siliceous grains, numerous aggregates of fine grain slightly glauconitic, calcareous sandstone, scattered fragments of calcareous grey mudstone.

5850-5860 100% sandstone - unconsolidated, quartz grain with numerous very coarse grain, lithic grains - angular-subangular grains of siliceous material (chert), large smooth eliptical to round grey-black grains present, coarse grain-very coarse grain pebble size quartz grains, poorly sorted, pyritic, aggregates of fine grain calcareous, slightly glauconitic sandstone present.

5860-5870 90% sandstone - quartzose to lithic, unconsolidated fine-pebble sized grains, angular lithic grain -subrounded grains, aggregates of slightly glauconitic fine grain calcareous sandstone present, pyritic.
10% mudstone - grey, calcareous.

5870-5880 60% sandstone - unconsolidated clear white - light grey quartz grains, fine pebble sized grains, subangular-subrounded numerous yellow lithic (siliceous) grains, well rounded dark grey-black grains present, also present pyritic calcareous fine sandstone aggregate present.
40% mudstone - grey-brown, calcareous, fossiliferous

5880-5890 75% sandstone - as at above
25% mudstone - as at above

5890-5900 75% sandstone as at above
25% mudstone as at above

15 February, 1968 2:25 a.m. washed out bumper sub.

5900-5910 80% sandstone - quartzose to lithic, fine grain - very coarse grain white-clear, subangular-subrounded, quartz grains, yellow siliceous grains, fine grain -very coarse grain, subangular-subrounded, occasionally well rounded orange-dark red chert grain, abundant aggregates of siliceous glauconitic, very calcareous, fine grain sandstone.
20% mudstone - grey-brown, calcareous, occasional bryozoa

5910-5920 80% sandstone - as at above
20% mudstone - as at above

5920-5930	75% <u>mudstone</u> - light grey-brown, calcareous, fossiliferous, 1 large foram, "marl: 25% <u>sandstone</u>- as at above
5930-5940	100% <u>sandstone</u> - quartz, fine grain - medium grain, subangular subrounded, unconsolidated grains, scattered siliceous basic grains.
5940-5950	100% <u>sand</u> as at above
5950-5960	100% <u>sand</u> as at above
5960-5970	60% <u>sandstone</u> - quartz scattered, coarse grain - very coarse grain, unconsolidated grains with abundant fine grain, calcareous aggregates of <u>sandstone</u> 40% <u>mudstone</u> - light grey, 1 very large foram.
5970-5980	As at above
5980-5990	75% <u>sandstone</u> - coarse grain quartz sand, unconsolidated with abundant dense fine grain aggregates of calcareous sandstone, pyritic, some siliceous, lithic grains. 25% <u>mudstone</u> - light grey, calcareous, scattered bryozoans
5990-6000	As at above
6000-6010	As at above
6010-6020	75% <u>sandstone</u> - white-light grey, very coarse grain quartz, subangular-subrounded, in abundant fine grains calcareous, <u>sandstone</u> aggregates 25% <u>marl</u> - light grey, calcareous fossiliferous.
6020-6030	75% <u>sandstone</u> as above 25% <u>mudstone</u> light grey-brown, slightly calcareous
6030-6040	75% <u>Sandstone</u> as at above 25% <u>marl</u> and <u>mudstone</u> - grey, calcareous, fossiliferous
6040-6050	90% <u>sandstone</u> - scattered coarse grain - very coarse grain of unconsolidated subrounded-subangular, white-clear quartz in abundant aggregates of calcareous <u>sandstone</u> - fine grain, slightly glauconitic and pyritic 10% <u>marl</u> as at above
6050-6060	90% <u>sandstone</u> - as at above occasional sub siliceous grains 10% <u>marl</u> - as at above grades to calcareous mudstone
6060-6070	90% <u>sandstone</u> - as at above, silty 10% <u>mudstone</u> - grey, calcareous, firm
6070-6080	90% <u>sandstone</u> - quartz grains, unconsolidated fine-very coarse grain with abundant aggregates of silty - fine grain slightly glauconitic, calcareous <u>sandstone</u>, scattered very coarse lithic (siliceous grains) pyritic. 10% <u>mudstone</u> - grey, firm calcareous
6080-6090	As at above
6090-6100	90% <u>sand</u> - quartz, unconsolidated, very fine to medium grain, subangular-subrounded, pyritic, also scattered aggregates of slightly glauconitic - chloritic calcareous, fine grain <u>sandstone</u> 10% <u>mudstone</u> - as at above
6100-6110	90% <u>sand</u> - quartz, unconsolidated grains, also aggregates of grains unconsolidated grains of quartz are coarse grain - very coarse grain, subrounded-subangular, aggregates are calcareous, slightly glauconitic, scattered subangular yellow siliceous grains present, pyritic 10% <u>mudstone</u> - grey, firm to hard, slightly calcareous

6110-6120	90% sand - as at above 10%.mudstone - as at above
6120-6130	90% sand - asat above 10% mudstone - as at above
6130-6140	100% sand - quartz, fine grain to medium grain, subangular-subrounded, scattered lithic grains (siliceous), occasionally very coarse grains.

Core No. 7

6175-80	50% sand; light brown, medium to coarse grained, consisting of quartz (light brown) subrounded to well rounded, unconsolidated 25% sandstone; light grey, very fine to fine grained, calcareous (calcareous cement 20%) non porous, hard, with glauconitic and pyrite; sandstone contains medium to coarse grain quartz sand grains. 25% shale; light grey, very calcareous (cavings?) trace coal; trace lithics - orange and grey chert.
6180-90	50% sand as above 25% Sandstone; as above 25% Shale: as above
6190-6200	50% Sand; as above 25% Sandstone; as above 25% Shale: as above. Traces as above, abundant pyrite
6200-10	As above
6210-20	As above; slight increase in amount of orange lithics
6220-30	As above
6230-40	30% sand; as above 40% sandstone; as above, calcareous cement up to 30% 30% shale: as above Traces of coal increase in glauconite, abudant pyrite
6240-60	As above
6260-70	20% Sand; medium to very coarse, as above 30% Sandstone; as above 50% Shale; as above, several fragments with imbedded bryozoans (in part cavings?)
6270-80	As above
6280-6300	As above
6300-10	as above; quartz sand somewhat finer, medium to coarse grained
6310-20	30% Sand;; fine to coarse grained, clear-tan quartz 40% Sandstone; light grey, very fine to fine, subangular to rounded, glauconitic, calcareous, medium hard. 30% Shale; light grey, medium soft, very calcareous, tabular pyrite abundant
6320-80	As above
6380-90	30% Sand; as above 50% Sandstone; light grey, very fine to fine grained, subangular to rounded, glauconitic, more argillaceous than calcareous now. 20% Shale; as above, pyrite abundant; trace bryozoans.
6390-6450	As above
6450-60	20% Sand; clear white-tan quartz grains, fine to coarse, sub angular to rounded 30% Sandstone; as above 50% Shale; light grey brown, non calcareous, soft, occasional forams, occasional bryozoans.

6460-70	Cavings
6470-80	Sample is very muddy. Almost unable to pick out individual cuttings. Washing any more than has been done would remove the clay material and the sample would not be typical. Composition can be guessed at as follows. 50% Mudstone; medium brown-grey, fine grained, very argillaceous glauconitic, carbonaceous, calcareous. 30% Sand; angular to subangular, many grains frosted, some slight brown staining, mostly clear. 10% Coal 10% Sandstone; light grey, fine grained, argillaceous cement non calcareous, pyritic, glauconitic.
6480-90	As above
6490-6500	40% Mudstone; as above 40% Sand; as above 10% Coal; as above 10% Sandstone; as above
6500-10	50% Mudstone; as above 20% Sand; as above 20% Coal; as above 10% Sandstone; as above
6510-20	50% Mudstone; silty, as above, very calcareous, carbonaceous and much skeletal material. Some forams and some valve fragments. 20% Sand; as above 20% Sandstone; as above 10% Coal
6520-30	60% Mudstone; as above 20% Sand; as above 15% Sandstone; as above 5% Coal; as above
6530-40	as above
6540-50	50% Silty mudstone; as above 30% Sand; as above 15% Sandstone; as above 5% Coal; as above
6550-60	As above, poor samples - very muddy
6560-70	As above
6570-80	(Silty Mudstone; light grey brown, calcareous, with fossiliferous fragments, medium dark grey brown, non calcareous, carbonaceous). 40% Silty mudstone; light grey brown and medium darkbrown, non calcareous and carbonaceous, medium soft, with fossiliferous fragments in calcareous mudstone. 30% Sand; clear-tan, medium to coarse grained, subangular to rounded, unconsolidated 25% Sandstone; light grey, very fine to fine grained, glauconitic, calcareous with pyrite. 5% Coal; black, vitrious, conchoidal fractures.
6580-6600	As above
6600-10	50% Mudstone; as above 30% Sand; as above 15% Sandstone; as above 5% Coal; as above
6610-6650	As above
6680-90	Mostly cavings containing calcareous mudstone, some pale sandstone and sand grains (coal).

6690-6700	20% Sand: clear-orange, angular to subangular, some grains frosted, medium to coarse grained (this is the coarser fraction of the sandstone). 40% Sandstone; light grey, fine grained, well sorted, medium rounded, suceritic, contains mainly quartz grains with a few orange chert grains, some glauconite. Cement is slightly calcareous. 20% Mudstone; carbonaceous, brown-dark grey, fine grained, with flakes of carbonaceous material. 20% Shale; medium-dark grey, fine grained, micaceous. (Cavings material; coal, fossil-bearing mudstone).
6700-10	As above
6710-20	No sample
6720-30	80% Sandstone; as above 20% Shale; as above Traces of shale (caving less but as above)
6730-50	As above
6750-60	60% Sandstone: as above 20% Shale: as above 20% Coal; as above
6760-70	As above
6770-80	50% Sandstone: very fine to medium grained, occasionally coarse grained, as above 40% Shale: dark grey brown, with abundant carbonaceous material 10% Coal
6780-90	As above
6790-6800	As above
6800-10	70% Sandstone; as above 30% Shale; as above
6810-20	70% Sandstone; as above 30% Shale; as above Trace of pyrite
6820-30	As above. Sandstone is more calcareous - cement? Increase in coal 10%
6830-50	As above
6850-60	65% Sandstone; as above. Some fragments of polyzoans. 25% Shale; as above 10% Coal; has been consistent at increased amount since 6820'
6860-70	75% Sandstone; as above 20% Shale 5% Coal
6870-90	As above
6890-6900	80% Sandstone 20% Shale; very little coal
6900-6910	80% Sandstone; grain size is now very fine to coarse with much more fine material than before. 20% Shale: carbonaceous Very little coal.
6910-30	As above Pumps were shut down for about an hour between samples.

6930-40	Sample very clay rich - 50% of total sample, remaining 50% is as above
6940-50	70% Sandstone; as above 20% Shale 10% Coal
6950-70	As above - still very clay-rich
6970-80	As above
6980-90	60% Sandstone; light tan, very fine to medium, with occasional coarse grains, very fine to fine fraction, consolidated medium and coarse grains, unconsolidated subangular to rounded, well sorted, calcareous, glauconitic. 40% Shale: medium grey, calcareous
6990-7020	As above
7020-30	40% Sandstone; as above, trace pyrite 50% Shale: as above 10% Coal: as above
7030-40	50% Sandstone; as above, with minor red jasper 30% Shale: as above, medium grey, calcareous 20% medium grey brown, carbonaceous, non calcareous, moderately hard, slight trace coal.
7040-50	40% Sandstone; as above 30% Calcareous shale; as above 30% Carbonaceous, non calcareous shale; as above, trace coal
7050-80	As above
7080-90	60% Sandstone; as above 20% Calcareous, shale 20% Carbonaceous, non calcareous shale; as above slight trace coal
7090-7100	70% Sandstone; as above 20% Calcareous shale; as above 10% Carbonaceous, non calcareous shale; as above, slight trace coal. Very clayey.
7100-10	50% Sandstone; as above 30% Calcareous shale; as above 20% Carbonaceous shale; as above Trace coal
7110-40	As above
7140-50	30% Sandstone; 50% Calcareous shale 20% Carbonaceous shale Trace of coal
7177-90	50% Sandstone; light grey, fine grained, with occasional medium grain, well sorted, non porous, slightly calcareous and very calcareous fragments consistingof quartz (90%) and feldspar (-approx. 10%) with abundant clay in matrix, glauconitic, micaceous 50% Shale; medium grey, calcareous and non calcareous, medium hard, with carbonaceous material. Trace pyrite, coal.
7190-7230	as above

7230-40	50% Clay: medium grey, obscures most of the sample 40% Sand; dominantly fine grained (silt), sub-well rounded, well sorted, mainly quartz. 10% Shale: as above Trace coal perhaps
7240-90	As above
7290-7300	Sample not taken
7301-7310	60% Siltstone; light grey, very fine grained to clay size, contains mica, some glauconite (?), stringers of carbonaceous material. Non calcareous, very similar to core no. 9. There is much loose clay. 40% Sandstone; pale grey, fine to medium grained, well sorted subangular to subrounded, dominantly quartz and some glauconite, pyrite, carbonaceous material. Cement is calcareous, kaolinitic
7310-40	As above
7340-7350	60% Mudstone; dark grey, very silty, micaceous, carbonaceous 40% Sand; unconsolidated quartz grains, medium to coarse grained, subangular, white to clear (Bad sample).
7350-7370	As above
7370-7380	75% Mudstone; dark grey, silty, carbonaceous, micaceous 25% Sand; quartz, very coarse to coarse grained, clear white, subangular to angular, slightly to very calcareous matrix lignite fragments, glauconitic.
7380-7390	75% Muddy siltstone; dark grey, carbonaceous, slightly calcareous, medium hard, micaceous. 25% Sandstone; light grey quartz, calcareous, medium hard to hard, well sorted, fine to very fine grained. Cavings? coarse to very coarse quartz, carbonaceous, chlorite, glauconite? chert.
7390-7400	As above
7400-7410	90% Mudstone; dark grey-black, very carbonaceous, silty, brittle to hard. 10% Sand; unconsolidated quartz grains, clear white to light grey, fine to coarse grained, subangular to subrounded, calcareous matrix. Methane increase.
7410-7420	90% Mudstone; as above 10% Sandstone; quartz grains, unconsolidated, white to light grey, subrounded, coarse grained, also scattered very fine to fine grained aggregates of calcareous sandstone (quartz grains in calcareous matrix, slightly glauconitic, yellow mineral fluorescence. No cut.
7420-7430	75% Mudstone; as above 25% Sandstone; as above, no cut
7430-7440	60% Mudstone; as above 40% Sandstone; as above, occasional coal fragments - black, shiny, pyrite.
7440-7450	50% Mudstone, as above, very silty, chloritic 50% Sand; quartz, unconsolidated, fine grained with occasional coarse grains, subangular to subrounded, occasional aggregates of calcareous, very fine grained sandstone, scattered coal fragments, 2 forams (may be contamination), scattered pyrite, some large very coarse grained lithic (silic) fragments.
7450-7460	50% Mudstone; as above 50% Sand: quartz and lithic (silic) unconsolidated, coarse grained to very coarse grained, angular to subrounded, aggregates of very fine grained sandstone, calcareous to non-calcareous.

7460-7470	70% Sand; quartz grains, unconsolidated grains, white-clear, fine to very coarse grained, subangular to subrounded, occasional aggregates of very fine grained calcareous sandstone. 30% Mudstone; dark grey, silty, chloritic, carbonaceous, slightly pyritic.
7470-7480	75% Sand; as above, medium grained, unconsolidated 25% Mudstone; as above
7480-7490	As above, predominantly coarse to very coarse grained, angular to subangular.
7490-7500	75% Sand; as above 25% Mudstone; as above, scattered coal fragments
7500-7510	75% Sand; as above, less calcareous material 25% Mudstone; as above
7510-7520	90% Sand; quartz, unconsolidated grains, medium to very coarse grained, subangular to subrounded, white to clear, occasional aggregates of very fine grained calcareous sandstone. 10% Mudstone; as above, with coal fragments
7520-7530	90% Sand; unconsolidated white quartz grains, coarse grained, subangular to subrounded, "excellent sand", almost no calcareous sandstone. 10% Mudstone; as above with scattered coal fragments
7530-7540	60% Mudstone; as above, with scattered coal fragments. 40% Sand, as above
7540-7550	70% Sand; as above 30% Mudstone; as above, with scattered coal fragments
7550-7560	60% Sand; as above, with scattered mica and coal fragments 40% Mudstone; as above
7560-7570	50% Sand; as above 50% Mudstone; as above
7570-7580	As above, with abundant coal fragments
7580-7590	50% Sandstone; as above 50% Mudstone; as above Abundant coal fragments
7590-7600	As above, scattered coal fragments.
7600-7610	60% Sandstone; as above 40% Mudstone; as above Scattered coal fragments
7610-7620	60% Sandstone; as above, but fine to coarse grained (predominantly medium grained. 40% Mudstone; as above Scattered coal fragments
7620-7630	80% Mudstone; as above 20% Sandstone; as above Scattered coal fragments
7630-7640	As above, abundant coal fragments
7640-7650	As above, scattered coal fragments
7694-7700	50% Mudstone; dark grey, medium hard, silty, carbonaceous, chloritic 40% Sand; quartz, very fine to very coarse grained, unconsolidated white-clear, subangular to subrounded, scattered coal fragments bryozoa, mica (cavings) 10% Siltstone; clayey, brown, hard, slightly carbonaceous

7700-7710 As above
60% Mudstone
40% Sand
Trace of brown siltstone
1 large foram ca.ings?

7710-7720 60% Mudstone;
40% Sand
Trace brown siltstone as above

7720-7730 50% Mudstone; as above
50% Sandstone; as above
Trace of siltstone as above plus Ammodisca or Glomospiva.

7730-7740 60% Sandstone; as above
40% Mudstone; (Sandstone tends to be finer though overall fine to coarse grained still).

7740-7750 60% As above sand; quartz, predominantly fine grained, slightly pyritic, scattered traces of coal, unconsolidated grains, silty, occasionally coarse grained.
40% Mudstone; dark grey, brittle, carbonaceous, micaceous, silty

7750-7760 As above, with 1 fragment of very chloritic siltstone (light green) and aggregates of very fine grained, calcareous sandstone, medium to fine grained.

7760-7770 70% Sand; quartz, unconsolidated grains, fine grained with numerous very coarse grains, clear-white, occasional aggregates of fine grained glauconitic sandstone, slightly pyritic, subangular to subrounded.
30% Mudstone; dark grey, carbonaceous, micaceous, also pyrite and coal fragments, slightly silty.

7770-7780 40% Sand; mainly quartz as above, with some yellow to buff cherty grains, unconsolidated, occasional aggregates of fine grained sandstone; as above
30% Mudstone; dark grey, chloritic, carbonaceous, micaceous slightly silty. Accessory coal and pyrite fragments. Mudstone now calcareous, fossiliferous, bryozoa? One foram of type registered above - Nummulites?
30% Calcareous sandstone; white, fine grained quartz with calcareous cement.

7780-7790 100% Sand; quartz, unconsolidated grains, subangular to subrounded, fine to medium grained with occasional very coarse grains, numerous aggregates of very fine grained calcareous sandstone.

7790-7800 60% Sand; as above, with less aggregates of calcareous sandstone
40% Mudstone; as above

7800-7810 As above (poor sample)

7810-7820 75% Sand; quartz, unconsolidated, very fine to fine grained, aggregates of very fine grained, calcareous sandstone present. Subangular to subrounded.
25% Mudstone; dark grey, carbonaceous to slightly calcareous

7820-7830 90% Sand; quartz unconsolidated etc. as above
10% Mudstone; as above
Coal fragments, pyrite

7830-7840 100% Sand; quartz, qhite-clear, unconsolidated, very fine to coarse grained, subangular to subrounded, pyrite, abundant coal fragments.

7840-7850 As above

7850-7860 90% Sand; as above
10% Mudstone; as above

7860-7870	As above. Abundant coal - sand fraction, fine to medium grained.
7870-7880	As above. Scattered coal.
7880-7890	As above
7890-7900	80% Sand; as above 20% Mudstone; as above
7900-7910	80% Sand; quartz, unconsolidated, coarse to very coarse grained subangular to subrounded, occasional dark grey siliceous (lithic) grain. 20% Mudstone; dark grey, carbonaceous, pyritic
7910-7920	100% Sand; as above, unconsolidated, but fine to medium grained and scattered very coarse grains, abundant coal fragments.
7920-7930	90% Sand; as above. Occasional aggregates of fine grained calcareous sandstone. 10% Mudstone; as above
7930-7940	70% Sand; as above 30% Sandstone; white, calcareous, fine grained, hard, well sorted
7940-7950	As above
7950-7960	75% Sand; as above 25% Mudstone; as above, with coal fragments, occasional dark siliceous and basic grains - subrounded to rounded.
7960-7970	75% Sand; fine grained to medium, quartz sand with calcareous matrix, firm to friable, glauconitic, mineral fluorescence, occasional lithic grain, subangular to subrounded, 25% Mudstone; grey, carbonaceous, chloritic, slightly pyritic
7970-7980	75% Mudstone; as above 25% Sandstone; as above
7980-7990	60% Sandstone; quartz, fine to medium grained, occasionally coarse grained, subangular to subrounded, calcareous matrix, aggregates of fine grained calcareous sandstone. 40% Mudstone; dark grey, carbonaceous, aphanitic.
7990-8000	90% Sandstone; as above, more unconsolidated, more clay matrix. 10% Mudstone; as above
8000-8010	90% Sandstone; as above 10% Mudstone; as above
8010-8020	75% Sandstone; as above 25% Mudstone; as above with some calcareous mudstone
8020-8030	50% Sandstone; as above 50% Mudstone, predominantly calcareous, olive grey, medium hard, very slightly carbonaceous, fossiliferous with shell fragments. Also some of mudstone as above
8030-8040	75% Shale; dark grey, brittle, medium hard, carbonaceous, silty 25% Sandstone; as above quartz, unconsolidated to aggregates of very fine to fine grained calcareous sandstone, subangular to subrounded, slightly glauconitic, occasional fragments of lithic (silic.) grain.
8040-8050	80% Shale; carbonaceous, dark grey-black, silty, alsolight grey, fossiliferous, calcareous shale. 20% Sand; fine grained, calcareous quartz, subangular to sub rounded, glauconitic.

8050-8060	75% Shale; dark grey, black, carbonaceous, chloritic, also light olive-grey, calcareous, silty mudstone-calc., trace of shell fragments.	
	25% Sand; quartz, white-clear, predominantly very fine to fine grained, fairly well sorted, calcareous matrix (aggregates of very fine grained sandstone in calcareous matrix present, predominantly unconsolidated grains, slightly glauconitic.	
8060-8070	60% Sand; as above, abundant very fine grained aggregates of quartz and lithic grains.	
	40% Shale; as above	
8070-8080	50% Sand; as above	
	50% Shale; as above Oil staining, very heavy, good yellow cut, may be contaminated, through all sample. Oil itself will not fluoresce., no significant increase on mud log.	
8080-8090	80% Sand; as above	
	20% Shale; as above Oil staining as above, no oil fluorescence, bright yellow cut.	
8090-8100	60% Sand; as above, calcareous	
	40% Shale; as above, no oil fluorescence or cut.	
8100-8110	60% Mudstone; dark grey, carbonaceous, chloritic, medium hard Trace of calcareous mudstone, olive green, medium hard, slightly carbonaceous.	
	30% Sand; as above, non calcareous.	
	10% Sandstone; quartz with calcareous cement as above	
8110-8120	60% Sand; quartz, predominantly unconsolidated grains with many aggregates of very fine grained calcareous sandstone, friable, subangular to subrounded, fairly well sorted, fine to medium	
	40% Shale; grey, brittle to hard, chloritic, carbonaceous, occasional fragments of light grey slightly calcareous shale, occasional peice of lignite.	
8120-8130	50% Sand; as above, including up to 10% aggregates of very fine grained calcareous sandstone; as above.	
	50% Mudstone; as above	
8130-8140	50% Sand; as above, including 20% aggregates of very fine grained calcareous sandstone; as above	
	50% Mudstone; as above, with strong trace of olive green calcareou mudstone; as above Trace coal, trace of pyrite	
8140-8150	60% Sand; as above, fine grained, unconsolidated Good yellow cut, but no oil fluorescence, probably contaminated from rig, no mud log show.	
	40% Mudstone; as above	
8150-8160	75% Sand; quartz, fine to medium grained, calcareous aggregates, occasional coarse grains of quartz, subrounded to subangular.	
	25% Mudstone; grey, carbonaceous, brittle, chloritic, no oil fluorescence, or cut.	
8160-8170	50% Sand; as above	
	50% Mudstone; as above	
8170-8180	60% Sandstone; aggregates of quartz and silic (lithic) grains in calcareous matrix, very fine grained to medium, silty occasional coarse grain of quartz, subangular to subrounded, slightly glauconitic. No oil fluorescence, no cut.	
	40% Shale, dark grey, carbonaceous.	
8180-8190	75% Sandstone; as above. No oil fluorescence or cut.	
	25% Shale; as above	
8190-8197	60% Sand; quartz, unconsolidated, coarse to very coarse grained, subangular to subrounded, with abundant aggregates of fine grained calcareous sandstone present, pyritic.	

8190-8197 (cont.)	40%	Coal and carbonaceous shale; contains resinous mineral associated with coal which gives brilliant blue white fluorescence. The mineral is very light and brittle. This mineral dissolves into a silver coloured precipitate. Not a liquid.
8197-8200	100%	Coal and lignite with fluorescent resinous material
8200-8210	90%	Shale; dark grey-black, brittle to hard, coal fragments present, carbonaceous.
	10%	Sandstone; light grey, fine grained, aggregates of quartz with calcareous matrix, 1 bright silver amber mineral occasional subangular to subrounded siliceous grain, also rare angular siliceous fragment.
8210-8220	90%	Shale; as above, amber (silver fluorescence) grains in shale fragment.
	10%	Sandstone; as above
8220-8230	90%	Shale; dark grey, carbonaceous, brittle, occasional silver fluorescent amber mineral in shale fragment (shale cavings).
	10%	sandstone; lithic (silic) - subquartzose, friable, chloritic, clay matrix, very fine to fine grained, occurs in aggregates subangular to subrounded, "dirty", occasional silic orange fragment, subrounded.
8230-8240	90%	Shale as above) shale cavings
	10%	Sandstone; as above)

See Core Description No. 11

8240-8250	60%	Shale, dark grey, very calcareous, brittle to hard, mica with resinous mineral as above
	40%	Sandstone - light grey -white, quartz to sublithic (silic) very fine to fine grain aggregate, chloritic, clay matrix occasionally slightly calcareous, abundant coal fragments present.
8250-8260		No sample returns.
8260-8270		Poor sample returns, probably 100% very fine grain sand
8270-8280	100%	Sand - unconsolidated quartz grains, very fine - fine grain, subangular, - subrounded, occasional chlorite and glauconite, mica.
8280-8290	100%	Coal
8290-8300	100%	Coal with abundant "resinous" mineral.
8300-8310		No samples
8310-8320	60%	Shale; dark grey, hard, non calcareous
	40%	Coal, black vitreous with abundant very fluorescent amber
8320-8330	80%	Sandstone; light grey very fine -fine grain, with occasional medium grain size, non porous, calcareous, consisting of quartz some red and dark grey chert grains, trace glauconite, trace pyrite, trace calcite grains.
	20%	Shale; light-medium brown grey, carbonaceous.
8330-8340	60%	Sandstone as above
	40%	very carbonaceous shale, as above, trace coal and amber.
8340-8350		As above
8350-8360		Cavings, (100% shale, coal with amber).
8360-8370		Very poor returns probably
	100%	Sandstone, as above, with some carbonaceous material and carbonaceous shale.

8370-8380	Samples not coming over shaker - can only be caught in trap. 100% Sandstone as above, mostly unconsolidated very fine to fine quartz grains, occasional medium grains. White-clear, with few red chert and medium grey, very little glauconite, strong trace white limestone, trace pyrite.	
8380-8410	As for 8370-8380)	No samples run over shaker, sand received only from trap
8410-8440	As above)	
8440-8470	As above)	
8470-8490	As above)	
8490-8510	As above)	
8510-8520	As above)	
8520-8540	)	
8540-8560	As above, trace muscovite and biotite, strong trace coal, dark grey - black, slight trace glauconite. Sandstone very fine - fine grained.	
8560-8580	As above	
8580-8600	As above	Samples from trap only
8600-8610	As above	
8610-8620	30% Sandstone; as above, with occasional medium grain size 50% Coal black vitreous, with abundant very fluorescent amber 20% Shale, dark grey and dark red brown, tabular to platy, non calcareous.	
8620-8630	100% Sandstone as above, with strong trace coal and shale	
8630-8640	As above	
8640-8650	90% Sandstone, light grey, as above, coming over shaker as consolidated sandstone grains, very fine-fine, with occasional medium grain size. 10% Shale, dark grey platy, non calcareous, with abundant coal some amber	
8650-8660	80% Sandstone, as above 10% Shale, as above 10% Coal, with abundant amber as above	
8660-8670	70% Sandstone, as above, but size ranging from very fine - coarse the coarse fraction occurring as unconsolidated grains, sandstone, marly, very slightly calcareous, trace pyrite. 20% Shale, as above 10% Coal, with abundant amber	
8670-8680	90% Sandstone; light grey, very fine-coarse, as above 10% Shale; as above	
8680-8690	90% Sandstone, as above, with increase in yellow-brown chert 10% Shale, as above	
8690-8697	As above	
8697-8727	Core No. 12 flesh colour fluorescence with yellow pinpoint mica fluorescence just as Lower Cretaceous in Crayfish A-1.	
8727-8730	80% Sandstone, as above)	New drill pipe being used with a black coating which gives very strong yellow cut.
8730-8740	90% Sandstone as above) 10% Shale as above)	

8740-8750	90% Shale, light medium grey, massive, medium soft, non calcareous carbonaceous 10% Sandstone, as above
8760-8770	60% Sandstone, soft grey, very fine-coarse grain, non porous hard angular-subrounded, calcareous, fair sorting consisting of quartz white-milky, (coarse grains - all unconsolidated in tray) some feldspar, strong trace pyrite and coal, trace chlorite, frequent red - brown chert. 40% carbonaceous shale, as above
8770-8780	60% Sandstone, as above 40% Shale; as above
8780-8790	50% Sandstone; as above 50% Shale; as above
8790-8800	90% Sandstone; as above 10% Coal; black vitreous with some amber
8800-8810	As above, coarse grain size fraction diminishing
8810-8820	90% Sandstone, light grey, very fine-medium with occasional coarse grain, non porous, hard, calcareous angular-subrounded, calcareous, fair sorting, components as above 10% Shale, as above
8820-8830	As above
8830-8840	As above
8840-8850	As above
8850-8860	80% Sandstone 20% Shale
8860-8870	As above
8870-8880	100% Sandstone. Very fine-fine with occasional medium grain otherwise as above
8880-8890	As above
8890-8940	80% Sandstone as above 20% Shale, medium grey, medium brown, non calcareous, carbonaceous
8940-8950	70% Sandstone, as above, very fine-coarse grain, strong trace coal 30% Shale as above
8950-8960	As above
8960-8970	90% Sandstone, as above 10% Shale, as above
9870-8980	100% Sandstone
8980-8990	As above
8990-9000	80% Sandstone as above. Trace pyrite chlorite, coal 20% Shale
9000-9010	80% Sandstone, as above 20% Shale, as above
9010-9020	As above, very fine-medium grain.
9020-9030	90% Sandstone as above 10% Shale as above

9030-9040	As above
9040-9050	70% Sandstone as above very fine-coarse grained 30% Shale, as above
9050-9060	80% Sandstone, as above trace pyrite chlorite coal 20% Shale, as above
9060-9070	As above, light brown, non calcareous, hard shale and medium non calcareous medium hard shale
9070-9080	As above
9080-9090	100% Sandstone, as above
9090-9100	90% Sandstone, as above 10% Shale, as above
9100-9110	As above
9110-9120	As above, trace pyrite, chlorite, coal
9120-9140	80% Sandstone, as above 20% Shale, as above
9140-9150	40% Sandstone, as above 60% Shale, as above
9150-9160	50% Sandstone, as above 50% Shale, as above
9160-9170	80% Shale, medium grey, medium, hard, non calcareous, very carbonaceous, some medium grey brown, non calcareous. 20% Sandstone, very fine-medium with occasional coarse grain calcareous, as above, with trace pyrite, chert.
9170-9180	30% Shale, as above 70% Sandstone, as above
9180-9190	As above
9190-9200	80% Sandstone, very fine-fine with occasional medium and coarse grain, very calcareous. 20% Coal, black vitreous, with abundant amber
9200-9205	90% Sandstone, as above. Trace pyrite, chlorite, red chert 5% Shale as above 5% Coal as above
9205-9210	70% Sandstone 30% Shale
9210-9220	As above
9220-9230	As above
9230-9240	90% Sandstone, as above, very calcareous, trace red garnet? 10% Shale, as above
9240-9250	60% Sandstone, as above 40% Shale, as above
9250-9260	50% Sandstone, as above 50% Shale, as above
9260-9270	30% Sandstone, as above 70% Shale, as above
9270-9280	As above

9280-9290	30% Shale, medium grey and medium grey brown, carbonaceous non calcareous. 70% Coal with abundant amber
	Core No. 13 9289-93.5'
9294-9300	30% Sandstone, as above, with slight trace green mineral (chlorite?) trace coal 70% Shale, as in core No. 13
9300-9310	50% Sandstone, very fine-medium grain, very calcareous 50% Shale
9310-9320	40% Sandstone as above 60% Shale as above
9320-9330	60% Sandstone, as above 40% Shale, as above
9330-9340	50% Sandstone, as above 50% Shale, as above
9340-9350	100% slight medium grey hard, silty non calcareous dark grey, hard dense, brittle non calcareous,
9350-9360	As above
9360-9370	As above
9370-9380	100% Conglomerate, coarse-pebble, angular composed of clear - white quartz, quartzite, with abundant rose quartz. From junk basket at 9383' and 9417' Conglomerate: cobble and boulder size fragments up to 7.5 x 5 cm. Fragments showing well rounded surfaces - frequently in contact with groundmass. a) quartzite, white with abundant rose quartz, salmon red, light and dark grey chert and trace pyrite. b) Chert: light medium and dark grey. c) Rhyolite (?) porphyry: macroscopically-deep purplish red under binocular - medium dark red brown. Aphanitic groundmass contains abundant anhedral quartz grains light yellow-brown, translucent, abundant euhedral feldspar exhibiting good cleavage, very few black mafic grains, several round dark grey, very coarse chert grains - possibly incorporated into rock during molten flow. d) groundmass: sandstone, light grey, very fine grain, hard, non porous, calcareous with abundant black, fine-medium grain, mafic grains, sandstone, groundmass contains zones of clear-white quartzite with 15-20% calcareous cement. Frequent pyrite.
9380-9385	As above
9385-9390	As above
9390-9395	As above
9395-9400	As above
9400-9410	As above
9410-9415	As above
9415-9420	As above
9420-9425	As above
9425-9430	50% cobble and boulder constituents 50% Sandstone groundmass, light grey-white, fine grained, non porous, slightly calcareous, with abundant black lithic grains, biotite, trace pyrite.

9430-9435	40% <u>Conglomerate cobble and boulder</u> constituents as above 60% <u>Groundmass</u> as above
9435-9440	As above
9440-9445	30% <u>Conglomerate cobbles and boulders</u> as for 9430-9435 70% <u>Sandstone groundmass</u> as for 9430-9435
9445-9450	As above
9450-9455	20% <u>Conglomerate constituents</u> 80% <u>Sandstone</u>, as above
9455-9460	As above
9460-9465	70% <u>Sandstone</u>, lithic, light grey-clear white, quartz and lithic (chert), very coarse grain - granular, angular grains abundant feldspar (orange). 30% <u>Sandstone</u> - lithic (quartz and chert), very fine-fine grain, aggregate in strong calcareous matrix.
9465-9470	100% <u>Sandstone</u> - lithic (quartz and chert), very fine to fine grain aggregate in siliceous matrix.
9470-9475	100% <u>Sandstone</u> - as above, but seems to be contaminated - no oil flow but heavy staining and yellow cut.
9475-9480	90% <u>Sandstone</u> - lithic (quartz and dark grey siliceous material in calcareous matrix, very fine grained - subangular-angular silty. 10% <u>Shale</u> - dark grey black, medium hard, occasional very coarse grains, angular, fragments occasional chert and siliceous material.
9480-9485	90% <u>Sandstone</u> as above 10% <u>Shale</u> - as above
	POH to change bits - resumed drilling at 11.00 p.m. 20 March
9485-9490	90% <u>Sandstone</u> - as above, with numerous very coarse grained siliceous fragments 10% <u>Shale</u> - as above, very carbonaceous, pyritic.
9490-9500	90% <u>Sandstone</u> as above 10% <u>Shale</u>, as above
9500-9510	80% <u>Sandstone</u>, lithic (s9liceous and quartz grains), light grey and clear to buff to tan, very fine-fine grained aggregates, angular-subangular, poorly sorted, light grey is slightly calcareous while tan is very calcareous (matrix), impermeable abundant angular fragments of very coarse grain granular white siliceous minerals, occasional pink feldspar crystal 20% <u>Shale</u>, dark grey, hard, carbonaceous, occasionally slightly calcareous.
9510-9520	75% <u>Conglomerate</u>, lithic, very coarse grain - granular, very angular, siliceous material in very fine grain - fine grain calcareous sandstone matrix, numerous pink feldspar crystals. 25% <u>Shale</u>, dark grey, hard, brittle, occasionally slightly calcareous.
9520-9525	100% <u>Conglomerate sandstone</u> - lithic (siliceous and chert), abundant pink feldspar, very coarse grain and very angular, in scattered aggregate of calcareous sandstone as above, occasional dark grey carbonaceous hard shale fragments.
9530-9535	90% <u>Conglomerate sandstone</u>, as at above in fine grain calcareous sandstone matrix. 10% <u>Shale</u> as above

9535-9540 75% Sandstone, light grey, aggregate of lithic grains in calcareous sandstone matrix within abundant coarse grain fragments of siliceous quartz grains, not as coarse textured as above angular, abundant green siliceous mineral fragments (jadite).
25% Shale, dark grey,hard, carbonaceous, occasional coal fragments.

9540-9545 80% Conglomerate - light grey, lithic, very coarse grain, angular fragments of chert, quartz, siliceous minerals, orange feldspar, abundant light pale green "jadeite", occasiona scattered aggregate of silty-fine grain calcareous chloritic sandstone (lithic).
20% Shale, dark grey-black, hard, carbonaceous, occasional coal fragments.
* Drilling rate 8'/hour with "button bit".

9545-9550 80% Conglomerate as above
20% Shale as above

9550-9555 80% Sandstone, light grey to tan, silty to fine grain, aggregate of lithic (quartz and siliceous grains) with calcareous matrix abundant angular quartz, chert and other siliceous fragments i.e. "jadeite" - very coarse grain, also orange feldspar abundant.
20% Shale, dark grey, carbonaceous, hard

9555-9560 75% Sandstone, as above with very small amount of conglomerate
25% Shale, as above with scattered coal fragments sample contaminated - no oil flow but streaming yellow cut.

9560-9565 80% Sandstone, light grey, lithic (siliceous and quartz grains) tan, silty to fine grained, angular to subangular, "aggregates of grains", calcareous matrix, chloritic numerous large very coarse grained angular fragments of quartz and siliceous material, orange feldspar - "less conglomerate material."
20% Shale, dark grey, carbonaceous, firm to hard, occasional coal fragments.

9565-9570 90% Conglomerate as above in calcareous sandstone matrix
10% Shale

9570-9575 90% Conglomerate as above
10% Shale

9575-9580 85% Sandstone, as above, interbedded with conglomerate as above
15% Shale, as above, pyrite present, occasional coal fragments

9580-9585 90% Sandstone, light grey to tan, lithic (siliceous and quartz grains), aggregates of silty to fine grained sandstone with calcareous cement, chloritic, angular to subangular, interbedded with conglomerate angular fragments of quartz, chert, feldspar and siliceous material (light green "jadeite") some glauconite
10% Shale, dark grey, hard, carbonaceous, some pyrite, and coal; fragments.

POH to change bits - BIT OK after 8½ hours drilling - good samples of conglomerate sandstone in junk basket.

9585-9590 75% Conglomerate sandstone, lithic (quartz and siliceous fragments) in calcareous lithic sandstone matrix, conglomerate is very coarse grained to pebble sized and angular fragments, calcareous sandstone is very fine to fine grained, angular to subangular, abundant orange feldspar.
25% Shale, dark grey, carbonaceous, hard, occasional coal fragments.

9590-9595	70% <u>Conglomerate sandstone</u>, as above, approximately 70% <u>calcareous sandstone</u> matrix. 30% <u>Shale</u>, as above with coal fragments
9595-9600	60% <u>Sandstone conglomeritic</u>, lithic 40% <u>Shale</u>, dark grey, very carbonaceous, hard Drilling break
9600-9605	60% <u>Sandstone, conglomerate</u> as above, calcareous, lithic, very fine-fine grained, aggregate, fine sandstone, angular to subangular. 40% <u>Shale</u>, dark grey very carbonaceous, brittle to hard
9605-9610	60% <u>Sandstone</u> conglomerate, very coarse grain, angular fragments of chert, quartz, other siliceous material and feldspar in lithic (siliceous material and quartz), sandstone, silty, very fine to fine grained, angular to subangular and very calcareous. 40% <u>Shale</u>, as above with numerous resinous calcareous fragments.
9610-9615	50% <u>Sandstone</u>, conglomerate in calcareous sandstone matrix as above 50% <u>Shale</u>, dark grey, carbonaceous, firm to hard, silty occasional fragments of <u>coal</u>.
9615-9620	60% <u>Conglomerate sandstone</u> - angular chert and quartz (siliceous) fragments in calcareous sandstone matrix as above 40% <u>Shale</u>, dark grey, carbonaceous
9620-9625	50% <u>Conglomeratic sandstone</u>, angular siliceous, fragments in calcareous sandstone matrix 50% <u>Shale</u>, as above
9625-9630	50% <u>Conglomerate sandstone</u> as above 50% <u>Shale</u> - as above
9630-9635	60% <u>Conglomerate sandstone</u>, lithic (chert, siliceous fragments and quartz) angular, very coarse grained, in calcareous sandstone, (lithic), matrix, large fragments of feldspar and "rhyolite". The sandstone "matrix" is very fine to fine grained, angular to subangular, hard, calcareous cement. 40% <u>Shale</u>, dark grey to black, carbonaceous.
9635-9640	70% <u>Conglomerate sandstone</u>, lithic (siliceous and quartz), very fine to fine grained, angular to subangular, calcareous hard, and conglomeratic to very coarse grained sandstone, conglomerate is lithic (siliceous and quartz), and angular, numerous orange feldspar fragments. 30% <u>Shale</u>, dark grey, carbonaceous, pyritic, firm to hard.
9640-9645	70% <u>Conglomerate sandstone</u>, very coarse grained, angular fragments of lithic material in a very silty-fine grained calcareous lithic sandstone matrix. 30% <u>Shale</u>, as above
9645-9650	80% <u>Conglomerate</u> as above 20% <u>Shale</u>, as above
9650-9655	75% <u>Sandstone</u>, lithic, aggregate of silty to fine grain green mineral, angular to subrounded, slightly calcareous, occasional angular fragments of rhyolite. 25% <u>Shale</u> and calcareous <u>fine grained siliceous sandstone</u> as above

9655-9660 75% Sandstone, lithic, green aggregate of angular -subrounded grains, chloritic, olivine, silty, slightly calcareous, hard, also large angular quartz and chert fragments, scattered hard calcareous lithic fine grained sandstone and fragments of ryholite.
25% Shale, grey to brown, very hard.

9660-9665 60% Sandstone, lithic composed predominantly of green minerals (chlorite and olivine and siliceous material) in aggregate of silty - fine grained sandstone with siliceous to slightly calcareous coal, subangular - subrounded, hard minor amount of fine grained aggregate of calcareous lithic sandstone (quartz and siliceous material), slightly conglomerate with red brown rhyolite, angular fragments.
40% Shale and siltstone, dark grey brown, carbonaceous

9665-9670 60% Sandstone equal amount of green chloritic aggregate of calcareous aggregate of siliceous material.
40% Shale as above, silty, minor conglomerate material.

9670-9675 75% Sandstone - predominantly lithic (chlorite, olivine and some siliceous material) aggregate, fine grained slightly calcareous, minor amounts of lithic (siliceous) calcareous sandstone, scattered angular fragments of chert, feldspar rhyolite
25% Shale- dark grey, silty, very carbonaceous.

9675-9680 75% Sandstone; predominantly green lithic sandstone as above, minor amount of light buff fine grained calcareous sandstone as above, scattered angular fragments of abundant glauconite and siliceous material
25% Shale, as above

9680-9685 75% Sandstone as above
25% Shale as above

9685-9690 90% Sandstone
10% Shale as above

9690-9695 75% Sandstone as above, equal amount of calcareous lithic buff sandstone and lithic green sandstone
25% Shale as above

9 695-9700 80% Sandstone, green lithic (chlorite, olivine, chert) aggregates, fine grained, subangular - subrounded grains, slightly calcareous, hard, occasional aggregate of grey to buff fine grain - very fine grain calcareous lithic sandstone (quartz and siliceous material, scattered angular fragments of chert and siliceous material (slightly conglomeritic,) occasional angular fragments of "ryholite"
20% Shale - dark grey, carbonaceous

9700-9710 80% Sandstone, about 50% Aggregates of lithic (siliceous grains and quartz) in calcareous matrix, grey to tan, very fine to fine grained, subangular, hard and 50% aggregates of green lithic (chlorite olivine etc.) sandstone, fine grained, subangular, occasional angular chert and quartz fragments. Green lithic sandstone is very slightly calcareous, cement is probably siliceous
20% Shale, grey, carbonaceous, hard

9710-9720 90% Sandstone and sand, abundant unconsolidated grains of lithic sand in sample tray. Also aggregate of green lithic sandstone, fine grained hard, subrounded, subangular (chlorite and siliceous grains), abundant calcareous, siliceous subrounded, lithic sandstone, fine grained and hard. May have porosity
10% Shale, dark grey, hard carbonaceous

9720-9730 80% Sandstone, abundant green aggregate and unconsolidated grains of chlorite, olivine and siliceous material, also numerous aggregates of light grey - buff calcareous very fine grain fine grain lithic (quartz and siliceous) sandstone.
20% Shale, dark grey, hard, silty, carbonaceous, occasional coal fragment.

9730-9740 90% Sandstone, abundant aggregates of light grey to buff calcareous sandstone, as above, with lesser amount of green sandstone than above, abundant unconsolidated grains, some porosity, scattered angular fragments of chert and quartz orange feldspar
10% Shale as above

9740-9750 90% Sandstone, unconsolidated grains and aggregate of lithic green sandstone with siliceous to clay matrix and cement, fine grained, subangular, consists of chlorite olivine and quartz grains. Equal amounts of light grey to tan calcareous lithic sandstone aggregates calcareous sandstone consists of fine grained subangular quartz and siliceous material with calcareous cement scattered large angular fragments of chert and siliceous material with rounded edge present, (pieces of conglomerate pebble)
10% Shale, as above

9750-9760 90% sandstone and sand - abundant light grey - tan aggregate and scattered grains of lithic (quartz and siliceous material)sandstone with calcareous cement, equal to lesser amount of green lithic (chlorite, olivine, chert)sandstone with clay to siliceous cement, scattered large angular fragments of quartz, chert, and siliceous
10% shale, dark grey, carbonaceous, hard.

9760-9770 75% sandstone and sand as above
25% shale as above

9770-9780 90% sandstone and sand as above, very few conglomerate fragments.
10% shale as above

9780-9790 90% sandstone and sand as above
10% shale, as above with scattered coal fragments, slight increase in hot wire and Cl.

9790-9800 80% sandstone, aggregate of green lithic very fine to fine grained and grey-tan calcareous lithic sandstone, silty-fine grained, sub-angular - subrounded, hard, numerous angular fragments, of siliceous material - quartz and chert, also feldspar - slightly conglomeritic
20% shale

9800-9810 75% sandstone aggregate of green lithic (chlorite, olivine, chert and quartz), sandstone very fine to fine grained, subangular to angular, hard, very slightly calcareous predominantly siliceous cement, and aggregate of calcarous lithic (quartz and chert),sandstone very fine to fine grained, subangular , occasional large angular siliceous fragments and angular fragments of orange feldspar, slightly porous.
25% shale, dark grey, carbonaceous, very hard.

9810-9820 75% sandstone as above
25% shale, grey, hard carbonaceous, appearance of red splintery shale.

9820-9830 90% sandstone and sand - as above, with some conglomerate
10% shale as above.

9830-9840 80% sandstone and sand as above with some conglomerate.
20% shale as above

Pulled out of hole at 9859 to cut core No. 17.

9840-9850 60% sandstone and sand as above
40% shale as above

See Core Description No. 14

9870-9880 60% sandstone, green lithic (chlorite,quartz, chert, volcanic fragments),aggregate and also grey to tan unconsolidated grains dense clayey matrix, slightly calcareous, subangular, hard, occasional angular fragments of quartz and chert.
40% shale grey dark brown, carbonaceous , hard.

9880-9890 70% sandstone, green lithic aggregate and unconsolidated grains as above, grey tan lithic sandstone as above.
30% shale dark grey, hard, carbonaceous, also blue grey, hard, slightly calcareous, brown, fissile.

9890-9900 60% sandstone and sand, light green aggregates of slightly calcareous sandstone and silty fine grained, hard, angular, lithic(chlorite, epidote, chert and siliceous material) subangular, also light grey-tan, lithic (quartz and siliceous fragments), calcareous cement, fine grained - silty, hard, angular fragments of siliceous material,
40% shale, grey, hard, carbonaceous, fissile, also blue grey shale, hard.

9900-9910 50% sandstone as above
50% shale as above

9910-9920 50% sandstone as above
50% shale as above

9920-9930 60% sandstone as above
40% shale as above

9930-9940 60% sandstone, light grey to green, aggregate of lithic sandstone (chert, quartz, chlorite, olivine) in dense clay to siliceous matrix, subangular,silty - fine grained, some medium grain, slightly calcareous, occasional angular fragment of chert and quartz,also silty.
40% shale, dark grey to brown, hard carbonaceous, and blue grey, hard fissile shale

9940-9950 60% sandstone as above
40% shale as above

9950-9960 50% sandstone, as above
50% shale as above

9960-9970 50% sandstone as above
50% shale as above

9970-9980 75% sand and sandstone, abundant unconsolidated grains in tray,light grey - green to tan, lithic (quartz, chert, chlorite, etc), silty - fine grained, subangular, slightly calcareous, occasional very coarse angular siliceous fragments, numerous aggregates of grains also present, clay matrix better porosity.
25% shale, dark gey - brown, hard, carbonaceous.

9980-9990 75% sandstone, lithic as above, aggregate of hard grey, green sandstone "tight" occasional angular fragments of siliceous material, slightly conglomeritic.
25% shale, as above with some grey blue hard shale.

9990-10,000 60% sandstone and sand as above
40% shale as above

10,000-10,010 80% sandstone and sand, grey to green lithic predominant, consists of unconsolidated silty - fine sand grains, (quartz, chert, chlorite olivine etc.) and scattered aggregate of grains,carbonaceous mica, occasional grey to tan calcareous lithic aggregate, very fine - fine grained, scattered angular fragments of chert and quartz.
20% shale, dark grey-brown, carbonaceous, hard and blue grey shale - hard.

10,010-10,020 75% sandstone lithic as above, conglomerate, abundant very coarse, angular siliceous fragments.
25% shale, dark grey - brown, hard,carbonaceous.

10,020-10,030 80% sandstone, light green lithic (as above), fine grained, subangular , hard, slightly calcareous.
20% shale, dark grey to brown, carbonaceous, also blue grey, and reddish brown, all hard.

10,030-10,040 75% sandstone, predominantly light green lithic as above, aggregate but fine grain to medium grain, abundant calcareous lithic sandstone and angular chert and quartz fragments, slightly conglomerate.
25% shale as above

10,040-10,050 80% sandstone conglomerate as above
20% shale as above

10,050-10,060 80% sandstone, càlcareous as above
20% shale as above

10,060-10,070 75% conglomerate, light grey - green, abundant angular fragments of quartz, chert, ryholite in fine grain - coarse grain, sandstone matrix. Matrix is angular-subangular lithic sandstone -green sandstone,slightly calcareous, and white-clear siliceous sandstone very calcareous, carbonaceous.
25% shale as above

10070-10080	60% conglomerate, clear to light grey quartz and chert, angular fragments, pyritic, carbonaceous, in green to buff sandstone matrix fine grain to coarse grain, slight to very calcareous. 40% shale as above
10080-10090	70% sandstone aggregate of grey - green lithics (chert, quartz, chlorite, and dark rock fragments)very fine to medium grain, sub-angular, hard, slightly calcareous, to siliceous matrix and buff silty to medium grain, lithic sandstone (quartz chert, and siliceous matedal) calcareous hard, carbonaceous, occasional angular siliceous fragments. 30% shale, dark grey - brown, cement, hard slightly pyritic.
10090-10100	80% sandstone and sand, light green lithic and tan calcareous lithic sandstone aggregates, silty - fine grained, subangular , abundant unconsolidated grains, slight increase in porosity, carbonaceous mica. 10% shale, dark grey - brown and carbonaceous and hard. 10% coal, black, shiny, small fragments - increase in Cl.
10100-10110	70% sandstone, as above but fine grain - coarse grain, numerous angular fragments of siliceous material. 30% shale, as above with abundant blue grey shale fragments.
10110-10120	50% sandstone as above 50% shale as above
10120-10130	60% sandstone as above 40% shale as above
10130-10140	60% grey green, lithic and buff calcareous lithic sandstone, scattered large angular fragments of siliceous material. 40% shale as above
10140-10150	80% sandstone, grey - green to buff small aggregates of lithic sandstone, green sandstone is fine grain - medium grain, slightly calcareous, subangular - angular, siliceous cement, buff, lithic sandstone aggregate, silty to medium grain, subangular, very calcareous hard, slightly carbonaceous, occasional angular large fragment of clear quartz, grey chert, slightly pyritic, occasional coarse grain, subrounded, clear quartz grain. 20% shale, grey - brown, hard, carbonaceous and also blue grey, hard shale.
10150-10160	75% sandstone, as above, occasional coarse grain to conglomeritic. 25% shale as above
10184-10190	70% sandstone,medium grain lithic, green cast on green quartzose material, contains carbonaceous grains. 30% shale and silt, grey green colour due (olivine?) or chlorite, tight, No fluorescence, other than traces pipe dope.
10190-10200	As at above with traces coal fragments.
10200-10210	As at above with grain material, medium coarse and no coaly material. Tight.
10210-10220	10% Clear quartzose sandstone grains, angular. 60% lithic sandstone as above 30% silt and shale grey with traces red and variegated No fluorescence. Tight.
10220-10230	As at above with trace coarse chert.
10230-10240	As above
10240-10250	70% lithic quartzose sandstone, medium grain green cast. 30% silt, light grey, cream-brown. No fluorescence,tight.

10250-10260	80% lithic quartzose sandstone, very slightly calcareous, greenish cast. 20% siltstone, light grey, cream and brown. Trace of black carbonaceous shale. No fluorescence. Tight.
10260-10270	As above
10270-10280	As above.
10280-10290	50% silt; grey. 50% lithic quartzose, cloritic, sandstone, cream to light green, Some carbonaceous pebbles incorporated with this medium grained sandstone. No fluorescence and no cut.
10290-10300	70% lithic sandstone; as above 30% silt grey and shale grey. Traces red and green variegated shale. No fluorescence.
10300-10310	As above.
10310-10320	As above.
10320-10330	50% lithic sandstone; as above. 50% silt; grey and grey brown, slight carbonaceous, and shale grey as above. Strong trace of red and green variegated shale. No fluorescence.
10330-10340	60% lithic sandstone; as above, very chloritic, non calcareous. 40% grey, slightly carbonaceous, siltstone, and grey shale. Strong trace of red and green variegated shale. No fluorescence.
10340-10350	70% lithic sandstone; as above, chloritic, non calcareous. 30% siltstone and shale as above. Trace red shale. No fluorescence.
10350-10360	30% lithic sandstone; as above. 70% siltstone and shale as above.
10360-10370	As above.
10370-10380	30% lithic sandstone; as above 70% siltstone and shale; siltstone is grey, brown and greenish grey, non calcareous, slightly carbonaceous, shale is red, variegated, red and green and black carbonaceous. Tight. No fluorescence.
10380-10390	70% lithic sandstone; as above. 20% silt; light grey 10% shale; dark grey, tight. No fluorescence.
10390-10400	As above.
10400-10410	60% lithic sandstone; as above, very chloritic 40% silt and shale; as above Tight. Trace amber fluorescence.
10410-10420	70% lithic sandstone; as above, very chloritic, tight. 30% silt and shale as above. No fluorescence.
10420-10430	As above but sandstone up to coarse grained occasional small chert.
10430-10440	As above.
10440-10445	As above with strong trace of orange quartzitic (cavings?).

Appendix (3)

DESCRIPTION OF CORES AND CORE ANALYSIS

EXPLORATION LOGGING OF AUSTRALIA, INC.
A Geological-Engineering Service

CORE# 1

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

OMPANY ESSO
DATE FEBRUARY 7, 1968
'ELL "PRAWN A-1"
DEPTH 3621 TO 3623
OCATION/FIELD OFFSHORE OTWAY BASIN
GEO-ENGINEER FERGUSON
OUNTY ______ STATE TASMANIA
OUNTRY AUSTRALIA
EMARKS CUT 2 FEET; RECOVERED NONE.

SAND
SILTY SAND
SILTST.
SHALE
LIME
CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	TOTAL CL⁻ G/G	REMARKS
			OIL	WATER			
-NO ANALYSIS-							

ANALYSIS GRAPH

PERMEABILITY MD. O—O
POROSITY % X—X
8 6 4 2 0
40 30 20 10 0

WATER SATURATION % PORE O—O
100 80 60 40 20 0
OIL SATURATION % PORE X—X
0 20 40 60 80 100

CORE# 2

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

MPANY ESSO
LL "PRAWN A-1"
CATION/FIELD OFFSHORE--OTWAY BASIN
UNTY ______ STATE TASMANIA
UNTRY AUSTRALIA
ARKS CUT 19 FEET; RECOVERED 3 FEET.
5' SAND: BRN, SILT TO COARSE GR, UNCONSOLTD;
NO CORE ANALYSIS.
5' SHALE, DK BRN-BLK, SILTY, MED, HARD.

DATE FEBRUARY 9, 1968
DEPTH 3938 TO 3957
GEO-ENGINEER FERGUSON

SAND
SILTY SAND
SILTST.
SHALE
LIME
CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	TOTAL CL⁻ G/G	REMARKS
			OIL	WATER			
3938.5	UNCONSOLIDATED SAND. UNABLE TO OBTAIN SUITABLE SAMPLE FOR ANALYSIS.						
3938.5 - 3941	SHALE						

ANALYSIS GRAPH

PERMEABILITY MD. O—O

POROSITY % X—X
8 6 4 2 0
40 30 20 10 0

WATER SATURATION % PORE O—O
100 80 60 40 20 0

OIL SATURATION % PORE X—X
0 20 40 60 80 100

RE #3

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

OMPANY ESSO
ELL "PRAWN A-1"
CATION/FIELD OTWAY BASIN OFFSHORE
UNTY ~~XXXXXXXX~~ STATE TASMANIA
UNTRY AUSTRALIA
MARKS CUT 30', RECOVERED 30' SILTSTONE & ALE: GRAY, SANDY IN PART, SLIGHTLY MICA-US.

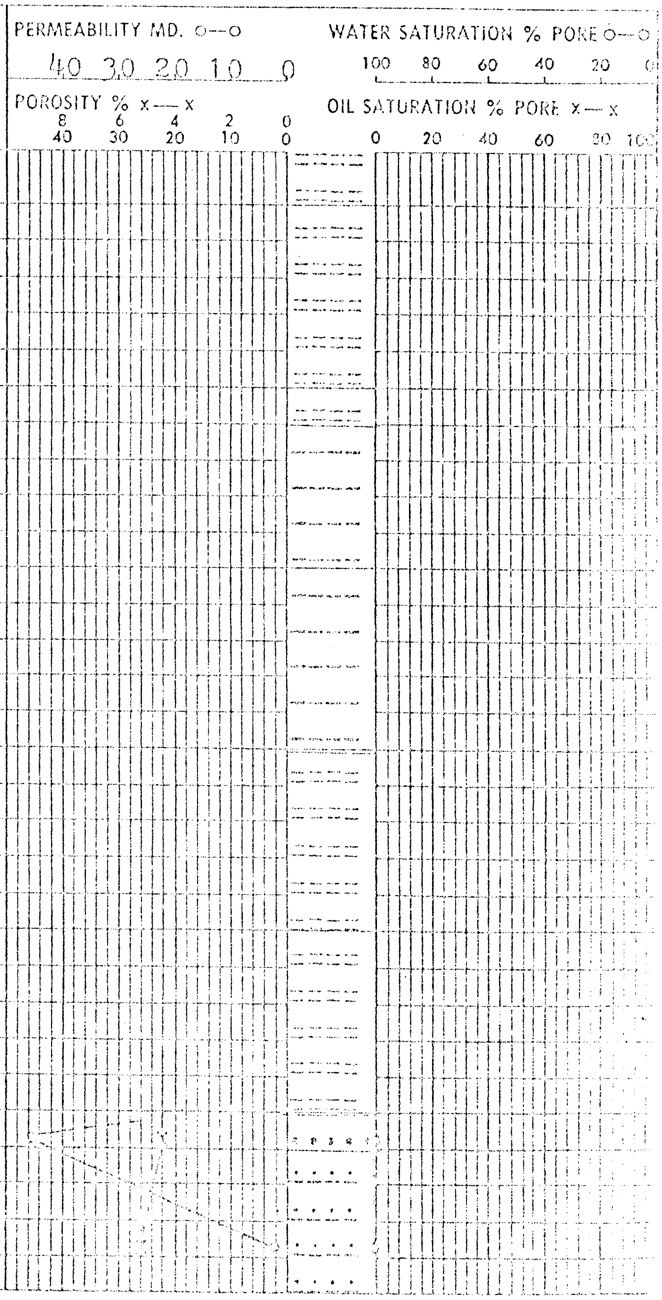
DATE FEB. 11, 1968
DEPTH 4254 TO 4284
GEO-ENGINEER FERGUSON & CLARKE

SAND — SILTY SAND — SILTST. — SHALE — LIME — CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME OIL	WATER	GRAVITY OIL °API	DRY BULK DNSTY	REMARKS
4254	SILTSTONE						
4260							
	SHALE						
4270	SILTSTONE						
4280	46	21.6	–	100	–	1.97	
4283	2.1	26.7	–	100	–	1.99	
4284							

ANALYSIS GRAPH



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EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

CORE #4

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: "EXLOGG" PERTH

CORE ANALYSIS REPORT

COMPANY ESSO
WELL "PRAWN A-1"
LOCATION/FIELD OTWAY BASIN
COUNTY OFFSHORE STATE TASMANIA
COUNTRY AUSTRALIA
REMARKS CUT 16', REC. 9' SANDSTONE: FINE-MEDIUM GRAIN, SUB-ANGULAR, QUARTOZE, CLAYEY FRIABLE & POROUS OR CALCAREOUS HARD & TIGHT

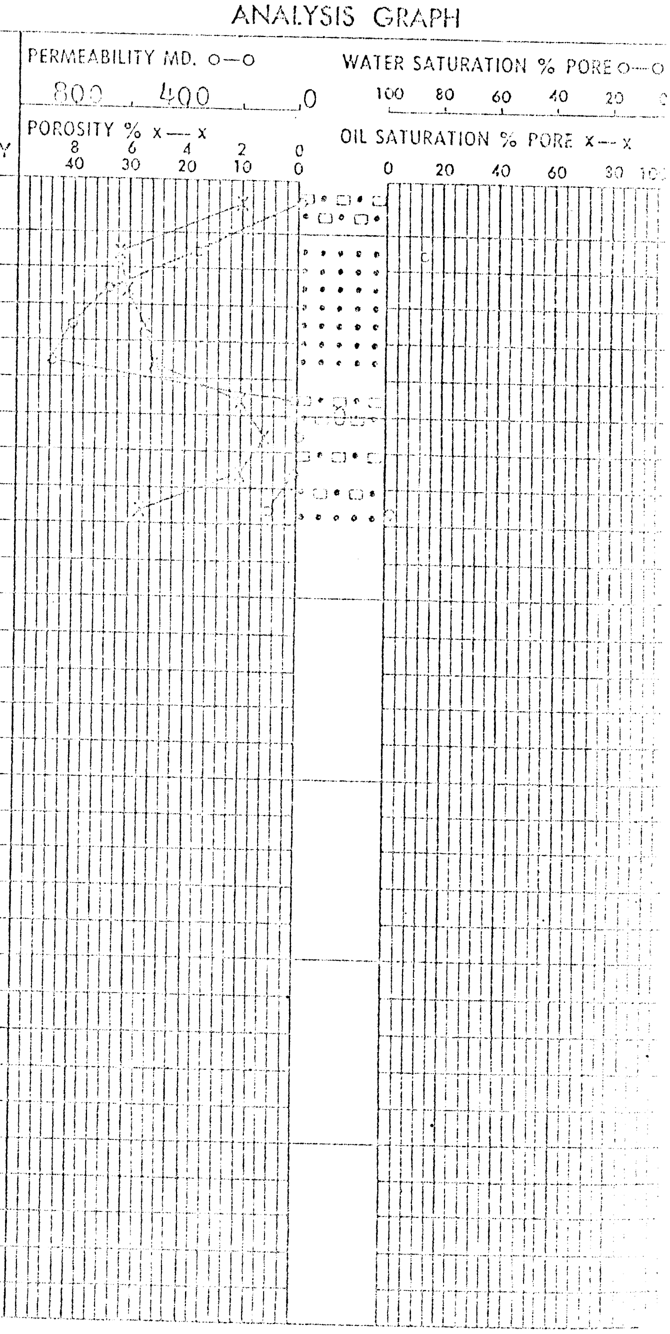
DATE FEB. 11, 1968
DEPTH 4581 TO 4597
GEO-ENGINEER FERGUSON, CLARKE & WATT

SAND	SILTY SAND	SILTST.	SHALE
LIME	CONGL.		

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME OIL	WATER	GRAVITY OIL °API	TOTAL Cl⁻ G/G	DRY BULK DNSTY REMARKS
4581	0	10.3	--	--	-		2.51
4582	364	31.5	--	87.0	-		1.28
4583	672	30.6	--	--	-		1.75
4584	821	27.8	--	--	-		1.59
4585	893	26.5	--	--	--		1.80
4586	0	10.2	--	--	--		2.44
4587	0	5.8	--	--	--		2.50
4588	0	10.0	--	--	--		2.36
4589	108	28.9	--	99.0	--		1.83
4590-4597 NO RECOVERY							

ANALYSIS GRAPH



EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

CORE# 5

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA

PHONE: 61 4437

CABLE: EXLOGG., PERTH

CORE ANALYSIS REPORT

COMPANY ESSO

WELL "PRAWN A-1"

LOCATION/FIELD OTWAY BASIN

COUNTY OFFSHORE STATE TASMANIA

COUNTRY AUSTRALIA

REMARKS CUT 28'; RECVD 27'. SANDSTONE: MED. BRN TO GRAY, V. SILTY, V.FN TO V.CRSE GRAIN; NON-CALCAREOUS, COMPOSED OF QTZ. CONTORTEDLY INTERBEDDED WITH REWORKED SILTSTONE.

DATE 12 FEBRUARY 1968

DEPTH 4935 TO 4963

GEO-ENGINEER WATT & FERGUSON

SAND

SILTY SAND

SILTST.

SHALE

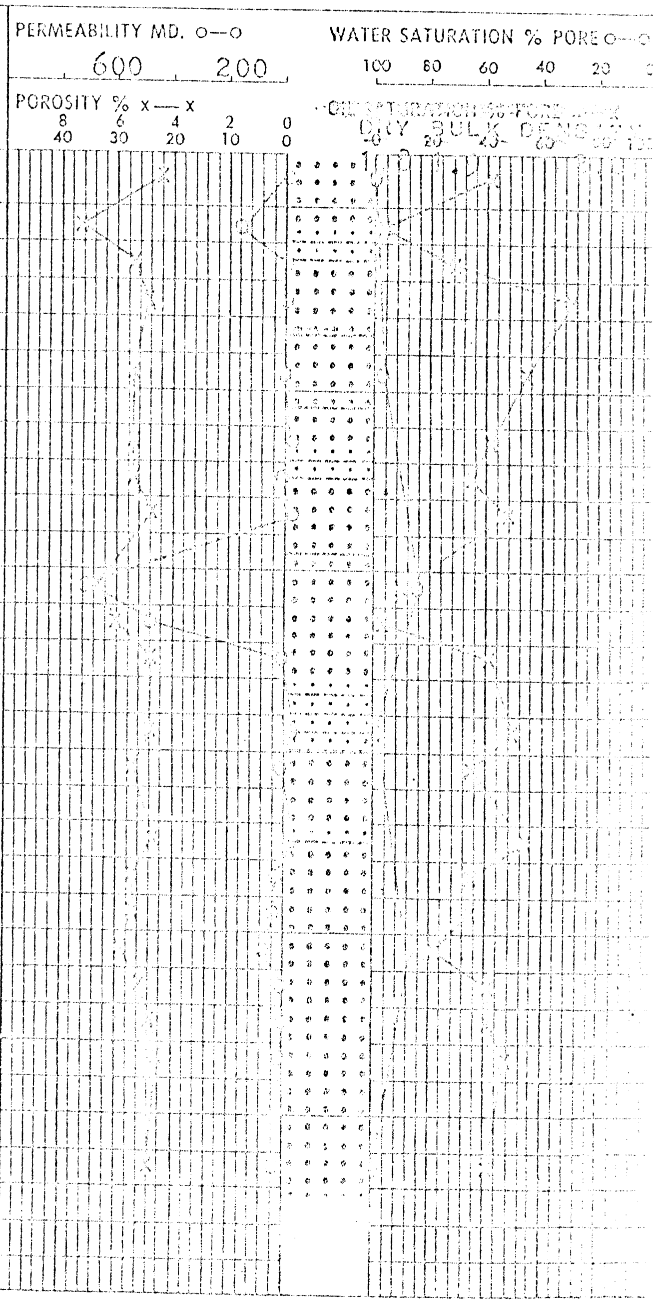
LIME

CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	DRY BULK DENSITY	REMARKS
			OIL	WATER			
4935	2	21.7	–	100		2.00	
4936	130	34.8	–	–		1.79	
4937	2	27.0	–	–		1.94	
4938	0	24.6	–	–		2.14	
4940	2	24.4	–	96		1.98	
4941.5	0	24.8	–	–		2.01	
4943.5	2	25.2	–	–		1.97	
4944	0	22.8	–	–		2.04	
4945.5	666	32.3	–	88		1.84	
4946.5	505	30.4	–	–		1.82	
4948	2	24.6	–	–		2.01	
4950	0	24.0	–	100		2.05	
4951	2	27.4	–	–		1.97	
4952.5	0	21.9	–	–		2.08	
4953.5	2	26.1	–	–		1.98	
4954.5	2	26.2	–	–		1.96	
4956	52	28.7	–	98		1.91	
4957	2	25.1	–	–		1.99	
4958	2	23.3	–	–		2.00	
4959	2	23.1	–	–		2.03	
4961.5	3	23.6	–	100		2.00	

ANALYSIS GRAPH



CORE #6

EXPLORATION LOGGING OF AUSTRALIA, INC.
A Geological-Engineering Service
PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY ESSO
WELL "PRAWN A-1"
LOCATION/FIELD OTWAY BASIN
COUNTY OFFSHORE STATE TASMANIA
COUNTRY AUSTRALIA
REMARKS CUT 28', REC. 26' SANDSTONE: DARK GRAY-GREEN, POORLY SORTED, MEDIUM-VERY COARSE GRAIN, SLIGHTLY PEBBLY, SHALY, PYRITIC, FIRM-FRIABLE, POROUS WITH HARD, TIGHT, CALCAREOUS ZONE 5629-31.

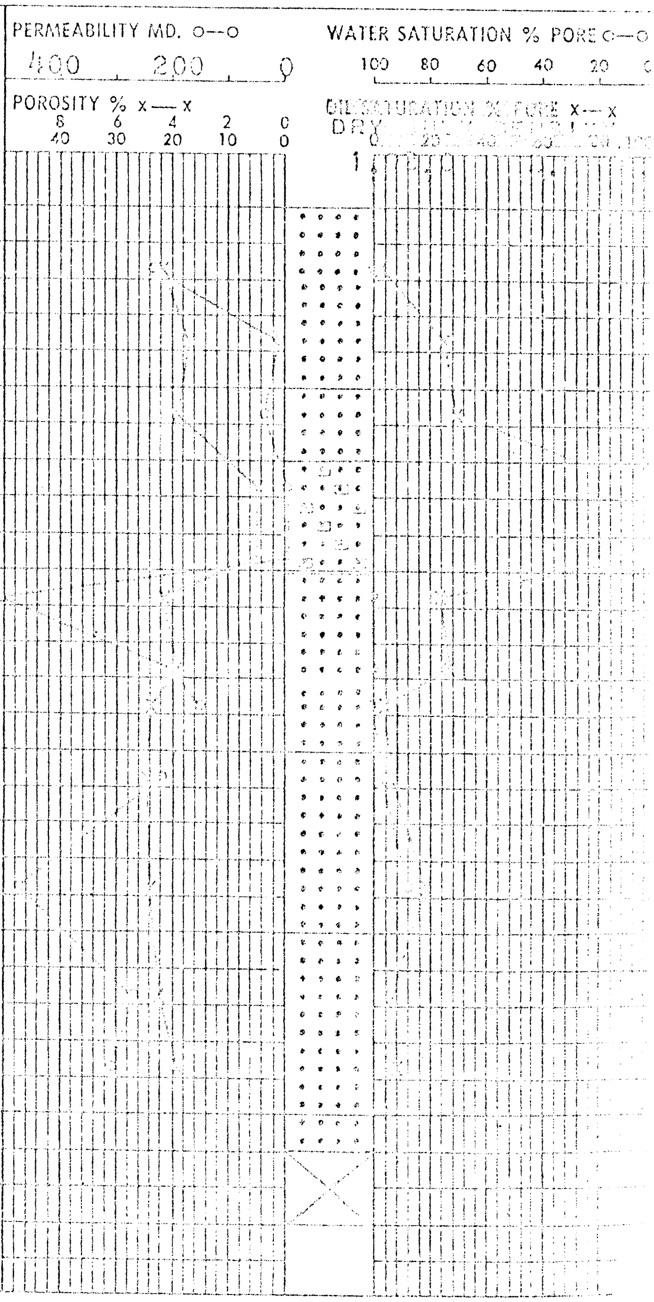
DATE FEBUARY 14, 1968
DEPTH 5621 TO 5649
GEO-ENGINEER WATT & CLARKE

SAND · SILTY SAND · SILTST. · SHALE · LIME · CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME OIL	FLUID SATURATION % PORE VOLUME WATER	GRAVITY OIL °API	DRY BULK DNSTY	REMARKS
5621							
5623	233	21.8	0	100		1.90	
5625	5	16.9	--	--		2.03	
5627	43	19.4	--	--		2.05	
5629	0	5.3	--	--		2.30	
5632	512	20.8	0	100		2.02	
5634	202	19.4	0	100		2.03	
5635	149	23.5	0	100		1.92	
5637	239	24.3	0	99		1.92	
5640	474	23.7	0	90		1.92	
5643	268	22.2	--	--		1.93	
5645	306	19.7	--	--		1.94	
5647							
	NO RECOVERY						
5649							

ANALYSIS GRAPH



CORE #7

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY ESSO
WELL "PRAWN A-1"
LOCATION/FIELD OTWAY BASIN
COUNTY OFFSHORE STATE TASMANIA
COUNTRY AUSTRALIA
REMARKS CUT 10' REC. 4' SANDSTONE; MEDIUM-PEBBLY GRAIN, SUB-ANGULAR TO SUB-ROUND, QUARTZOZE, SHALY, GRADED IN PART, FLOW STRUCTURED, FRIABLE-WELL CEMENTED, CALCAREOUS & SILICIOUS STREAKS.

DATE FEBRUARY 16, 1968
DEPTH 6145 TO 6155
GEO-ENGINEER WATT & CLARKE

SAND
SILTY SAND
SILTST.
SHALE
LIME
CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME OIL	WATER	GRAVITY OIL °API	DRY BULK DNSTY	REMARKS
6145							
6146	0	5.3	0	83		2.55	
6147	0	25.4	0	85		1.95	
6148	264	25.9	0	80		2.00	
6149	0	13.3	0	96		2.40	
	NO RECOVERY						
6155							

ANALYSIS GRAPH

PERMEABILITY MD. o--o 200 100 0
POROSITY % x—x 8 6 4 2 0 / 40 30 20 10 0
WATER SATURATION % PORE o—o 100 80 60 40 20 0
OIL SATURATION % PORE x---x
DRY BULK DENSITY

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

CORE#8

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH.

CORE ANALYSIS REPORT

COMPANY ESSO

WELL "PRAWN A-1"

LOCATION/FIELD OFFSHORE/ OTWAY BASIN

COUNTY ______ STATE TASMANIA

COUNTRY AUSTRALIA

REMARKS CUT 26'; RECD 22½: ½ FT. MED-GY, FN LMIN, ARGILLAC SHALE & 21½ FT. LT-GY, V/POROUS, /CALC, KAOLINITIC, QTZ SANDSTONE: V/FN TO FN LOSE-PACKED GRAINS, OCC CRS-PEBBLY, SUBANG. NO SHOWS.

DATE 4 MARCH 1968

DEPTH 6651 TO 6677

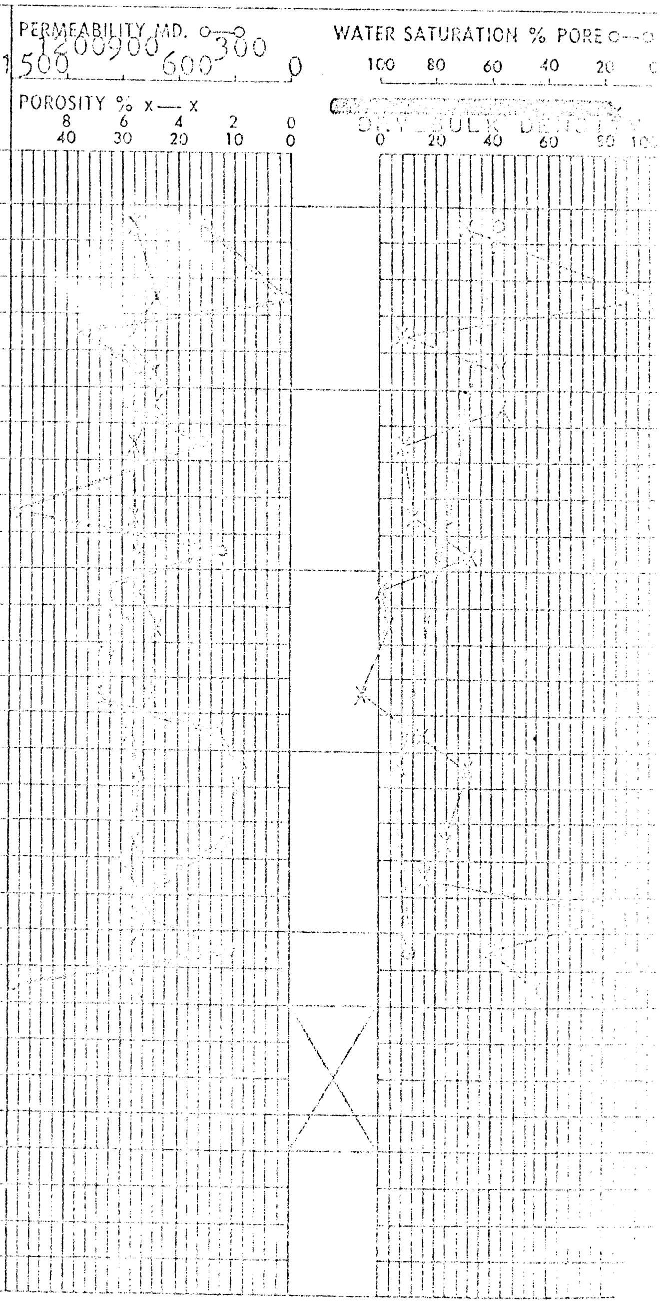
GEO-ENGINEER FERGUSON, CLARKE & MACGILL

SAND	SILTY SAND	SILTST.	SHALE
LIME	CONGL.		

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	DRY BULK DENSTY	REMARKS
			OIL	WATER			
6652							
6652.5	464	27.6	–	*58.0		1.98	
6653							
6654.5	14	22.9	–			2.14	
6655.5	1080	29.2	–			1.92	
6656.5	803	25.7	–			2.01	
6657.5	848	25.7	–			2.01	
6658.5	501	28.5	–			1.92	
6659							
6660	1450	28.5	–	*77.0		1.93	
6661.5	365	26.9	–			1.98	
6662.5	970	26.5	–			1.90	
6663.5	876	22.7	–			1.91	
6664							
6665	1010	24.9	–			1.88	
6666.5	395	28.3	–			1.94	
6667.5	238	25.7	–	93.0		1.98	
6668							
6669	352	27.2	–			1.96	
6670	670	27.6	–			1.94	
6671	824	25.0	–			2.12	
6672	332	27.8	–	82.5		2.00	
6673	1450	27.0	–			2.04	
6674							
6675							
6676	NO	RECOVERY					
6677							
	*POOR SAMPLES DUE AIR EXPOSURE.						

ANALYSIS GRAPH



CORE #9

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA

PHONE: 61 4437

CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY ESSO

WELL "PRAWN A-1"

LOCATION/FIELD OTWAY BASIN

COUNTY OFFSHORE STATE TASMANIA

COUNTRY AUSTRALIA

REMARKS CUT 30'; REC'D 30'; SILTSTONE: BLACK, FISSILE, SLIGHTLY CARBONACEOUS; INTERBEDDED WITH MINOR STRINGERS OF SANDSTONE: DARK GRAY, FINE TO MEDIUM GRAIN, SUBROUNDED, CLAYEY, TIGHT, HARD.

DATE MARCH 5, 1968

DEPTH 7147 TO 7177

GEO-ENGINEER CLARKE

SAND · SILTY SAND · SILTST. · SHALE · LIME · CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	DRY BULK DENS.	REMARKS
			OIL	WATER			
7164	0	18.9	0	76.2	--	2.24	

ANALYSIS GRAPH

PERMEABILITY MD. o—o

WATER SATURATION % PORE o—o 100 80 60 40 20 0

POROSITY % x—x 8 6 4 2 0 / 40 30 20 10 0

OIL SATURATION % PORE x—x 0 20 40 60 80 100

CORE # 10

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA

PHONE: 61 4437

CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY: ESSO

WELL: PRAWN A-1

LOCATION/FIELD: OTWAY BASIN

COUNTY: OFFSHORE STATE: TASMANIA

COUNTRY: AUSTRALIA 3

REMARKS: CUT 10', REC'D 6': ½ FT. GRAY, COARSE TO PEBBLY, SUBANGULAR TO SUBROUNDED, FRIABLE SANDSTONE; 2 FT. GRAY, HARD SILTSTONE; 1 FT. BLACK PAPER SHALE; NO SHOWS. THIN-BEDDED.

DATE: MARCH 7, 1968

DEPTH: 7684' TO 7694'

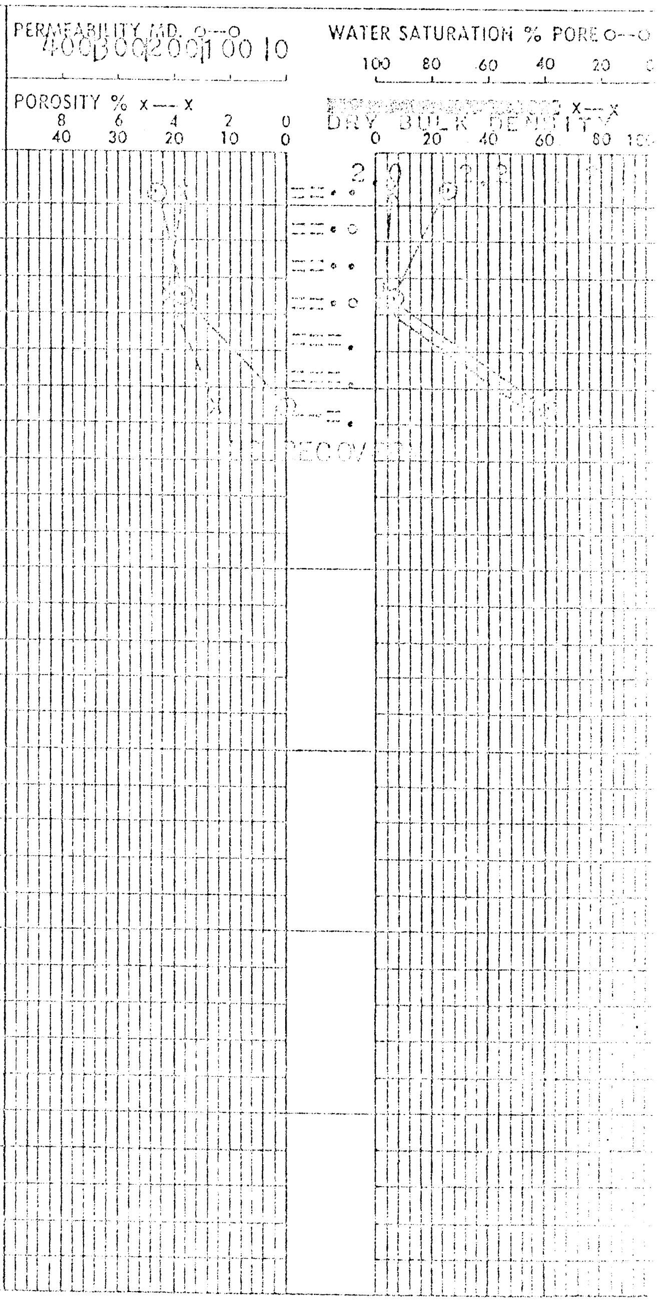
GEO-ENGINEER: CLARKE

SAND / SILTY SAND / SILTST. / SHALE / LIME / CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	DRY BULK DENS.	REMARKS
			OIL	WATER			
7684	235	18.3	0	76.0	–	2.11	
7685							
7686							
7687	184	20.6	0	94.4	–	2.07	
7688							
7689							
7690	0	12.1	0	59.6	–	2.34	
7691--7694			NO RECOVERY				

ANALYSIS GRAPH



CORE #11

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

OMPANY ESSO
ELL PRAWN A-1
OCATION/FIELD OTWAY BASIN
OUNTY OFFSHORE STATE TASMANIA
OUNTRY AUSTRALIA
EMARKS CUT 30', REC. 30' SANDSTONE: QUARTZ, LT. GRAY, VERY FINE-FINE GRAINED, SUB ANGULAR, CLAY MATRIX WITH SCATTERED CARBONACEOUS SHALE LAMINAE AND CALCAREOUS STREAKS, NO SHOWS.

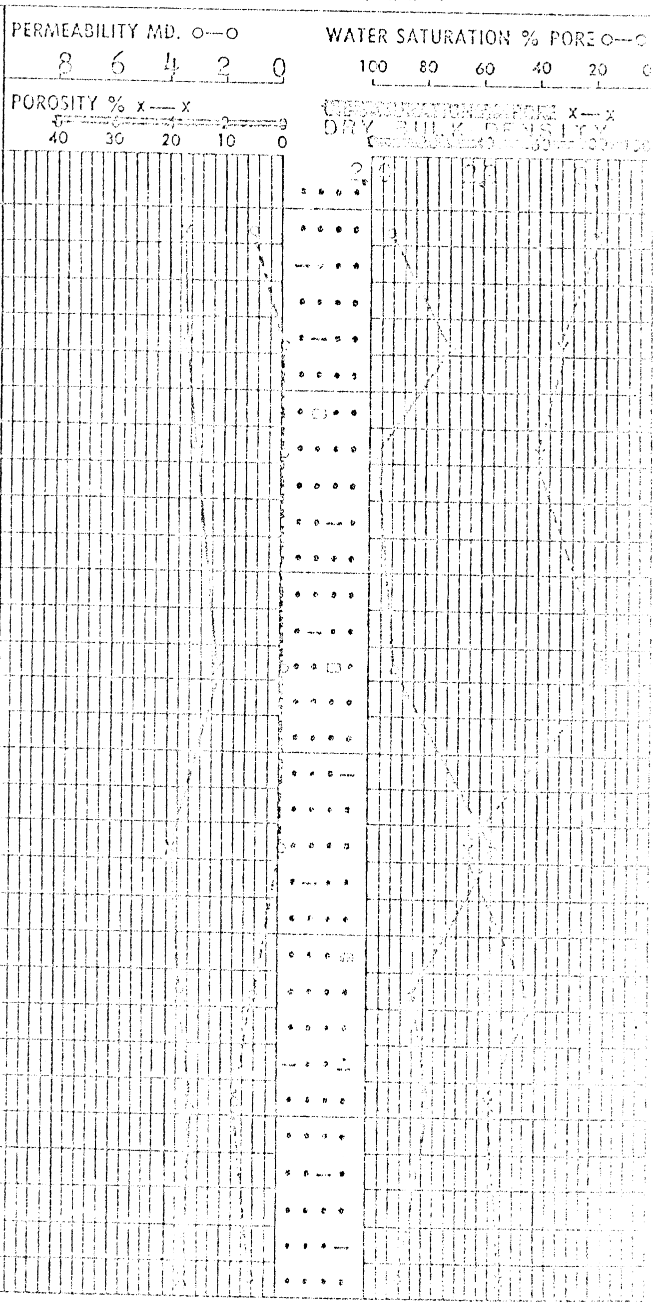
DATE MAR. 12, 1968
DEPTH 8217 TO 8247
GEO-ENGINEER WATT AND MACGILL

SAND · SILTY SAND · SILTST. · SHALE · LIME · CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	DRY BULK DNSTY	REMARKS
			OIL	WATER			
8217							
8218	1.2	17.5	–	87.0		2.40	
8221	0	16.0	–	22.0		2.34	
8224	0	16.2	–	82.6		2.30	
8230		13.1	–	86.4		2.42	
8235	0	18.5	–	56.9		2.18	
8239	1.3	12.4	–	81.5		2.20	
8242	1.4	16.2	–	77.6		2.22	
8247	1.3	16.1	–	95.4		2.23	

ANALYSIS GRAPH



ORE #12

EXPLORATION LOGGING OF AUSTRALIA, INC.

A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

OMPANY ESSO
ELL PRAWN A-1
CATION/FIELD OFFSHORE, OTTWAY BASIN
UNTY ____ STATE TASMANIA
UNTRY AUSTRALIA

DATE MARCH 15, 1968
DEPTH 8697 TO 8727
GEO-ENGINEER WATT, FERGUSON, MACGILL

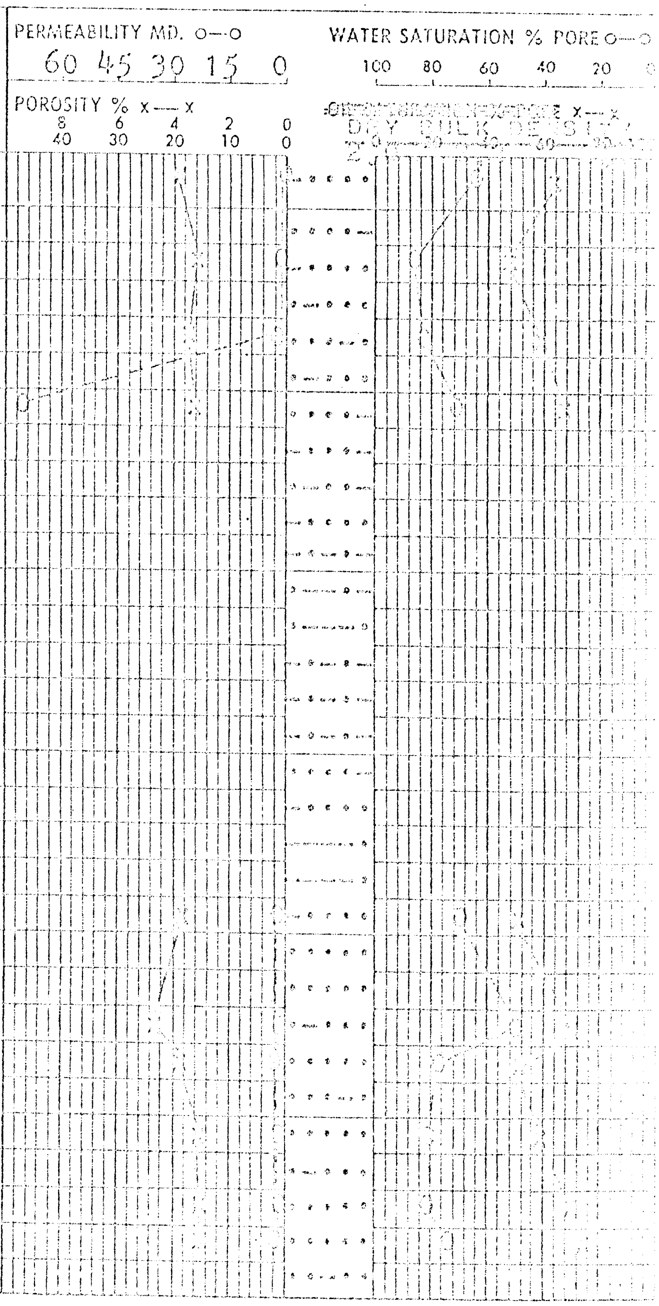
EMARKS CUT 30', RECOVERED 30'- SANDSTONE: LT. EY, FINE-MEDIUM, SUB-ROUND, QUARTZ, CLEAR, CLAYEY, LCAREOUS IN PART, WITH UNEVENLY DISTRIBUTED RBONACEOUS SHALE LAMINAE; FINE CURRENT BEDDING; D BALLS; NO SHOWS

SAND · SILTY SAND · SILTST. · SHALE · LIME · CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME		GRAVITY OIL °API	DRY BULK DENS	REMARKS
			OIL	WATER			
8697	0	17.2	--	74.5		2.32	
98							
99	1.62	16.5	--	86.5		2.24	
8700							
01	1.68	16.9	--	82.0		2.30	
02							
03	67.0	16.2	--	70.0		2.34	
04							
05							
06							
07							
08							
09							
10		SHALEY	INTERVAL				
11							
12							
13							
14							
15							
16							
17	2.12	18.5	--	67.5		2.26	
18							
19							
20	2.05	22.0	--	50.0		2.36	
21.5	1.22	18.3	--	75.0		2.26	
22							
23.5	0	15.9	--	81.0		2.30	
24							
25	0	14.7	--	82.0		2.34	
26.5	0	14.7	--	74.0		2.36	
8727							

ANALYSIS GRAPH



EXPLORATION LOGGING OF AUSTRALIA, INC.
A Geological-Engineering Service

CORE #13

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY ESSO
WELL PRAWN A-1
LOCATION/FIELD OTTWAY BASIN
COUNTY OFFSHORE STATE TASMANIA
COUNTRY AUSTRALIA
REMARKS CUT 5', RECOVERED 4.5' : HARD, BLACK, CARBONACEOUS SILTY SHALE.

NO CORE ANALYSES REQUIRED.

DATE 3/19/68
DEPTH 9289 TO 9294
GEO-ENGINEER MACGILL

SAND	SILTY SAND	SILTST.	SHALE
LIME	CONGL.		

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME OIL	WATER	GRAVITY OIL °API	TOTAL CL⁻ G/G	REMARKS
9289	)						
90	)						
91	) SHALE						
92	)						
93.5	)						

ANALYSIS GRAPH

PERMEABILITY MD. o—o
POROSITY % x—x
8 6 4 2 0
40 30 20 10 0

WATER SATURATION % PORE o—o
100 80 60 40 20 0
OIL SATURATION % PORE x—x
0 20 40 60 80 100

CORE #14

EXPLORATION LOGGING OF AUSTRALIA, INC.
A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY ESSO
WELL PRAWN A-1
LOCATION/FIELD OTWAY BASIN
COUNTY OFFSHORE STATE TASMANIA
COUNTRY AUSTRALIA
REMARKS CUT 23', REC'D. 23':
SANDSTONE: LIGHT GRAY TO GREENISH GRAY, LITHIC (COMPOSED OF QUARTZ, CHERT, & VOLCANIC FRAGMENTS), SUBANGULAR TO ANGULAR WITH MINOR LAMINAE OF CARONACEOUS SHALE.

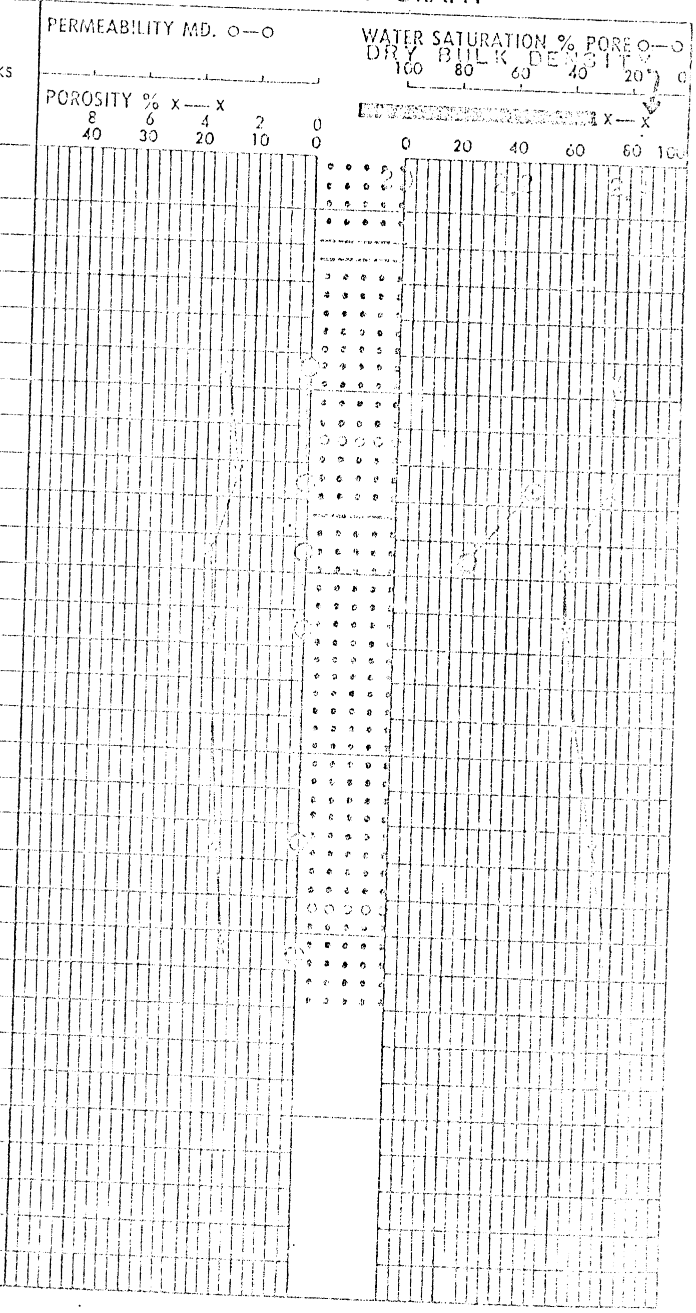
DATE MARCH 25 1968
DEPTH 9850' TO 9873'
GEO-ENGINEER FERGUSON, CLARKE

SAND
SILTY SAND
SILTST.
SHALE
LIME
CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME: OIL	FLUID SATURATION % PORE VOLUME: WATER	GRAVITY OIL °API	DRY BULK DENS.	REMARKS
(9851)							
9856	0	14.3	–	–	–	2.38	
9859	0	12.3	0	53.0	–	2.37	
9861	0	16.8	0	77.0	–	2.30	
9863	0	16.1	–	–	–	2.31	
9869	0	14.8	–	–	–	2.36	
9872	0	13.2	–	–	–	2.39	
(9873)							

ANALYSIS GRAPH



63

CORE #15

EXPLORATION LOGGING OF AUSTRALIA, INC.
A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY ESSO
WELL PRAWN A-1
LOCATION/FIELD OTWAY BASIN
COUNTY OFFSHORE STATE TASMANIA
COUNTRY AUSTRALIA
REMARKS CUT 16', REC'D 16': SANDSTONE & SILTSTONE (14'), MEDIUM-GRAY, VERY HARD & DENSE, WITH CARBONACEOUS PARTINGS, & BLACK SHALE (2'); SOLID DIPS; NO SHOWS; H_2O OF HYDRATION?

DATE 27 MARCH 1968
DEPTH 10,168 TO 10,184
GEO-ENGINEER CLARKE

SAND — SILTY SAND — SILTST. — SHALE — LIME — CONGL.

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME OIL	FLUID SATURATION % PORE VOLUME WATER	GRAVITY OIL °API	DRY BULK DENS.	REMARKS
(10,168)							
--							
--							
--							
--							
--							
10,174	0	0.05	--	--		2.50	
--							
--							
10,177	0	1.30	0	100	--	2.46	
--							
--							
10,180	0	1.15	0	100	--	2.45	
10,181	0	0.05	0	100	--	2.41	FLOUR?
--							
10,183	0	5.51	0	100		2.41	BUBBLES
(10,184)							

ANALYSIS GRAPH

PERMEABILITY MD. o—o
POROSITY % x—x 8 6 4 2 0 / 40 30 20 10 0
WATER SATURATION % PORE o—o 100 80 60 40 20 0
DRY BULK DENS. x—x 0 20 40 60 80 100
2.2 2.4 2.6

CORE #16

EXPLORATION LOGGING OF AUSTRALIA, INC.
A Geological-Engineering Service

PERTH ADDRESS: 69 GREAT EASTERN HIGHWAY, VICTORIA PARK, WESTERN AUSTRALIA
PHONE: 61 4437
CABLE: EXLOGG, PERTH

CORE ANALYSIS REPORT

COMPANY: ESSO
WELL: PRAWN A-1
LOCATION/FIELD: OTWAY BASIN
COUNTY: OFFSHORE STATE: TASMANIA
COUNTRY: AUSTRALIA

DATE: 29 MARCH 1968
DEPTH: 10,450 TO 10,477
GEO-ENGINEER: CLARKE

REMARKS: CUT 27', REC'D 27': VERY HARD & TIGHT, CARBONACEOUS GRAYWACKE; RARE BLACK SHALE & COAL SEAMS; CALCITE VEINLET; HIGH DIPS; NO SHOWS.

SAND
SILTY SAND
SILTST.
SHALE
LIME
CONGL.
COAL

TABULAR DATA

DEPTH FEET	AIR PERM. MD.	POROSITY PERCENT	FLUID SATURATION % PORE VOLUME: OIL	FLUID SATURATION % PORE VOLUME: WATER	GRAVITY OIL °API	DRY BULK DENS	REMARKS
(10,451)							
–							
10,453	0	0.18	–	–		2.84	
–							
–							
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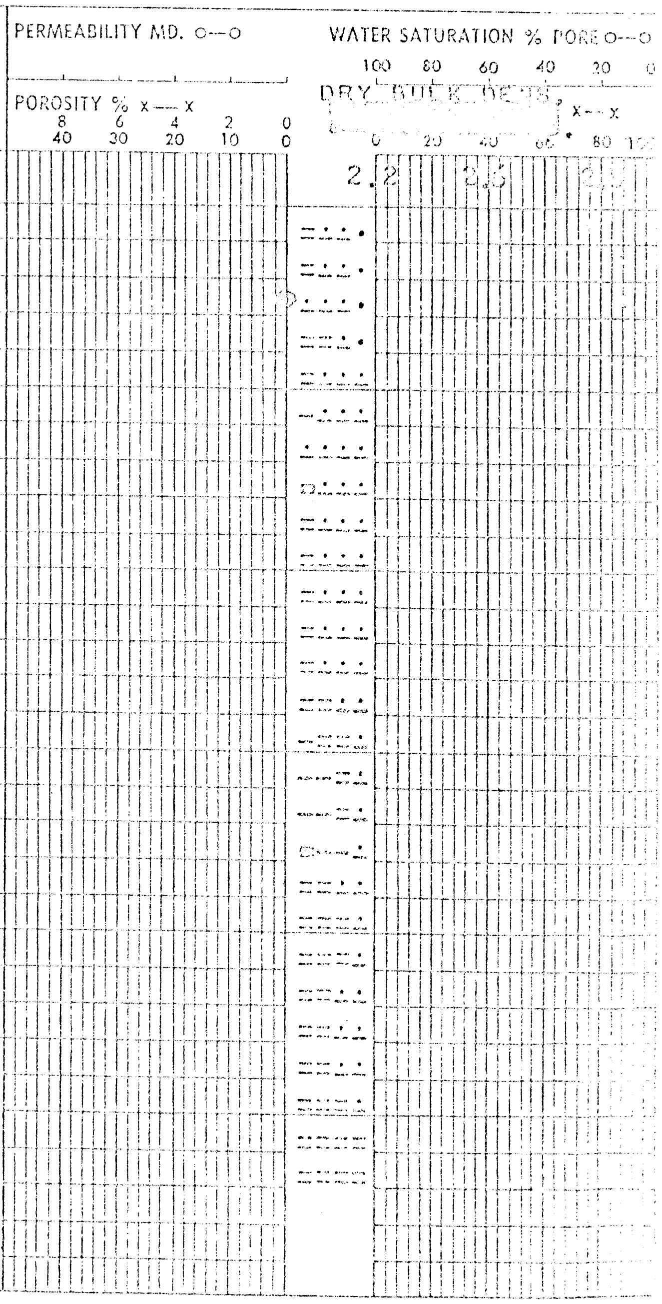
–							
(10,477)							

ANALYSIS GRAPH



7

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

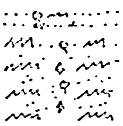
Core No. 2

Note: Core No. 1 3621-3623 No Recovery

WELL: PRAWN A-1

Interval Cored 3938-57 ft., Cut 19 ft., Recovered 3 ft., (15.8 %) Fm.

Bit Type C-14A, Bit Size 7 3/4" in., Desc. by C.K. LUNT Date 9th Feb, 1968.
R.L. Graham

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.) Descriptive Lithology
0 2 4 6 8 10			3938-3938.5 (0.5') SAND: lt. brn. (indiv. sand grs. are tan to milky to clr; silty to m. gr. with occ. crs. gr.; fair sorting; unconsol.; sl. calc.; w/ traces of minute carbon mat'l.
			3938.5-3941 (2.5') SANDY SILTSTONE: dk. brn - black; m. hd; w/ abund. v.f. - med. qtz sand grains (+ siderite?) Occ. isolated lumps of py. (up to 2 cm.) Tr. fossil frags.

REMARKS:

7

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. 3

WELL: PRAWN A-1

Interval Cored 4254 - 84 ft., Cut 30 ft., Recovered 30 ft., (100 %) Fm.

Bit Type C-14-A, Bit Size 7 3/4 in., Desc. by C.K. Lunt Date 10 Feb. 1968

Depth & Coring Rate (min./ft.) 0 2 4 6 8	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
			4254-4260'	6' SILTSTONE: m. dk gry, non calcareous w/widely scattered f- v.crs.- occas. pebble size grains of clear & tan qtz. and lithic grs. Occas. pyrite fillings (up to 4 cm x 1 cm. w/calcareous effervescence in the vicinity of these fillings. Fossil frags (incl. brachiopods ?) widely scattered throughout - occas. pyritized. Thin indistinct silty carb material scattered throughout.
			4260 - 4269	9' SHALE: m. dk gry non calcareous w/occas. pyrite filling (deposites) (1 cm x 1/4 cm max.) w/foss frags as above scattered throughout.
			4269 - 4279	10' SILTSTONE: m. dk gry non-calcareous w/occas. pyrite fillings (deposites) as above; w/ vf-f gr mica widely scattered throughout.
			4279 - 4284	5' SILTSTONE: as above w/ .5 ft. thick transition zones of v. silty vf gr. well sorted m. hd. n.p. SS
				No sedimentary structures

REMARKS:

7

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. 4

WELL: Prawn A-1

Interval Cored 4581-4597 ft., Cut 16 ft., Recovered 9 ft., (55 %) Fm.

Bit Type C-20, Bit Size 7 3/4 in., Desc. by C.K. Lunt Date 11 Feb. 1968

Depth & Coring Rate (min./ft.) 0 1 2 3 4	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
			4581'-4581'3"	3" SANDSTONE: lt gry vf-m gr. v. hd. well sorted n.p. v. calcareous - composed of subround-rounded qtz grs. Abund biotite, pyrite - some chlorite
			4581'3"-4586'9"	5'9" SANDSTONE: m dk brnish grn gry, silty, vf-f gr. m. soft (friable) porous, subrounded-rounded non calcareous.
			4586'9"-4588'3"	1'3" SANDSTONE: as in interval 4581-4581'3"
			4588'3"-4590'	1'9" SANDSTONE: as in interval 4581'3"-4586'9"

REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

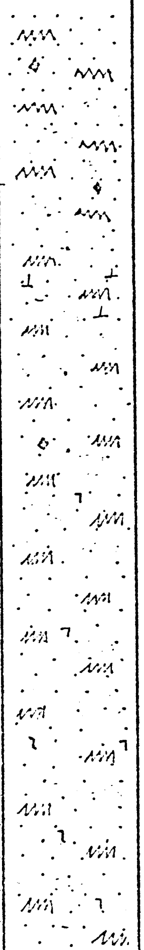
CORE DESCRIPTION

Core No. 5

WELL: Prawn A-1

Interval Cored 4935-4962 ft., Cut 28 ft., Recovered 27 ft., (96 %) Fm.

Bit Type C-20, Bit Size 7 3/4 in., Desc. by C.K. Lunt Date 12 Feb 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 1 2 3 4			4935-4941.5'	6.5' SANDSTONE: m grn-gry, v. slty, vf - v. crs gr., non calcareous - composed of qtz: cl - lt gry - wh. w/ chlorite, pyrite - contortedly interbedded w/ reworked SILTSTONE (comprising 50% of interval) and zones of vf-f gr v. slty SANDSTONE as above
			4941.5-4944'	2.5' SILTY SANDSTONE: m. dk gry (m. grn-gry in less silty zones) v. f gr. w/ small lenses m. gry SILTSTONE as above. Entire interval reworked
			~~4944~~-4945.5'	1.5' SANDSTONE: m grn gry, slty vf - f gr. finely bedded, calcareous - w/ several pebble sized lumps gry MUDSTONE at base of interval
			4945.5-4948.5'	3' SANDSTONE: as above interbedded w/ m gry SILTSTONE as above
			4948.5-4962'	13.5' SANDSTONE: lt gry v. silty vf gr non calc. w/ mica widely scattered throughout - contorted bedding throughout - evidence of burrowing.

REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

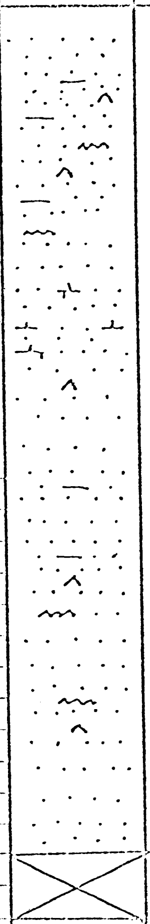
CORE DESCRIPTION

Core No. 6

WELL: Prawn A-1

Interval Cored 5621-5649 ft., Cut 28 ft., Recovered 26 ft., (93 %) Fm. U. Cret. ?

Bit Type C-20 , Bit Size 8 5/16 in., Desc. by Culp & Whittle Date 14, Feb. 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 5631			5621-5629	Sandstone - dark gray to green, poorly sorted, consists of approximately 50% quartz and 50% lithic grains, medium to very coarse grained with some grains pebble size, qtz. grains are subangular to subrounded, lithic grains predominantly siliceous and angular but scattered coarse grains of dark gray - black basic minerals are also present. Very shaly, pyritic and slightly carbonaceous, silty, firm to friable, porous.
			5629-5631	Sandstone - light gray, fine - coarse-grained, hard, very to slightly calcareous, about 50% quartz and 50% lithics (siliceous)
			5631-5647	Sandstone - like 5621 - 5629
			5647-5649	No Recovery

REMARKS: No oil fluorescence or cut.

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. 7

WELL: Prawn A-1

Interval Cored 6145-6155 ft., Cut 10 ft., Recovered 4 ft., (40 %) Fm. Otway ?

Bit Type C-20, Bit Size 8 5/16 in., Desc. by Culp & Whittle Date 16 Feb. 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 6145 / 6149 / 6155			6145-6149	Sandstone - quartzose to sublithic, light gray; quartz grains are clear to white and lithic grains are siliceous, yellow to light gray. Sandstone is fine to very coarse-grained with occasional laminae of granule to pebble-sized grains. Shaly; occasional thin parallel laminae of dark gray to black carbonaceous mudstone present; scattered inclusions of mudstone also occurs. slightly pyritic, carbonaceous and micaceous; Graded bedding present, mudstone lamina in contact with pebble-granule sand grains exhibits "Turbid" characteristics. Subangular to subrounded grains. Siliceous cement present. Sandstone grades from friable to hard. Some good porosity and permeability present.
			6149-6155	No Recovery

REMARKS: No oil fluorescence or cut present.

ESSO STANDARD OIL (AUSTRALIA) LTD.

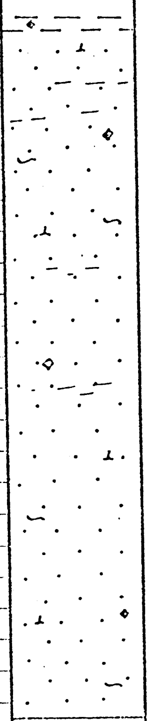
CORE DESCRIPTION

Core No. 8

WELL: PRAWN A-1

Interval Cored 6651-6677 ft., Cut 26 ft., Recovered 22½ ft., (86 %) Fm.

Bit Type C-31, Bit Size 8 5/16 in., Desc. by C.K. Lunt Date 5 March 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 1 2 3 4				
			6651 - 51.5	.5' SHALE: m. gry, non calc. w/ fine lenses and fine laminations of ss: lt. gry, v.f.g. glauconitic, w/ trace pyrite accumulation.
			6651.5 - 54.5	3' SANDSTONE: lt. gry, v. porous v.f. - f.g. w/ occas. m.g. s.a. - s.r. well sorted, v. sli. calc. - consisting of qtz. grains w/ approx. 10% feldspar w/ 5-10% interstitial kaolinite - v.f. grains of shaly carbonaceous material scattered throughout. Frequent laminae carbonaceous shale. Glauconitic, occas small accumulations of pyrite.
			6654.5 - 70	15.5' SANDSTONE: as above w/ occas. crs. - pebble grain size. Occas. v. thin laminae carb. shaly material, occas rust red chert.
			6670 - 71.5	1.5' SANDSTONE: as above w/ m - crs. fraction increasing - fair sorting, < 10% interstitial kaolinite.
			6671.5 - 73.5	2' SANDSTONE: as above but v.f. - f.g. non porous - sli. porous w/ 10 - 20% wh. kaolinitic clay material

REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

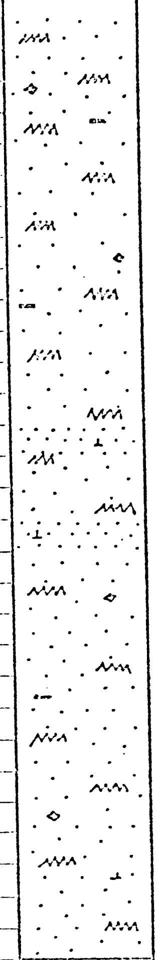
CORE DESCRIPTION

Core No. 9

WELL: PRAWN A-1

Interval Cored 7147 - 77 ft., Cut 30 ft., Recovered 30 ft., (100 %) Fm.

Bit Type C-31, Bit Size 8 5/16 in., Desc. by C.M. Lunt Date 6 March 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 3 6 9 12				
			7147-60.5'	13.5' 80% SILTSTONE: m. gry. slt.-v.f.g. hd. noncalc. micaceous (biotite) w/occas. pyrite accumulations. 20% SANDSTONE: lt. gry. v.f.-f.g., sa.-sr., non porous, well sorted calcareous. Consists of 90% qtz, 10% feldspar, glauconitic, sli carbonaceous w/tr. pyrite. SILTSTONE & SANDSTONE interbedded throughout section. Contorted bedding evidence of burrowing - near shore deposit
			7160.5-61.5'	1' SANDSTONE: lt. gry. non porous as above. vf.-f.g. sa.-sr. v. calc. w/parallel laminations of v.f. and f. grain sizes.
			7161.5-63.5'	2' as in interval 7147-60.5'
			7163.5-65.5'	2' as in interval 7160.5-61.5'
			7165.5-77'	11.5' as in interval 7165.5-63.5'

REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

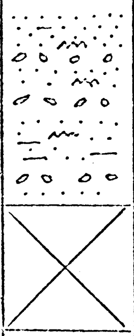
CORE DESCRIPTION

Core No. 10

WELL: Prawn A-1

Interval Cored 7684-7694 ft., Cut 10 ft., Recovered 6 ft., (60 %) Fm. Otway ?

Bit Type C-31, Bit Size 8 5/16 in., Desc. by B.L. Culp Date 7 March 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 7684			7684'-7685'	Sand - quartz, brown to light gray, friable, coarse to very coarse-grained, clay matrix, subangular to subrounded, very thin laminations of dark gray carbonaceous shale present, occasional chert grains, good porosity and permeability.
7690			7685'-7685½'	Sandstone - quartz, light gray, silty to fine-grained, dense clay matrix, very thin laminations of black carbonaceous shale, with very thin bed of quartz and chert pebble conglomerate at base.
7694			7685½'-7690'	Sandstone - like above but medium to coarse-grained becoming silty and fine-grained at base. Thin bed of black carbonaceous shale inclusions at 7689 feet
			7690-7694	No Recovery

REMARKS: No oil fluorescence or cut present.

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. 11

WELL: Prawn A-1

Interval Cored 8217-8247 ft., Cut 30 ft., Recovered 30 ft., (100 %) Fm. Otway

Bit Type C-20, Bit Size 8 5/16 in., Desc. by B.L. Culp Date March 13, 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
8217 – 8247			8217-8247	Sandstone – quart to sublithic, light gray, very fine to fine-grained, subangular, dense clay matrix which is occasionally slightly calcareous, micaceous and slightly carbonaceous, slightly chloritic with some glauconite present. Contains scattered very thin laminae of black shale and occasional shale "lumps". "Resinous" particles are present in the shale as flakes which have a brilliant silver-blue fluorescence. These very thin shales are carbonaceous and micaceous. Bedding is parallel. The entire interval is silty and hard. The porosity and permeability are probably poor to fair.

REMARKS: No oil fluorescence or cut occurs in the core.

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

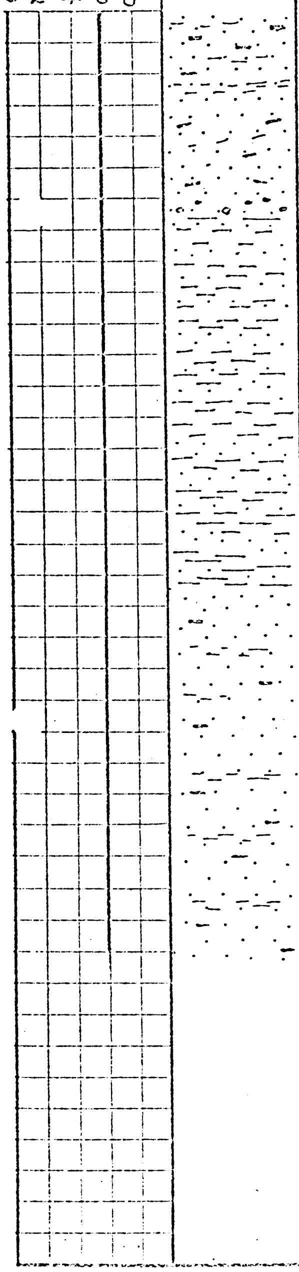
Core No. 12

WELL: PRAWN A-1

Interval Cored 8697-8727 ft., Cut 30 ft., Recovered 30 ft., (100 %) Fm. L. Cret.

Bit Type C-20, Bit Size 8 5/16 in., Desc. by C.K. LUNT Date 16 MAR. 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 2 4 6 8				
			8697-98.5'	1.5' SANDSTONE: lt. gry., n.p. v.f-f w/occas. m.g. well sorted, hd. composed of 90% qtz., 10% fald. w/ 20-25% clay matrix, w/freq. fine lam of carb. mat. and laminations of shale: m.gry. hd. non calc. traces pyrite, chlorite, red & gry. chert
			8698.5-8702'	3.5' SANDSTONE: as above w/v.f.-v. crs. g. size in lower 3" of the upper ft. accomp. by abund. cm. sized frags of shale. Thin parallel lam. coaly material dipping 10° scattered throughout.
			8702.-03'	1' SANDSTONE: lt. gry., n.p., vf-pebble size, fair sorting, ang.-sub round. Composition as above w/several 2-3 cm thick contorted stringers of coaly material
			8703-03.5'	.5' CONGLOMERATE: fragments of m.gry., cm. size, ang. non calc. shale and m.gry.-brn. rounded balls, non calc mudstone in v.f-f.g. ss. w/ comp. as above.
			8703.5-15.5'	12' SHALE: m.gry., hd., non calc. carb. w/occas. cm size frags of amber, w/mica. Finely lam. and interbedded w/ v.f-f.g. ss. as above.
			8715.5-27'	11.5' SANDSTONE: as in interval 8697-98.5'



REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. 13

WELL: PRAWN A-1

Interval Cored 9289 - ~~93.5~~ 94 ft., Cut 5 ft., Recovered 4.5 ft., (90 %) Fm. L. Cret.

Bit Type C-8, Bit Size 8 5/16 in., Desc. by C.K. Lunt Date 18 Mar. 1968

Depth & Coring Rate (min./ft.) 0 10 20 30 40	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
			9289-93.5	4.5' SHALE: dk. gry. hd., brittle w/abund carbonized plant remains and occas. small inclusions of coal up to 4 mm., non calcareous except in immed. vicinity of inclusions. Occasional thin somewhat contorted laminae of lt. gry. shale.

REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

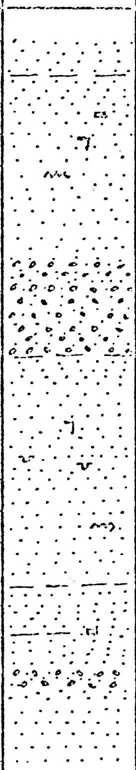
CORE DESCRIPTION

Core No. 14

WELL: Prawn A-1

Interval Cored 9850-9873 ft., Cut 23 ft., Recovered 23 ft., (100 %) Fm. Otway

Bit Type C-8, Bit Size 8 5/16 in., Desc. by B. L. Culp Date March 24, 1968

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 9850 … 9873			9850-9873	Sandstone - lithic (composed of quartz, chert and volcanic rock fragments), light gray to greenish gray, predominantly silty to fine-grained, subangular to angular, dense clay matrix, siliceous to calcareous cement, very hard, slightly micaceous and carbonaceous. Contains conglomeratic zones of siliceous and volcanic pebbles which are subrounded to rounded in a sandstone matrix. Scattered thin continuous and discontinuous very thin laminae of dark gray to black hard carbonaceous shale are present with a rare very thin lamina of coal. The sandstone exhibits faint to fair laminae of alternating very fine and fine-grained sand. Occasional burrowing is present. The upper 3 feet of the core exhibits slickensides inclined at more than 45 degrees on broken surface. The entire core appears to have very low porosity and poor to negligible permeability.

REMARKS: No oil fluorescence or cut observed.

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. 15

WELL: Prawn A-1.

Interval Cored 10168-10184 ft., Cut 16' ft., Recovered 16' ft., (100%) Fm. Otway ?

Bit Type C-8, Bit Size 8 5/16 in., Desc. by E.A. James Date March 27/68

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0	10168 – 10179	V. Poor Porosity and Perm. No fluor. or cut.		Sandstone, lithic, medium grained, green cast overall becoming grey on drying, 70-80% cream & white underlain & 30-20% brown grey; Abundant carbonaceous remains with 3-5% carbonaceous remains (pebbles) interspersed in the s.s. Rest is quartzose with tr mica and glauconite. 3 or 4 very minor popping zones - in this section of core and 1 very minor popping zone on shale break below. This s.s. becomes finer towards base. One bed at 10171 has so many carbonaceous chunks it is a conglomerate.
	10179 – 10184'	Nil Porosity Perm No fluor. or cut.		Alternating fine ss. as above with grey shale, Last 4' has high angle beds and core is shattered along bedding planes. Some current ripple marks at 10179

REMARKS:

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

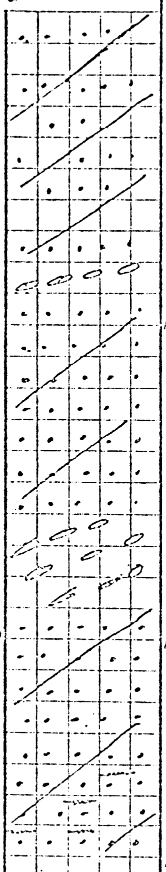
Core No. 16

WELL: PRAWN A-1

Interval Cored 10450-10477 ft., Cut 27 ft., Recovered 27 ft., (100+ %) Fm. OTWAY

Bit Type C-8, Bit Size 8 5/8 in., Desc. by E. A. James Date MARCH 30/68

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0	10450			S.S. lithic, quartzose & up to 20% black rounded carbonaceous grains, med. gr., non calcareous; greenish cast on core to white sand with black specks; No fluorescence; 2 or 3 traces of bleeding (popping). No cut stain and no cut. Very poor to nil φ and perm. Very high bedding dips, up to 30°. Three slickensides. Shale pebbles 10458-10459 and 10466-10469. Last 3' of core is more silty and a greywacke.
10	10460			
20	10470			
27	10477 END of core			



REMARKS:

Appendix (4)

SIDEWALL CORE DESCRIPTIONS

SIDEWALL CORE DESCRIPTIONS RUN 2

No. 1 10263' Rec. ½"

Silty sandstone: greenish grey, friable, 20% very slightly calcareous whitish cement?/matrix?, tight, silty to fine grained, quartz, lithic and chlorite grains, angular to subangular. No odour, no fluorescence, no staining, no cut.

No. 2 10262' Rec. 3/4"

As for No. 1.

No. 3 9805 Rec. ½"

Sandstone: whitish grey, friable, 30% calcareous cement, tight, silty to coarse grained, lithic (dark grains - siliceous) and quartzose grains, angular to subround, poorly sorted. No odour, no fluorescence, no staining, no cut.

No. 4 9804' Rec. ½"

As for No. 3 with increase in dark lithic fragments (siliceous?) mafic?
No odour, no fluorescence, no staining, no cut.

No. 5 9685' Rec. ½"

Sandstone: whitish grey, friable, 20% slightly calcareous cement (matrix?), tight, very fine to medium grained, lithic and quartzose grains (as above), angular to subround, poorly sorted.
No odour, no fluorescence, no staining, no cut.

No. 6 9684' Rec. ½"

Sandstone: greenish grey, friable, 20% calcareous cement, tight very fine to medium grained, lithic, quartz, feldspar?, mafic and chloritic? grains, rounded to sub angular, poorly sorted.
No odour, no fluorescence, no staining, no cut.

No. 7 9562' Rec. 1"

Sandstone: whitish grey, friable, 30% very slightly calcareous cement and matrix, tight, very fine to coarse grained with occasional pebble sized angular quartz grains, lithic, quartz, feldspar? mafic? chloritic?, grains, subrounded to subangular, poorly sorted.
No odour, no fluorescence, no staining, no cut.

No. 8 9561' Rec. 1-3/4"

Clay: pale grey, non calcareous, compacted, moderately hard. No. odour, no fluorescence, no staining, no cut.

No. 9 9560' Rec. 3/4"

Silty claystone: grey, firm, medium hard, very slightly calcareous, tight, carbonaceous.
No odour, no fluorescence, no stain, slight yellow cut, (possibly contamination).

No. 10 9560' Rec. 1"

As for No. 13 with calcareous material (possibly fracture fillings).
No odour, no fluorescence, no stain, no cut.

No. 11 9557.5' Rec. ½"

Sandstone: grey, friable, 20% calcareous white cement, tight, very fine to medium grained, with occasional coarse grain, quartz, lithic, and feldspar grains, angular to sub angular, poorly sorted.
No odour, no fluorescence, no staining, no cut.

No. 12 9556 Rec. ½"

Sandstone: greenish grey with white flecks, friable, 35% calcareous cement, tight, coarse to very coarse grained, angular to subangular siliceous grains, poorly sorted. No odour, no fluorescence, no staining, no cut.

No. 13 9555 Rec. ½"

Silty sandstone: grey, friable, 20% slightly calcareous white cement, tight, silty to very fine grained, quartz and lithic grains, angular, to subangular, fair sorting.
No odour, no fluorescence, no staining, no cut.

No. 14 9553' Rec. 3/4"

Conglomerate: grey, friable, 20% calcareous cement, tight, very fine to pebble sized grains, quartz, siliceous pebbles and some lithics, angular to rounded, very poorly sorted.
No odour, no fluorescence, no stain, no cut.

No. 15 9552 Rec. 1"

Conglomerate: grey, friable, 20% calcareous cement and kaolinitic? matrix, tight, clay to pebble sized grains, quartz and dark siliceous grains, angular to rounded, very poorly sorted.
No odour, no fluorescence, no staining, bright yellow cut probably due to contamination.

No. 16 9551 Rec. 3/4"

Conglomerate: greenish grey, friable, 20% calcareous cement, tight, silt to pebble size grains, fine grained, quartz with lithics to pebble size, angular to rounded, very poorly sorted. Evidence of slickensiding and fracturing. Fractures filled with calcareous material.
No odour, no fluorescence, no staining, no cut.

No. 17 9365 Rec. 3/4"

Siltstone: grey, friable, white, very slightly calcareous cement or matrix material (15), clay to fine grained sand sized grains, quartz and lithics, poorly sorted.
No odour, no fluorescence, no stain, slowly developing slight yellow cut.

No. 18 9364 Rec. ½"

Shale: dark grey-brown, medium hard, low fissility, silty, carbonaceous. No odour, no fluorescence, no staining, no cut.

No. 19 9265 Rec. ½"

Shale: dark grey, dense, low fissility, carbonaceous, no odour, scattered mineral fluorescence (amber?), no staining no cut.

No. 20 9139' Rec. ½"

Sandstone: pale grey, hard, 20% slightly calcareous cement, tight, fine-medium grained, mainly clear quartz with occasional lithic grains, angular to subangular, poor sorting. No odour, no fluorescence, no stain, no cut.

No. 21 8955 Rec. 3/4"

Sandstone: white, friable, very slightly calcareous, porosity fair, silt to fine grained, clear quartz with occasional lithic grain, angular, poorly sorted. No odour, no fluorescence, no stain, no cut.

No. 22 8954' Rec. ¼"

Sandstone: white, friable, very slightly calcareous, tight, fine-medium grained, mainly clear quartz with occasional lithic grains, angular to subangular, poor sorting, no odour. No fluorescence, no staining, no cut.

No. 23 8557' Rec. 1"

Contact between: Sandstone: grey, fairly porous, medium hard, fine - medium grained, mainly clear quartz with lithics angular-subangular, poorly sorted, no odour, no fluorescence, no stain, no cut. Shale: dark brown, finely laminated, non calcareous, medium hard. No odour, no fluorescence, no stain, no cut.

No. 24 8307' Rec. 1½"

Shale: dark brown, hard, carbonaceous, non calcareous No odour, no fluorescence, no stain, no cut.

No. 25 8187' Rec. 1"

Sand, quartz grains in dense clay matrix, (felspathic), very silty, very slightly calcareous, no fluorescence.

No. 26 8184' Rec. ¼"

Sand, friable, silty, very fine grained, slightly calcareous, no fluorescence.

No. 27 8147' Rec. ½"

Sand, calcareous, but friable, quartz and siliceous grains in calcareous clayey matrix, minor fluorescence.

No. 28 8067' Rec. 3/4"

Sand, fine grained, slightly calcareous, dense clay matrix, white to light grey, soft.

No. 29 8050 rec. ½"

Sand, very shaley, badly contaminated, with mud cake.

No. 30 8040' Rec. ¼"

Sandstone, fine-medium grained, occasionallight grey quartz, predominantly quartz, clay matrix, no fluorescence, hard.

No. 31 7984' Rec. ½"

Sand, quartz, silty and fine grained, dense clay matrix, scattered with dark minerals, soft, very slightly calcareous, no fluorescence.

No. 32 7970" Rec. ½"

Sand, very silty, very fine grained, very carbonaceous, soft (carbonaceous, very thin laminae through out sand), no fluorescence.

No.33 7968' Rec. ¼"

Shale, dark grey, soft, silty

No. 34 7820' Rec. 1"

Sand, fine grained, silty, quartz, dense clay matrix, slightly calcareous, friable, no fluorescence.

No. 35 7758' Rec. ½' frag.

Sandstone, very carbonaceous, dark grey, fine grained quartz in clay matrix, no fluorescence

No. 36 7756' Rec. 1¼"

Sandstone, white to light grey, medium-grained, high percentage dark grey siliceous minerals, occasional coarse grained quartz, subangular no fluoresence.

No. 37 7652' Rec. 1¼"

Sand, quartz, fine-coarse, grained, subangular clay matrix, occasional very coarse grains of siliceous material, no fluorescence.

No. 38 7650 Rec. ½'

Sandstone, very fine to fine grained, feldspathic, friable, light grey, pyritic, chlorite, or glauconite, non calcareous.

No. 39 7514' Rec. ½'

Sand, very friable, quartz, subangular, clay matrix, medium-coarse grained, very slightly calcareous, no fluorescence.

No. 40 7508 frag.

No. 41 7508 frag.

Sand medium-coarse grained, quartz, subangular, very friable.

No. 42 7484 Rec. 1¼"

Sand, light grey, silty and very fine grained, soft, clay matrix, no fluorescence.

No. 43 7468' Rec. ½"

Shale, very dark grey, very sandy, very silty.

No. 44 7455 Frag.

Shale, soft, dark grey to black

No. 45 7398 frag.

Sandstone, fine grained, friable, porous, but silty, light grey, shaley streaks, no fluorescence.

No. 46 7386' Rec. 1"

Sandstone, quartz, dense clay matrix subangular, very shaley, silty fine grained, no fluorescence.

No. 47 7384' Rec. 1½"

Sand, light grey, quartz, fine grained, clay matrix, occasional very coarse grained, subangular-subrounded.

No. 48 7372 Rec. 3/4"

Sand, light grey, silty, very fine grained, clay matrix, paper thin dark shale laminae, carbonaceous.

No. 49 7360 Rec. ¼"

Sand, badly fragmented

No. 50 7350' Rec. 1½"

Sand, white to light grey, quartz, fine grained clay matrix, sub-angular, shale, laminae on one side, sand friable to firm, no fluorescence.

No. 51 7348' Rec. ½"

Shale, dark grey, very silty, carbonaceous, brittle

No. 52 7338 N.R.

N.R.

No. 53 7342' Fragments

Shale as above

No. 54 7332 Rec. ¼"

Shale, soft, slightly silty

No. 55 7310

Shale, hard, dark grey to black

No. 56 7300. Rec. 3/4"

Sand, silty-fine grained, white to light grey, very calcareous, glauconitic, or chloritic, abundant quartz grains, very abundant green mineral.

No. 57 7298 Rec. 1"

Sandstone, grey to light green, fine grained, abundant green mineral, (glauconite or chlorite), subangular, ferruginous stain, micaceous, calcareous matrix.

No. 58 7278. Rec. 1 3/4"

Shale, soft-firm, non calcareous

No. 59 7253' Rec. 1 3/4"

Sand, calcareous, firm, quartz grains, calcareous matrix, silty, fine grained, dull even yellow fluorescence (very pale, mineral fluorescence) no cut.

No. 60 7240' Rec. 1"

Shale, dark grey, silty, slightly carbonaceous, non calcareous.

No. 61 7220' Rec. 1"

Shale, as above

No. 62 7104' Rec. 1¼"

Sand, very fine grained, silty, quartz, clay matrix, shale inclusion present (dark grey).

No. 63 7096' N.R.

N.R.

No. 64 7088' Rec. 1"

Sand, fine grained, to very fine grained, quartz, carbonaceous, light grey.

No. 65 7082' Rec. 1"

No. 66 7060 Rec. 1¼"

Mudstone, light grey, sticky

No. 67 7056 Rec. ½"

Mudstone; grey, carbonaceous, thin laminae of very fine grained quartz sand, no fluorescence.

No. 68 6548' Rec. 1¼"

Shale, dark grey.

No. 69 6547' Rec. ½"

Mudstone, dark grey, soft

No. 70 6487' Rec. 1¼"

Mudstone, as last above

No. 71 6484' Rec. ½"

Shale, dark grey to black, sticky

No. 72 6096' Rec. 3"

Shale as above

No. 73 6094 Rec. 1"

Mudstone, with thin very fine grained sand laminae, dark grey

No. 74 5902 N.R.

N.R.

No. 75 5900 N.R.

N.R.

No. 76 5579' Rec. 1 1/3"

Sand, quartz, light grey, very fine to fine grained, firm but friable

No. 77 5516 Rec. 1½"

Sand, light grey, silty, very fine grained, very shaley, very slightly calcareous, no fluorescence.

No. 78 5298 Rec. ½"

Sandstone, light grey, very silty, possibly porous, very calcareous, very fine-fine grained, moderately hard composed of quartz grains with chlorite - abundant pyrite, calcareous cement 15-20%.

No. 79 4882' Rec. 1 3/4"

Sandstone, medium grey, very silty, slightly porous, non calcareous, very fine to medium grain, angular-subrounded, moderately hard, composed of clear to light yellow quartz, traces of chlorite, traces of dark micaceous.

No. 80 4874 Rec. 1"

Sandstone, white, very silty, non porous, very calcareous, very fine-coarse, angular-subangular, medium soft, composed of 50% quartz grains and 50% silt and finely granular calcareous material.

No. 81 4855 Rec. 1 3/4"

Mudstone, very silty and sandy, dark grey, appears slightly calcareous.

No. 82 4334 Rec. 1"

Sandstone, medium grey, very silty, slightly porous, non-calcareous, very fine-medium grain, angular-subrounded, medium hard, composed of clear to light yellow quartz, traces of chlorite, traces of dark micaceous.

No. 83 4145' Rec. 1 3/4"

Sandstone, medium green-grey, silty, porous, non-calcareous, very fine to fine grain, subangular-subrounded, soft, composed of quartz, slight traces of glauconite and pyrite.

No. 84 4136' Rec. 1¼"

Sandstone, very silty, medium dark green-grey, non-porous, non calcareous, very fine to fine with occasional coarse grains, subangular-subrounded, medium hard, composed of quartz.

No. 85 4126' Rec. 1"

Sandy mudstone, dark grey, non-porous, non-calcareous, with coarse to large pebbles of red chert.

No. 86 4120' Rec. 1"

Sandy mudstone as for 4126 but deep red brown in colour (rust) with numerous limonite goethite pellets, medium-coarse grains, frequently stained quartz fine to pebble size.

No. 87 3964' Rec. 1½"

Silty conglomerate, soft, very dark brown to black with limonite goethite as above and abundant stained (brown) quartz pebbles.

No. 88 3960' Rec. 1"

Silty conglomerate, very dark brown with some lighter coloured pebbles. Abundant stained (brown) rounded quartz pebbles and yellow claystone pebbles - minor limonite - goethite pellets as above, silty fraction is non-calcareous.

No. 89 3893' Rec. 1¼"

Silty sandstone, very dark brown, non-porous, non-calcareous, about 40% silt and 60% very fine to fine (occasionally medium) clear and yellow quartz grains with glauconite sub-angular-subrounded, well sorted, round fractions medium soft.

No. 90 3746' Rec. 1"

Silty sandstone, same as for No. 21 with about 70% clear quartz (occasionally milky grains) with glauconite and occasionally limonite-goethite pellets. Grain size fine to medium, occasionally coarse.

No. 91 3680' Rec. 3/4"

As for No. 22, grain size fine to coarse, occasionally very coarse

No. 92 3465' Rec. 1"

As for No. 22 and No. 23, grainage very fine to medium mainly with occasional pebble grain, pellets are fine.

No. 93 3426' Rec. ¼"

Sandstone, light tan and porous, slightly calcareous, very fine to coarse, poorly sorted, subangular0subrounded, soft friable, composed of clear to light tan quartz grains, occasionally fine to medium light reddish brown chert.

No. 94 3310 Rec. ½"

Sandstone, light tan, very porous, slightly calcareous, poorly sorted, subangular-subrounded, soft friable, composed of clear to light tan quartz grains, abundant fine fragments of grey claystone.

No. 95 3204' Rec. ¼"

Sandstone, light tan, very porous, slightly calcareous, very fine to medium, occasionally coarse, poorly sorted, subangular-subrounded, soft friable, composed of clear to light tan quartz, grains, abundant fine fragments of grey claystone.

No. 96 3038' ½"

Sandstone, dark brown, grey, silty, fairly porous, slightly calcareous, very fine to pebble sized, subangular-subrounded, soft friable, composed of clear to medium yellow brown stained quartz grains.

No. 97 3030' 3/4"

Sandstone, dark brown grey, silty, possibly porous, slightly calcareous, very fine to pebble sized, subangular-subrounded, soft friable, composed of clear to medium yellow brown stained quartz grains.

No. 98 2770' Rec. 2"

Marl, olive grey, very clayey, firm-medium soft with minute trace chalky material.

No. 99 2764' Rec. 2"

Marl, olive grey, veryclayey, greasy texture, medium soft with frequent poorly preserved fossiliferous fragments (bryozoans)

No. 100 2510' Rec. 1"

Marl, olive grey, very clayey, medium soft, with frequent fairly preserved bryozoans, glauconitic

No. 101 2508' Rec. 1½"

Marl, olive grey, very clayey, medium soft, with frequent fairly preserved bryozoans, glauconitic.

No. 102 2460' Rec. 2"

Calcarenite: tan silt fine grained, medium soft, with glauconitic (very fine-fine grained) silt size particles 25%, very little residue after immersion in acid.

No. 103 2440' Rec. 1 3/4"

Calcarenite: tan with coatings of bright rust red-brown in some grains, very fine-medium grained, hard, composed of calcite grains (some identifiable as fossil fragments), abundant, very fine dark brown grains, subrounded-rounded, very soft (clay pellets?)

No. 104 2420' Rec. 2"

Calcarenite, deep rust red brown throughout, otherwise as above.

No. 105 2412 Rec. 1½"

Marl, medium dark grey, clayey, medium soft, glauconitic, (glauconitic grains very fine-fine), with abundant small forams and bryozoan fragments.

No. 106 2225' Rec. 2"

Marl, medium dark grey, very clayey medium soft, greasy texture with abundant fossiliferous fragments as above.

No. 107 2016' Rec. 1½"

Marl, medium dark grey, very clayey, medium soft with abundant fossiliferous fragments.

No. 108 2008 Rec. 2"

Marl, as above

No. 109 1815' Rec. 2"

Marl: Medium light green grey, medium soft-medium hard, clayey, very fossiliferous (forams, bryozoans).

No. 110 1620' Rec. 2"

Marl: light green-grey, medium soft, greasy, clayey with abundant fossiliferous fragments, mainly bryozoans and forams

No. 11 1424' Rec. 1 3/4"

Marl: as above

No. 112 1424' Rec. 2"

Marl: silt sized grains, light grey, medium soft - medium hard, fossiliferous

No. 113 1420' Rec. 2"

Marl silty as above

No. 114 1288' Rec. 2"

Silty marl: light grey, soft, very few fossiliferous fragments.

No. 115 1286' Rec. 2"

Silty marl: as above

No. 116 1090' Rec. 2"

Silty marl: as above with occasional fossiliferous fragments

No. 117 955' Rec. 2"

Silty marl: light grey, very soft, (firm) as above

Appendix (5)

ELECTRICAL LOG INTERPRETATION

AND

VELOCITY SURVEY SUMMARY

VELOCITY SURVEY

Well ....PRAWN A-1..................

Basin ....OTWAY BASIN..................

INTRODUCTION

Esso personnel ....R.J. Steele, P. Birmingham....................

Contractor ....UNITED GEOPHYSICAL..........................

Supplied (1) Instruments

(2) Personnel

Seismic Observer H. Van Willigen

Marine Shooter ..L. Moore....

(3) Licenced Shooting Boat

name ....Wendy Maree....

date loaded ....

date released ..9/3/68..........

Agent .....A. Olsen..................

....Desma Engineering.........

amount of powder ......415....lbs

size of cans ....16-2/3 lbs.

number of cans ......25......

number of caps ......25......

number of boosters ...25......

Personnel and Instruments

assembled at .....Melbourne...... date 9/3/68.....

boarded (rig) Ocean Digger....... date 9/3/68.....

date of survey ......9/3/68.........

casing depth ....2680'..........

T.D. when shot 8200'.................. FTD ....

water depth ......354'..............

SURVEY PROCEDURE

Weather: sea ...Slight-Moderate..................

rig movement ......Nil....................

rig noise ....Nil....................

Hydrophones: number ....2..................

depth below sea level ......10............ft

position adjacent to riser (10'S)..........

....

Shot Positioning and Charges:

marker buoys (number ....2............

(distance ......1000.......

(direction .....N.&.S.......

charge depth ....5....ft

number of shots .5.......charge size...16-2/3 ..lbs.

number of shots .10......charge size...33-1/3 ..lbs.

number of misfires ......0..............

amount of powder used ......416..........lbs amount of powder dumped ....-.....lbs.

Well-phone positioning :

T-bar ....Not used...........

number of depths ...6.................

Time: first shot ....1500...............

last shot ....1710...............

rig time ....3 hours............

RESULTS

Quality of records (good ....10..........
(fair ....4..........
(poor ....-
(not used ....-..........

Comparison of Interval Times with sonic log
/△/average ....1..............microsec/foot
/△max/ ..5/vertical hole formula microsec/foot

CONCLUSION

Reliability of T-D curve Fair/good.................

COMMENTS:

1. The abnormal variations in the direct travel times between shots from opposite sides of the well suggest that the hole is slightly deviated. The results were used in a deviated hole formula and velocities were found to be essentially the same as those calculated for an average of the two times.
2. The Sonic log (Run 1) was found to be in error.

Company	Well	Elevation Derrick Floor	Total Depth	Coordinates	Section, Township, Range	County	Area or Field
ESSO EXPLORATION AUSTRALIA INC.	PRAWN A-1 (Shot 1)	89	8200'	143°06'27"S 39°21'25"E	OTWAY BASIN	VICTORIA	

Shothole Information - Elevation, Distance & Direction from Well

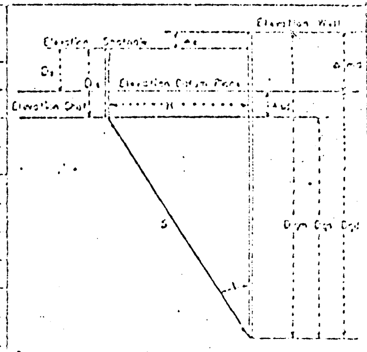
OCEAN DIGGER

N̄ — * — S̄ N

LOCATION

DATUM: Sea Level

Record Number	Shot Number	Time of Shot	Dgm	Ds	tus	tr	T Reading	Polarity	Grade	Dgs	H	TAN i	Cos i	Tgs	Δsd	Δsd/V	Tgd	Tgd Average	Dgd	Δ Dgd	Δ Tgd	Vi Interval Velocity	Va Average Velocity
1	N	15.00	3020			Charge exploded too deep																	
1A	N	15.05	3020	5	.001	.238	.453	D	G	2926	1180	.4033	.9274	.420	5	.001	.421	.422	2931				6937
12	S	17.10	3020	5	.001	.176	.442	D	G	2926	890	.3042	.9567	.423	5	.001	.424						
																				1130	.1205	9378	
2	N	15.20	4150	5	.001	.235	.567	D	G	4056	1165	.2872	.9611	.545	5	.001	.546	.543	4061				7479
11	S	17.00	4150	5	.001	.169	.550	D	G	4056	855	.2108	.9785	.538	5	.001	.539						
																				650	.063	10317	
3	N	15.30	4800	5	.001	.240	.628	D	G	4706	1190	.2529	.9695	.609	5	.001	.610)						
3A	N	15.35	4800	5	.001	.236	.626	D	F	4706	1170	.2486	.9705	.608	5	.001	.609)	.606	4711				7774
10	S	16.55	4800	5	.001	.172	.612	D	G	4706	870	.1849	.9833	.602	5	.001	.603						
																				1675	.150	11167	
4	N	15.45	6475	5	.001	.238	.768	D	G	6381	1180	.1849	.9833	.755	5	.001	.756						
9	S	16.30	6475	5	.001	.168	.760	D	F	6381	850	.1332	.9912	.753	5	.001	.754	.756	6386				8447
9A	S	16.40	6475	5	.001	.175	.762	D	G	6381	885	.1387	.9905	.755	5	.001	.756						
																				835	.078	10705	
5	N	15.55	7310	5	.001	.239	.851	D	G	7216	1185	.1642	.9868	.840	5	.001	.841	.834	7221				8658
8	S	16.17	7310	5	.001	.163	.832	D	F	7216	825	.1143	.9935	.827	5	.001	.828						
																				840	.068	12353	
6	N	16.05	8150	5	.001	.234	.915	D	G	8056	1160	.1440	.9898	.906	5	.001	.907	.902	8061				8937
7	S	16.10	8150	5	.001	.165	.901	D	F	8056	835	.1036	.9947	.896	5	.001	.897	↑	↑				



Dgm = Geophone depth measured from well elevation
Dgs = " " " " shot "
Dgd = " " " " datum "
Ds = Depth of shot
De = Shothole elevation to datum plane
H = Horizontal distance from well to shotpoint
S = Straight line travel path from shot to well geophone
tus = Uphole time at shotpoint
T = Observed time from shotpoint to well geophone
tr = " " " to reference geophone
Δe = Difference in elevation between well & shotpoint
Δsd = " " " shot & datum plane
Δsd = Ds - De
Dgs = Dgm - Ds ± Δe; tan i = $\frac{H}{D_{gs}}$
Tgs = cos i T = Vert. travel time from shot elev to geophone
Tgd = Tgs ± $\frac{\Delta sd}{V}$ = " " " datum plane "
Dgd = Dgm - Δmd
Vi = Interval velocity = $\frac{\Delta D_{gd}}{\Delta T_{gd}}$
Va = Average " = $\frac{D_{gd}}{T_{gd}}$

Surveyed by: UNITED

Date: 9 March 1968

Weathering Data:

Casing Record 2783'

* H modified because reference phones located approx. 10' south of wellsite.

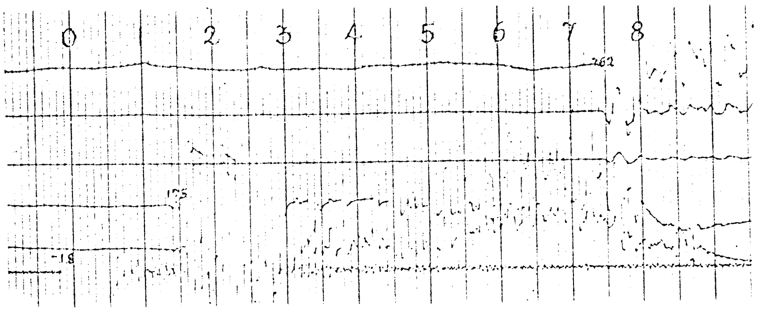
VELOCITY SURVEY ERROR CHECK

PRAWN A-1

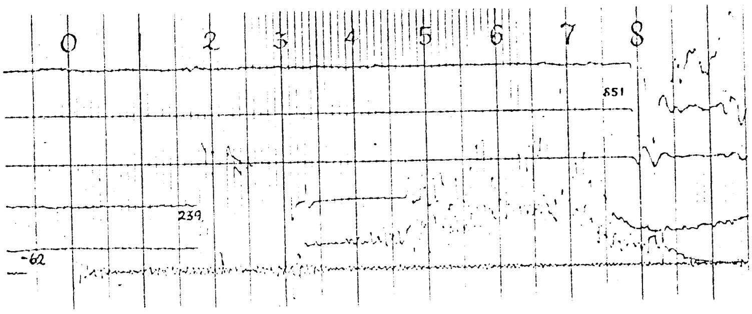
...th ...S.L.	Av. Vertical Travel Time (check shots)	Ti Check Shots (sec.)	Ti Sonic Log (sec.)	△ (Millisecs.)	Depth Interval (ft.)	Error (Microsec per ft.)
	VERTICAL HOLE ANALYSIS					
...931		.121	.122	-1	1130	-0.9
...061						
...061		.063	.064	-1	650	-1.5
...711						
...711		.150	.152	-2	1675	-1.2
...386						
...386		.078	.074	+4	835	+4.8
...7221						
...7221		.068	.068	0	840	0
...8061						

ESSO Prawn A-1
Well Velocity Record

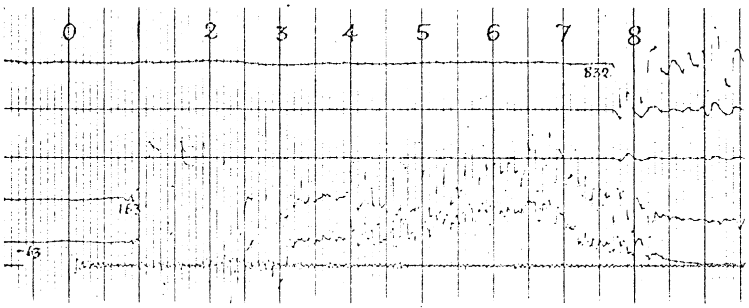
SHOT: 9 A
OFFSET: 1000'S
DEPTH OF GEOPHONE: 6475'
CHARGE: 33 1/3 lbs. @ 5'
TIME: 16·45



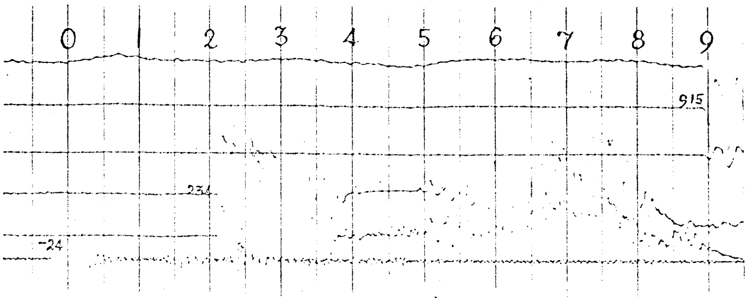
SHOT: 5
OFFSET: 1000'N
DEPTH OF GEOPHONE: 7310'
CHARGE: 33 1/3 lbs. @ 5'
TIME: 16·00



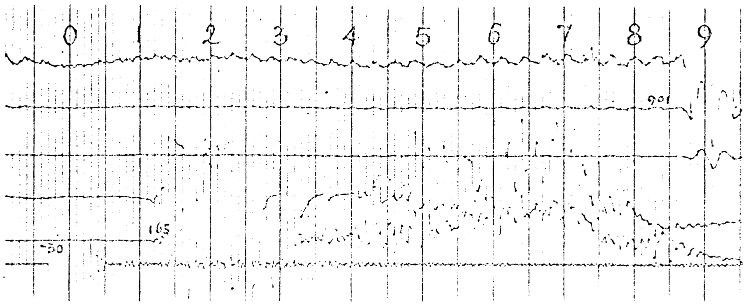
SHOT: 8
OFFSET: 1000'S
DEPTH OF GEOPHONE: 7310'
CHARGE: 33 1/3 lbs. @ 5'
TIME: 16·20



SHOT: 6
OFFSET: 1000'N
DEPTH OF GEOPHONE: 8150
CHARGE: 33 1/3 lbs. @ 5'
TIME: 16·05



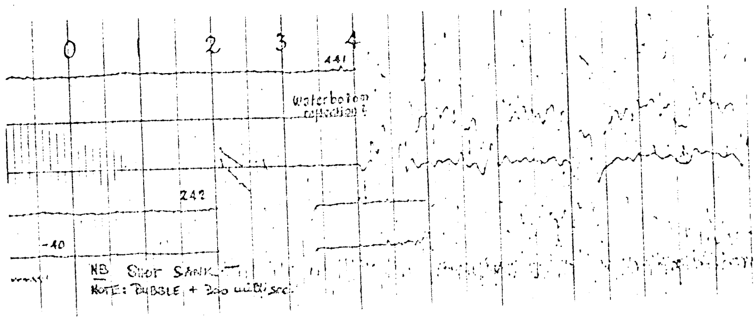
SHOT: 7
OFFSET: 1000'S
DEPTH OF GEOPHONE: 8150'
CHARGE: 33 1/3 lbs. @ 5'
TIME: 16·10



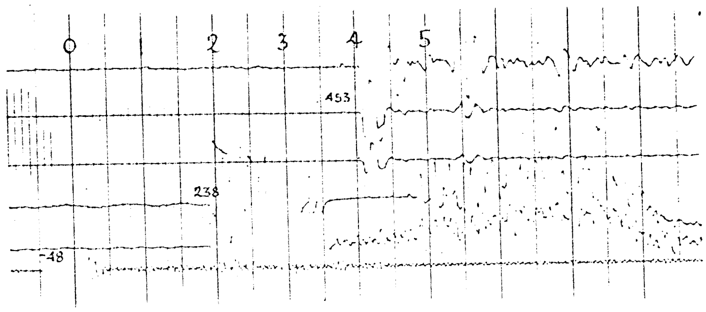
ESSO Prawn A-1

Well Velocity Record

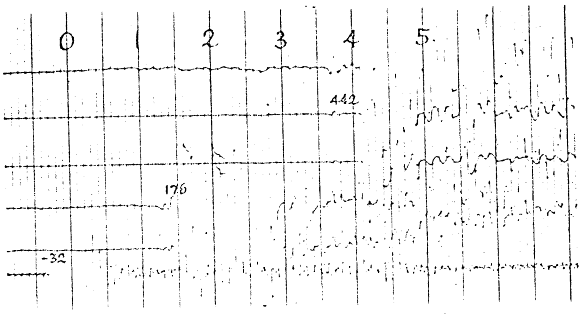
SHOT: 1
OFFSET: 1000'N
DEPTH OF GEOPHONE: 3020'
CHARGE: 16⅔ lbs. @ 5'
TIME: 15·00



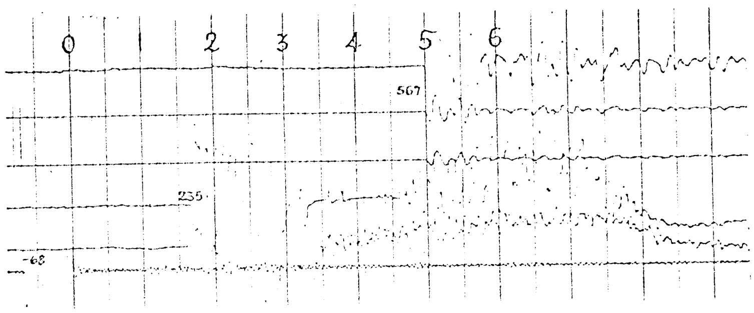
SHOT: 1A
OFFSET: 1000'N
DEPTH OF GEOPHONE: 3020'
CHARGE: 16⅔ lbs. @ 5'
TIME: 15·10



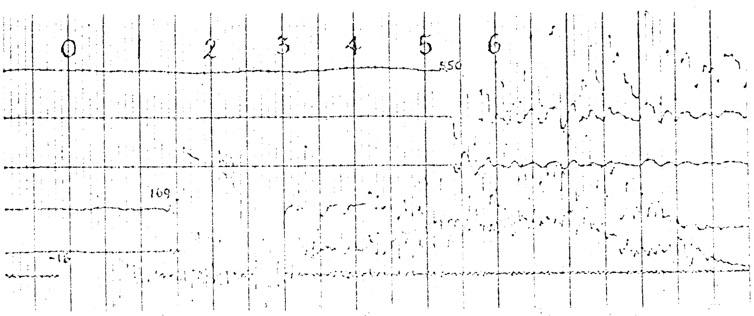
SHOT: 12
OFFSET: 1000'S
DEPTH OF GEOPHONE: 3020'
CHARGE: 33⅓ lbs. @ 5'
TIME: 17·10



SHOT: 2
OFFSET: 1000'N
DEPTH OF GEOPHONE: 4150'
CHARGE: 16⅔ lbs. @ 5'
TIME: 15·20

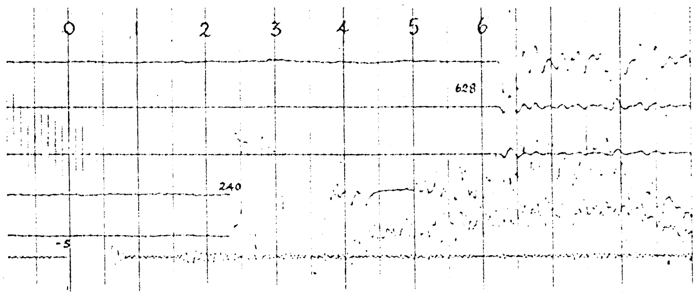


SHOT: 11
OFFSET: 1000'S
DEPTH OF GEOPHONE: 4150'
CHARGE: 33⅓ lbs. @ 5'
TIME: 17·50

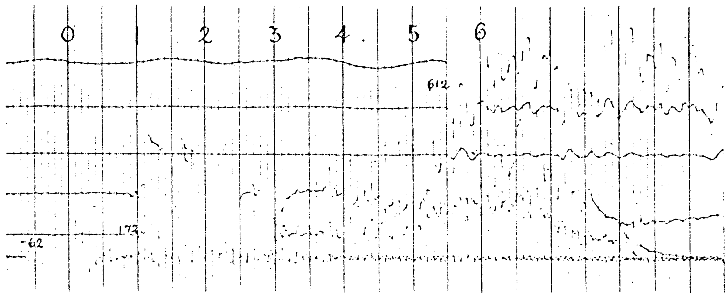


ESSO Prawn A-1
Well Velocity Record

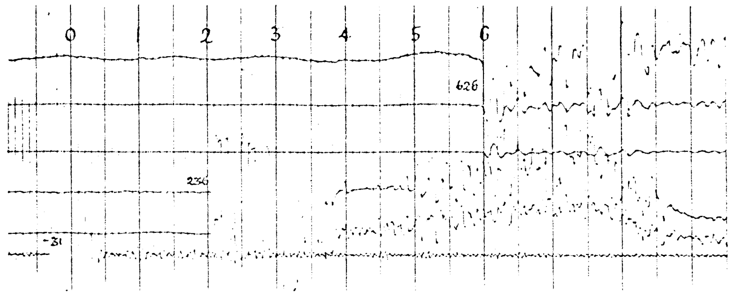
SHOT: 3
OFFSET: 1000' N
DEPTH OF GEOPHONE: 4800'
CHARGE: 16 2/3 lbs. @ 5'
TIME: 15·30



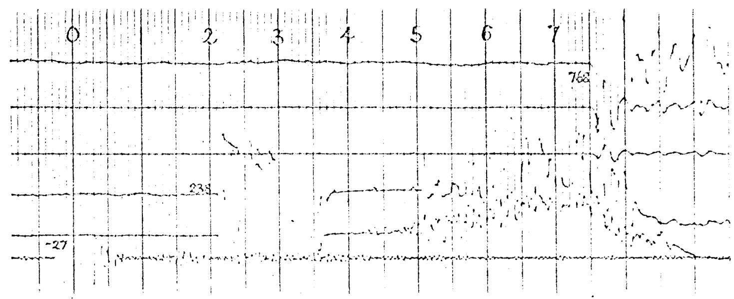
SHOT: 10
OFFSET: 1000' S
DEPTH OF GEOPHONE: 4800'
CHARGE: 33 1/3 lbs. @ 5'
TIME: 16·55



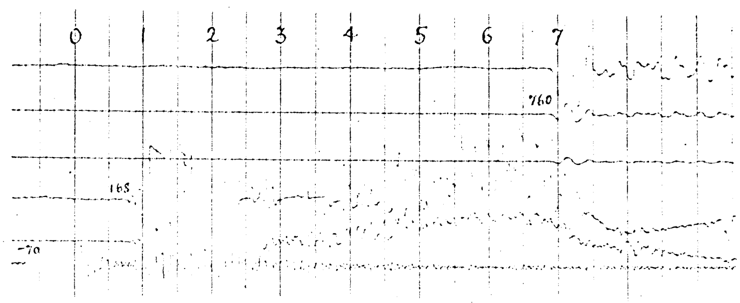
SHOT: 3 A
OFFSET: 1000' N
DEPTH OF GEOPHONE: 4800'
CHARGE: 16 2/3 lbs. @ 5'
TIME: 15·35



SHOT: 4
OFFSET: 1000' N
DEPTH OF GEOPHONE: 6475'
CHARGE: 33 1/3 lbs. @ 5'
TIME: 15·50



SHOT: 9
OFFSET: 1000' S
DEPTH OF GEOPHONE: 6475'
CHARGE: 33 1/3 lbs @ 5'
TIME: 16·30



67/4273
Copy 2

VELOCITY SURVEY

Well ....PRAWN A-1.......

Basin ....OTWAY BASIN.......

INTRODUCTION

Esso personnel ....R.J. Steele, P. Birmingham....

Contractor ....UNITED GEOPHYSICAL....

Supplied (1) Instruments

(2) Personnel

Seismic Observer H. Van Willigen

Marine Shooter ..L. Moore.....

(3) Licenced Shooting Boat

name ....Wendy Maree....

date loaded ....

date released ..9/3/68.......

Agent ....A. Olsen.......

....Besma Engineering........

amount of powder ......415..lbs

size of cans ....16-2/3..lbs.

number of cans ......25.....

number of caps ......25.....

number of boosters ...25.....

Personnel and Instruments

assembled at ....Melbourne...... date 9/3/68.....

boarded (rig) Ocean Digger...... date 9/3/68.....

date of survey ....9/3/68.........

casing depth.......2680'.........

T.D. when shot 8200'.......... PTD ....

water depth ....354'...........

SURVEY PROCEDURE

Weather: sea ...Slight-Moderate..........

rig movement .....Nil..........

rig noise ....Nil..........

Hydrophones: number .....2..........

depth below sea level ......10........ft

position adjacent to riser (10'S)........

....

Shot Positioning and Charges:

marker buoys (number ....2........

(distance ......1000.......

(direction .....N.&.S.......

charge depth ....5....ft

number of shots .5.......charge size...16-2/3..lbs

number of shots .10.......charge size...33-1/3..lbs

number of misfires ......0..........

amount of powder used ......416..........lbs amount of powder dumped ....-.....lbs.

Well-phone positioning :

T-bar ....Not used..........

number of depths ...6.................

Time: first shot ....1500...............

last shot ....1710...............

rig time ....3 hours............

RESULTS

Quality of records (good ....10..........
(fair ....4..........
(poor ....-..........
(not used ....-..........

Comparison of Interval Times with sonic log

/△/average ....1..............microsec/foot

/△max/ ..5/vertical hole formula microsec/foot

CONCLUSION

Reliability of T-D curve .Fair/good................

COMMENTS:

1. The abnormal variations in the direct travel times between shots from opposite sides of the well suggest that the hole is slightly deviated. The results were used in a deviated hole formula and velocities were found to be essentially the same as those calculated for an average of the two times.
2. The Sonic log (Run 1) was found to be in error.

UNITED GEOPHYSICAL COMPANY, S.A.

UGCC - 5A

OBSERVER'S REPORT Date 9/3/68 Time Left Town .... Time Arrived Field .... Sheet No. .... Of ....

Seismograph Party No. 141 Base BRISBANE Province .... Prospect PRAWN A-1

Truck No. Inst. Series No. Type Geo. Geo. Group /Trace Wind Weather

LINE AND SHOT POINT No.	BEARING TOP	BEARING BOTTOM	DEPTH OF PHONE SPREAD KB.	GROUP SEPARATION	RECORD No.	TAPE No.	FILTER	CHARGE	DEPTH	TIME	REMARKS [illegible]
1			3020					16	5	1500	48 60
1A			3020					16	5	1510	58 66
2			4150					16	5	1520	54 62
3			4800					16	5	1525	50 58
3A			4800					16	5	1535	44 56
4			6475					33	5	1545	44 56
5			7310					33	5	1555	35 52
6			8150					33	5	1605	22 46
7			8150					33	5	1610	30 44
8			7310					33	5	1620	38 52
9			6475					33	5	1630	42 54
9A			6475					33	5	1645	36 50
10			4800					33	5	1655	40 54
11			4150					35	5	1705	44 56
12			3020					33	5	1710	42 56
TOTALS								415			

HOLES PROFILES RECORDS DYNAMITE

FIELD CONDITIONS

Time Left Field .... Time Arrived Town .... Signed [illegible]

OBSERVER

Distribution

ORIGINAL — To Client

DUPLICATE — Party File

TRIPLICATE — Supervisor

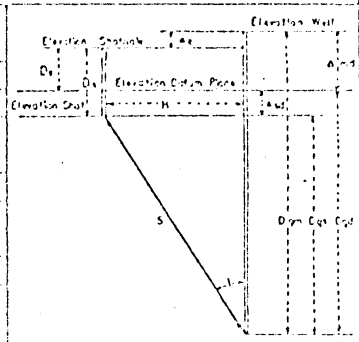
Wind .... Weather ....

PARTY CHIEF/MGR.

REPORT ALL ACCIDENTS, HOWEVER SLIGHT

	Shothole information – Elevation, Distance & Direction from Well	Company	Well	Elevation Derrick Floor	Total Depth	Coordinates	Section, Township, Range	County	Area or Field
	OCEAN DIGGER N — [*] — S (North arrow: N)	ESSO EXPLORATION AUSTRALIA INC.	PRAWN A-1 (Shot 1)	89	8200'	143°06'27"S 39°21'25"E	OTWAY BASIN	VICTORIA	
						DATUM : Sea Level			

Record No.	Shothole No.	Time of Shot	Dgm	Ds	tus	tr	T Reading	T Polarity	T Grade	Dgs	H	TAN i	Cos i	Tgs	Δsd	Δsd/V	Tgd	Tgd Average	Dgd	ΔDgd	ΔTgd	Vi Interval Velocity	Va Average Velocity
1	N	15.00	3020			Charge exploded too deep																	
1A	N	15.05	3020	5	.001	.238	.453	D	G	2926	1180	.4033	.9274	.420	.5	.001	.421	.422	2931				6937
12	S	17.10	3020	5	.001	.176	.442	D	G	2926	890	.3042	.9567	.423	5	.001	.424						
																				1130	.1205	9378	
2	N	15.20	4150	5	.001	.235	.567	D	G	4056	1165	.2872	.9611	.545	5	.001	.546	.543	4061				7479
11	S	17.00	4150	5	.001	.169	.550	D	G	4056	855	.2108	.9785	.538	5	.001	.539						
																				650	.063	10317	
3	N	15.30	4800	5	.001	.240	.628	D	G	4706	1190	.2529	.9695	.609	5	.001	.610)						
3A	N	15.35	4800	5	.001	.236	.626	D	F	4706	1170	.2486	.9705	.608	5	.001	.609)	.606	4711				7774
10	S	16.55	4800	5	.001	.172	.612	D	G	4706	870	.1849	.9833	.602	5	.001	.603						
																				1675	.150	11167	
4	N	15.45	6475	5	.001	.238	.768	D	G	6381	1180	.1849	.9833	.755	5	.001	.756						
9	S	16.30	6475	5	.001	.168	.760	D	F	6381	850	.1332	.9912	.753	5	.001	.754	.756	6386				8447
9A	S	16.40	6475	5	.001	.175	.762	D	G	6381	885	.1387	.9905	.755	5	.001	.756						
																				835	.078	10705	
5	N	15.55	7310	5	.001	.239	.851	D	G	7216	1185	.1642	.9868	.840	5	.001	.841	.834	7221				8658
8	S	16.17	7310	5	.001	.163	.832	D	F	7216	825	.1143	.9935	.827	5	.001	.828						
																				840	.068	12353	
6	N	16.05	8150	5	.001	.234	.915	D	G	8056	1160	.1440	.9898	.906	5	.001	.907	.902	8061				8937
7	S	16.10	8150	5	.001	.165	.901	D	F	8056	835	.1036	.9947	.896	5	.001	.897						



Dgm = Geophone depth measured from well elevation
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Ds = Depth of shot
De = Shothole elevation to datum plane
H = Horizontal distance from well to shotpoint
S = Straight line travel path from shot to well geophone
tus = Uphole time at shotpoint
T = Observed time from shotpoint to well geophone
tr = " " " to reference geophone
Δe = Difference in elevation between well & shotpoint.
Δsd = " " " " shot & datum plane
Δsd = Ds - De
Dgs = Dgm - Ds + Δe ; tan i = H / Dgs
Tgs = cos i T = Vert. travel time from shot elev to geophone
Tgd = Tgs + Δsd/V = " " " datum plane "
Dgd = Dgm - Δwd
Vi = Interval velocity = ΔDgd / ΔTgd
Va = Average " = Dgd / Tgd

Surveyed by: UNITED
Date: 9 March 1968
Weathering Data:

Casing Record 2783'

* H modified because reference phones located approx. 10' south of wellsite.

VELOCITY SURVEY ERROR CHECK
PRAWN A-1

Depth Rel.S.L.	Av. Vertical Travel Time (check shots)	Ti Check. Shots (sec.)	Ti Sonic Log (sec.)	△ (Millisecs.)	Depth Interval (ft.)	Error (Microsec per ft.)
	VERTICAL HOLE ANALYSIS					
2931		.121	.122	-1	1130	-0.9
4061						
4061		.063	.064	-1	650	-1.5
4711						
4711		.150	.152	-2	1675	-1.2
6386						
6386		.078	.074	+4	835	+4.8
7221						
7221		.068	.068	0	840	0
8061						

APPENDIX 5

ELECTRICAL LOG ANALYSIS

PRAWN A-1

by

B.L. CULP

Introduction

Induction-Electrical, Sonic, Formation Density, and Continuous Depmeter logs were run by Schlumberger on the Esso Prawn A-1 well from a total depth of 10,477 feet up to the bottom of the 20 inch casing at 934 feet. A Cement Bond log was run from 5500-7300 feet. The following table lists all of the mechanical logs run on the well.

Log		Interval (Feet)
I.E.S.	Run 1	934-2782
	2	2676-5600
	3	5500-8197
	4	8148-10477
SGRC	1	934-2774
	2	2676-5595
	3	5550-8198
	4	8148-10478
FDC	1	934-2782
	2	2676-8196
	3	8148-10478
CDM	1	932-2777
	2	2676-8192
	3	8148-10475
CBL	1	5500-7300

Data derived from the induction-electrical, sonic and formation density logs were used to calculate porosities and as an aid in determining the presence or absence of hydrocarbon bearing zones.

Method of Analysis

The method of log analysis used for the purpose of interpreting log data from the Prawn A-1 well has been referred to as the "Magnolia Plot". This technique is a graphical presentation and basically consists of plotting resistivity (or conductivity) values against corresponding sonic log transit times and/or bulk density from the Formation Density log on special log paper. The resistivity is plotted on the ordinate of the paper with a logarithmic scale while the abscissa is measured in a linear scale which is plotted in sonic transit time or bulk density.

In brief, the initial plotting procedure consists of plotting on the chart water saturated sands having a fairly constant SP curve indicative of a fairly constant water salinity. A series of points plotted from salt water saturated sands will fall high on the chart and establish a line indicative of 100% water saturation. This line should intersect the abscissa at a matrix transit time or density, equivalent to zero porosity. All other points of interest which plot low and to the right on the chart should have the greatest hydrocarbon potential. A porosity scale is plotted on the abscissa for determining porosities of the various points on the chart.

Resistivity versus sonic transit time and bulk density of selected zones from the Prawn A-1 are compared on the attached charts. Porosity and water saturation values are shown next to their respective depths in the upper left hand corner of each chart. These values were taken directly from the chart itself and estimated to the nearest per cent.

Results of Log Analysis

Four overall intervals are plotted on the attached charts:

Chart A	Resistivity vs. Sonic	3034-5578 feet
Chart A'	Resistivity vs. Density	3034-5578 "
Chart B	Resistivity vs. Sonic	5642-6740 "
Chart B'	Resistivity vs. Density	5642-6740 "
Chart C	Resistivity vs. Sonic	6665-8154 "
Chart C'	Resistivity vs. Density	6665-8154 "
Chart D	Resistivity vs. Sonic	8225-10430 "
Chart D'	Resistivity vs. Density	8225-10430 "

Charts A and A' - 3034-5570 feet - Tertiary and Upper Cretaceous sands

All points are indicated to have water saturations greater than 70 per cent with the exception of points 19, 20 and 21. These three points are from 3034-3478 feet and in a zone of upward decreasing water salinity within a massive Tertiary sand sequence. Their apparently anomalous position on the chart is attributed to this salinity change. Log calculations indicate the salinity of the formation water to decrease from approximately 27000 ppm at 4900 feet to 9400 ppm at 3034 feet. No indications of oil or gas were noted at these depths in either sidewell cores or on the mud log.

Zones of low porosity were plotted for control in the low porosity range. Good porous sands within the overall interval 3034-5570 feet appear to have porosities greater than 20%. It is interesting to note that porosities derived from the sonic log give the highest porosity values.

No possibly commercial zones of hydrocarbons are indicated to be present within the overall interval analyzed on these charts.

Charts B and B' - 5642-6740 feet - Upper Cretaceous sands

Sands within the interval from 5642-6740 feet appear to have water saturations greater than 70% and a salinity of about 41000 ppm. The overall section consists of massive salt water bearing sands with high porosities. Here again the sonic log porosities appear to be slightly higher than those computed from the density log. No indications of hydrocarbon are interpreted to be present within this interval.

Charts C and C' - 6665-8154 feet - Upper Cretaceous sands

All sands within this interval are interpreted as being water saturated. Point 25 (7298-7303 feet) is indicated to have a water saturation of about 60% and a porosity of 19% on the Resistivity-sonic plot (Chart C). The Resistivity-Density Chart C' however, indicates the water saturation to be approximately 85% and the porosity about 9%.

Overall porosity values for the interval 6665-8154 feet appear good. No indications of possible hydrocarbon bearing sands are interpreted to be present.

Chart D and D' - 8225-10430 feet - Upper and Lower Cretaceous sands

Water saturations computed from the Resistivity-Density plot (Chart D') indicate two points to be anomalous. Points 16 (9548 feet) and 17 (9577 feet) are shown to have water saturations of 71 and 38 per cent and porosities of 9 and 11 per cent respectively. The Resistivity and Sonic plot (Chart D) however, indicates water saturations greater than 70% with porosities of 8 and 4 per cent. These points are within a massive hard conglomerate with a calcareous sandstone matrix referred to as the Waarre Formation of basal Upper Cretaceous age. The salinity of the Waarre formation was calculated to be approximately 46000 ppm.

The highest porosity plotted on Chart D is 23 per cent at a depth of 8585 feet in Upper Cretaceous sands with a water saturation of about 92%. Porosities from within the Lower Cretaceous Otway Group, below 9660 feet, were in the 9 to 15 per cent range on the Resistivity-Sonic plot (Chart D). The water salinity of the Otway beds was calculated to be about 20,500 ppm.

Summary

No indications of hydrocarbons are interpreted to be present in Prawn A-1. Porosities and water saturations obtained from resistivity-sonic and resistivity-density plots for the most part, seem to agree reasonably well. The few discrepancies illustrates the advisability of running more than one porosity tool.

The sands within the Tertiary and Upper Cretaceous section in general exhibit good porosities in the 20% range. Basal Upper Cretaceous and Lower Cretaceous Otway sandstones however, appear to have porosities less than 15%.

CHART A'

ANALYSIS BY: B.L.CULP

RESISTIVITY DENSITY LOG - GULF COAST TYPE

% ø	SW
28	100
27	95
6	100
29	96
6	100
28	100
4	100
25	100
32	100
8	100
31	100
32	95
0	100
25	100
11	100

Well: ESSO Prawn A-1

No.	Depth	No.	Depth	% ø	SW
1	5570-5578	16	3957-3962	10	100
2	5496-5504	17	3894	15	100
3	5486 Tight	18	3860-3870	27	80
4	5373-5376	19	3470-3478	28	-
5	5304 Tight	20	3310	24	-
6	5100	21	3034	14	-
7	5052 Tight	22			
8	4882-4888	23			
9	4600-4604	24			
10	4533 Tight	25			
11	4448	26			
12	4296-4304	27			
13	4122-4130	28			
14	4032-4040	29			
15	3962-3967	30			

Decrease in formation water salinity

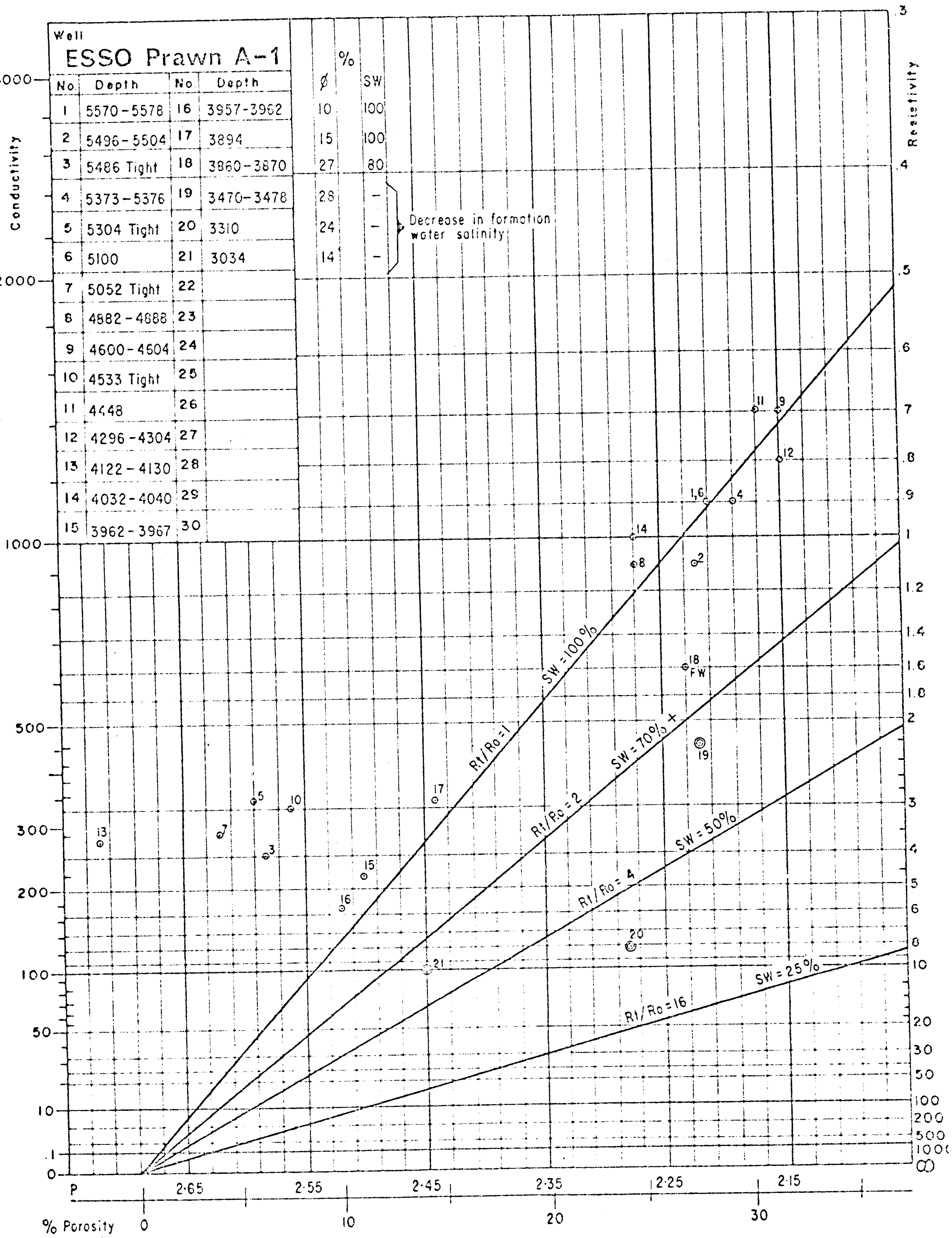


CHART A

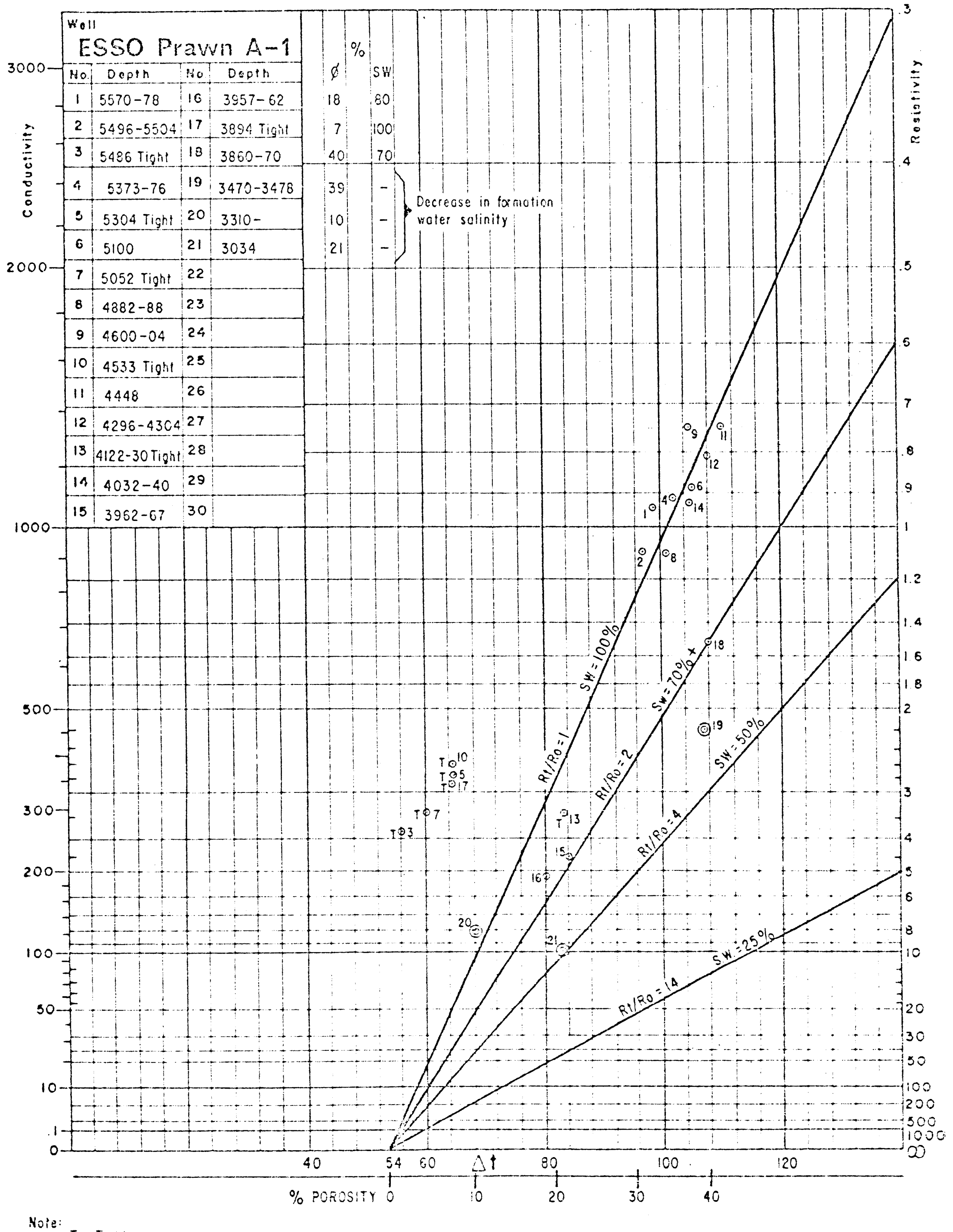
ANALYSIS BY: B.L.CULP

RESISTIVITY VELOCITY LOG - GULF COAST TYPE

Well: ESSO Prawn A-1

% φ	% SW	No.	Depth	No	Depth	% φ	% SW
32	100	1	5570-78	16	3957-62	18	80
31	100	2	5496-5504	17	3894 Tight	7	100
0	100	3	5486 Tight	18	3860-70	40	70
35	100	4	5373-76	19	3470-3478	39	-
8	100	5	5304 Tight	20	3310-	10	-
38	99	6	5100	21	3034	21	-
4	100	7	5052 Tight	22			
34	98	8	4882-88	23			
37	100	9	4600-04	24			
8	100	10	4533 Tight	25			
41	98	11	4448	26			
39	98	12	4296-4304	27			
21	90	13	4122-30 Tight	28			
38	98	14	4032-40	29			
22	75	15	3962-67	30			

Decrease in formation water salinity (wells 19–21)



Note: T — Tight

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CHART B

ANALYSIS BY: B.L.CULP

RESISTIVITY VELOCITY LOG - GULF COAST TYPE

% Ø	% SW
34	100
37	92
31	83
32	81
28	100
29	88
6	100
9	100
32	100
33	95

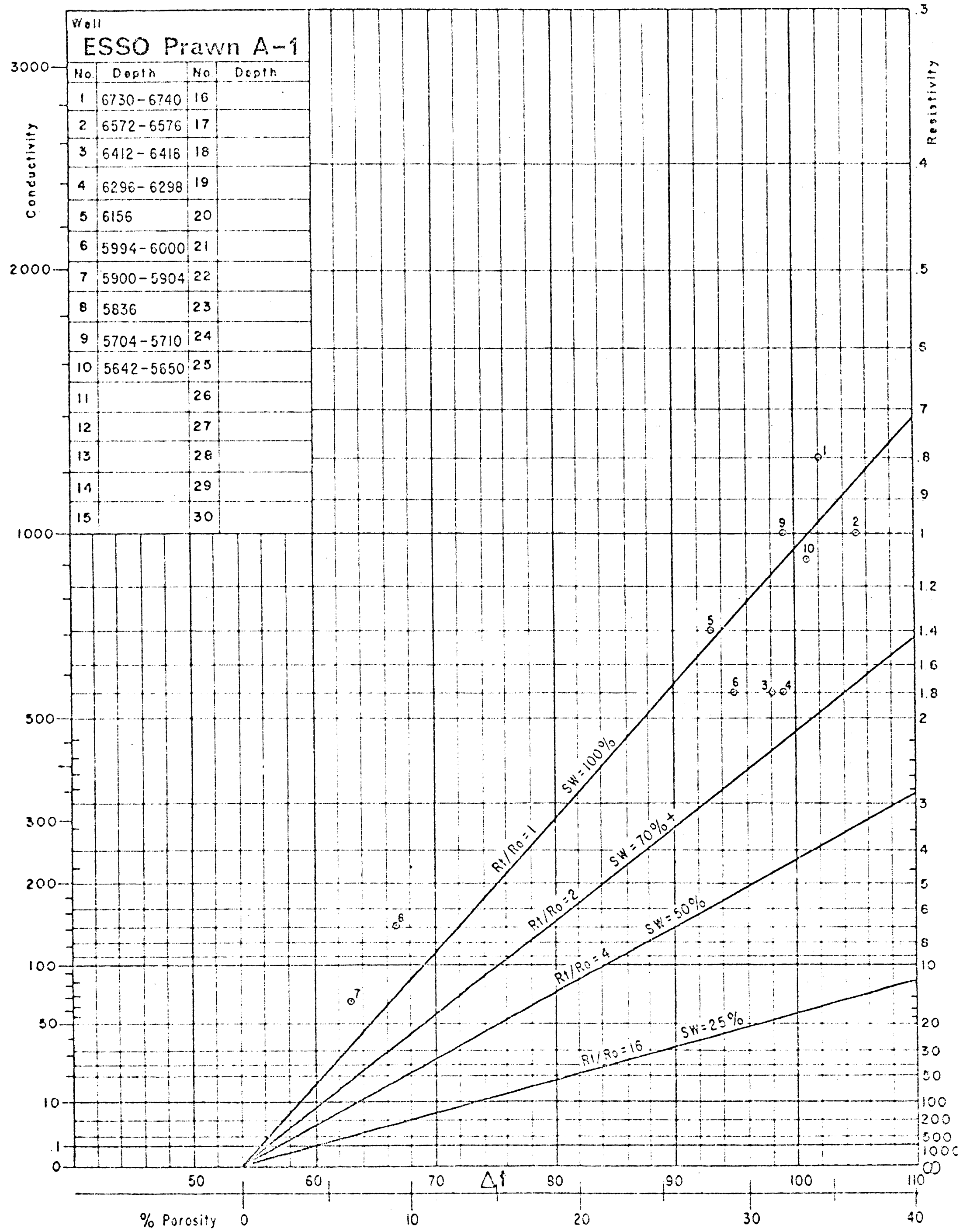


CHART B'

ANALYSIS BY: B.L.CULP

ø %	SW %
29	100
27	100
22	95
24	87
25	95
23	92
4	100
5	100
29	100
28	92

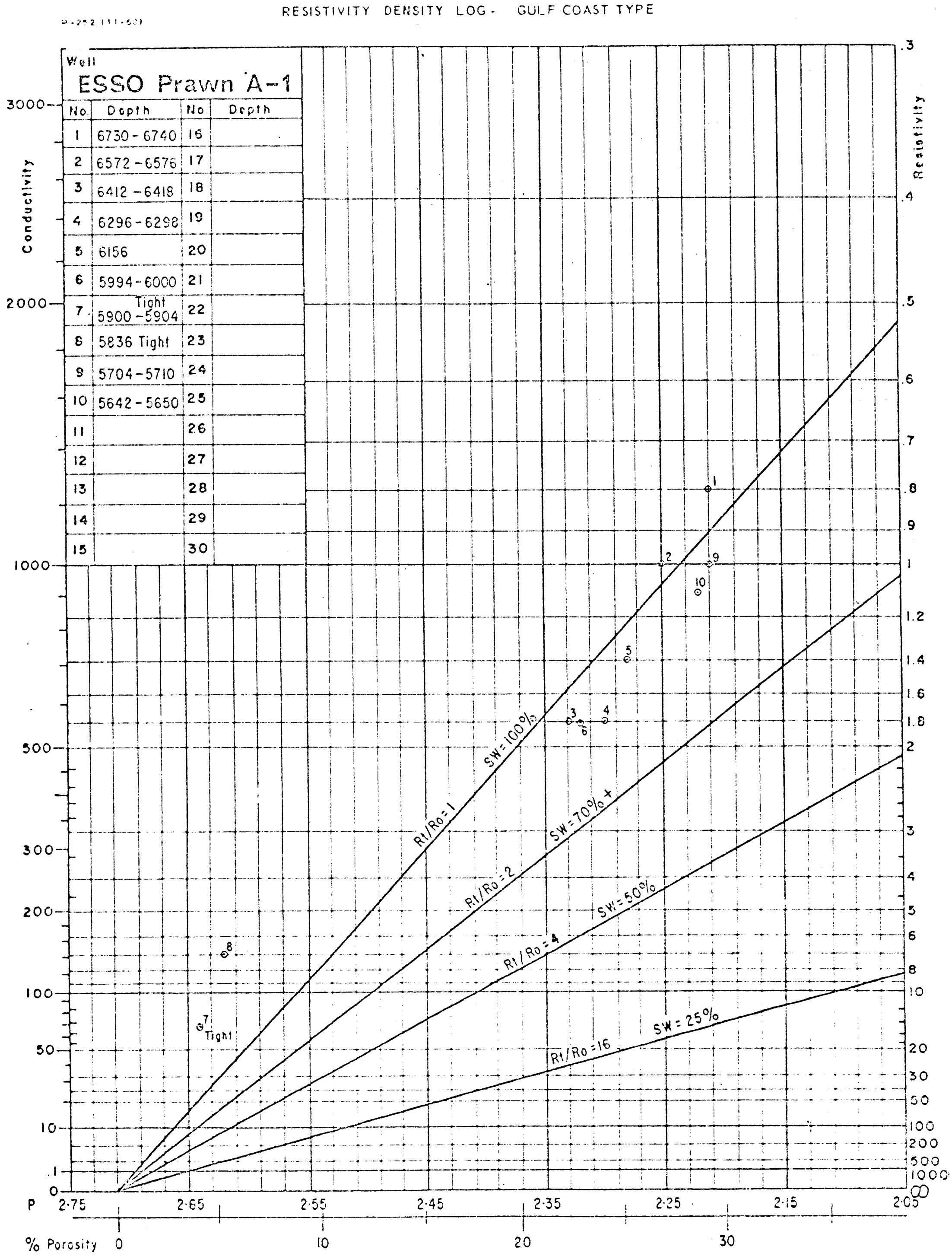


CHART C

ANALYSIS BY: B.L.CULP

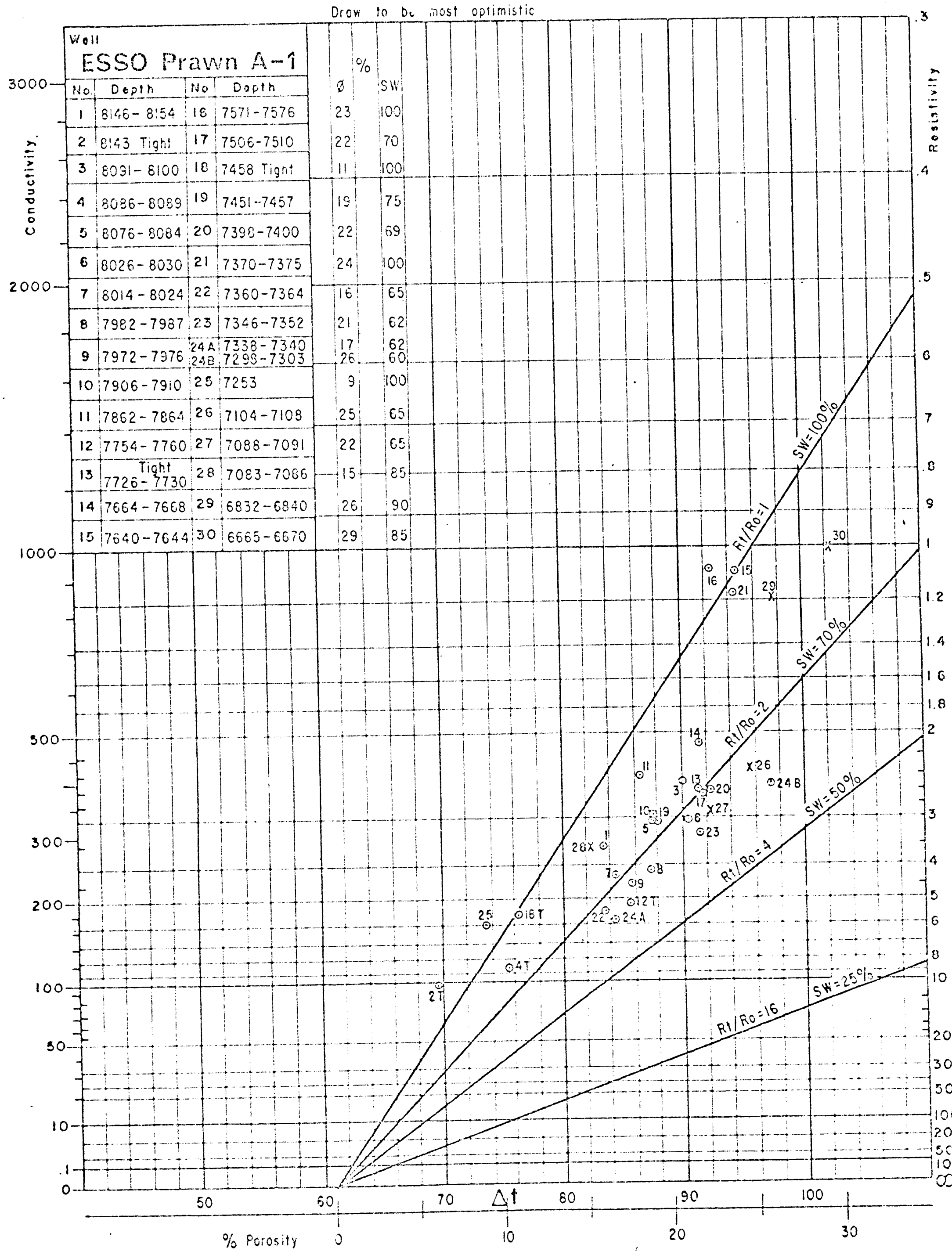
RESISTIVITY VELOCITY LOG - GULF COAST TYPE

Draw to be most optimistic

Well

ESSO Prawn A-1

No.	Depth	% Ø	% SW	No.	Depth	% Ø	% SW
1	8146-8154	16	85	16	7571-7576	23	100
2	8143 Tight	0-6	100	17	7506-7510	22	70
3	8091-8100	21	80	18	7458 Tight	11	100
4	8086-8089	10	80	19	7451-7457	19	75
5	8076-8084	19	75	20	7398-7400	22	69
6	8026-8030	21	65	21	7370-7375	24	100
7	8014-8024	17	70	22	7360-7364	16	65
8	7982-7987	19	65	23	7346-7352	21	62
9	7972-7976	17	65	24A	7338-7340	17	62
				24B	7298-7303	26	60
10	7906-7910	19	75	25	7253	9	100
11	7862-7864	18	90	26	7104-7108	25	65
12	7754-7760	17	65	27	7088-7091	22	65
13	Tight 7726-7730	22	70	28	7083-7086	15	85
14	7664-7668	22	80	29	6832-6840	26	90
15	7640-7644	24	100	30	6665-6670	29	85



1004/OP/12

CHART C'

ANALYSIS BY: B.L.CULP

RESISTIVITY DENSITY LOG - GULF COAST TYPE

Well: ESSO Prawn A-1

No.	Depth	% Ø	SW	No.	Depth	% Ø	SW
1	8146-8154	17	90	16	7571-7576	23	95
2	8143	6½	100	17	7506-7510	21	84
3	8091-8100	20	90	18	7458	9½	100
4	8086-8089	6½	100	19	7451-7453	17½	86
5	8076-8084	19	85	20	7398-7400	17	95
6	8026-8030	19	85	21	7370-7375	24	85
7	8014-8024	14	95	22	7360-7364	11	95
8	7982-7987	17½	75	23	7346-7352	15½	95
9	7972-7976	17	75	24A	7338-7345	12½	90
				24B	7298-7303	15	100
10	7906-7910	18½	85	25	7253	12½	90
11	7862-7864	18½	85	26	7104-7108	23	78
12	7754-7760	10½	100	27	7088-7091	19½	80
13	7726-7730	20	85	28	7083-7086	15	100
14	7664-7668	20½	94	29	6832-6840	27	95
15	7640-7644	25½	86	30	6660-6670	27½	100

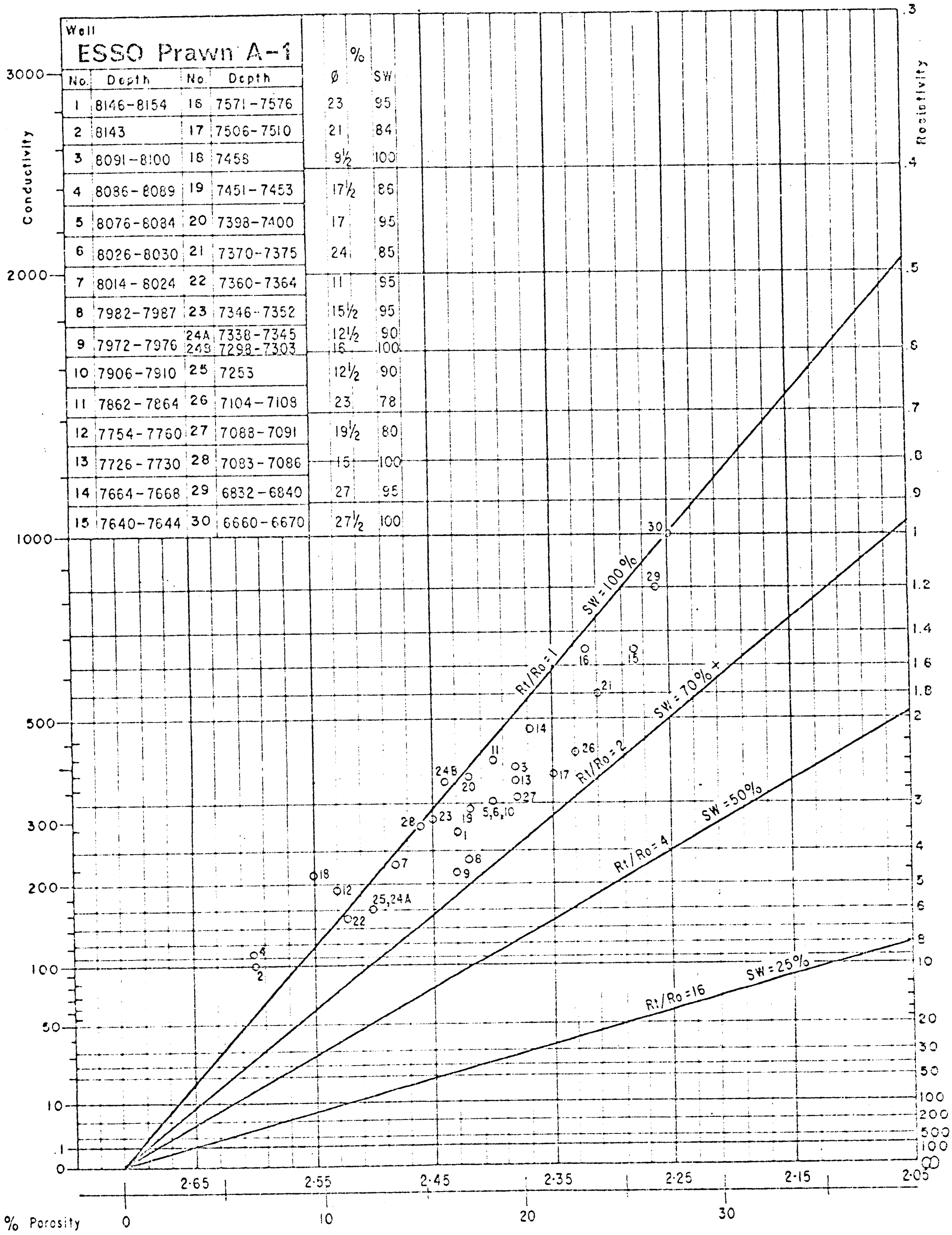


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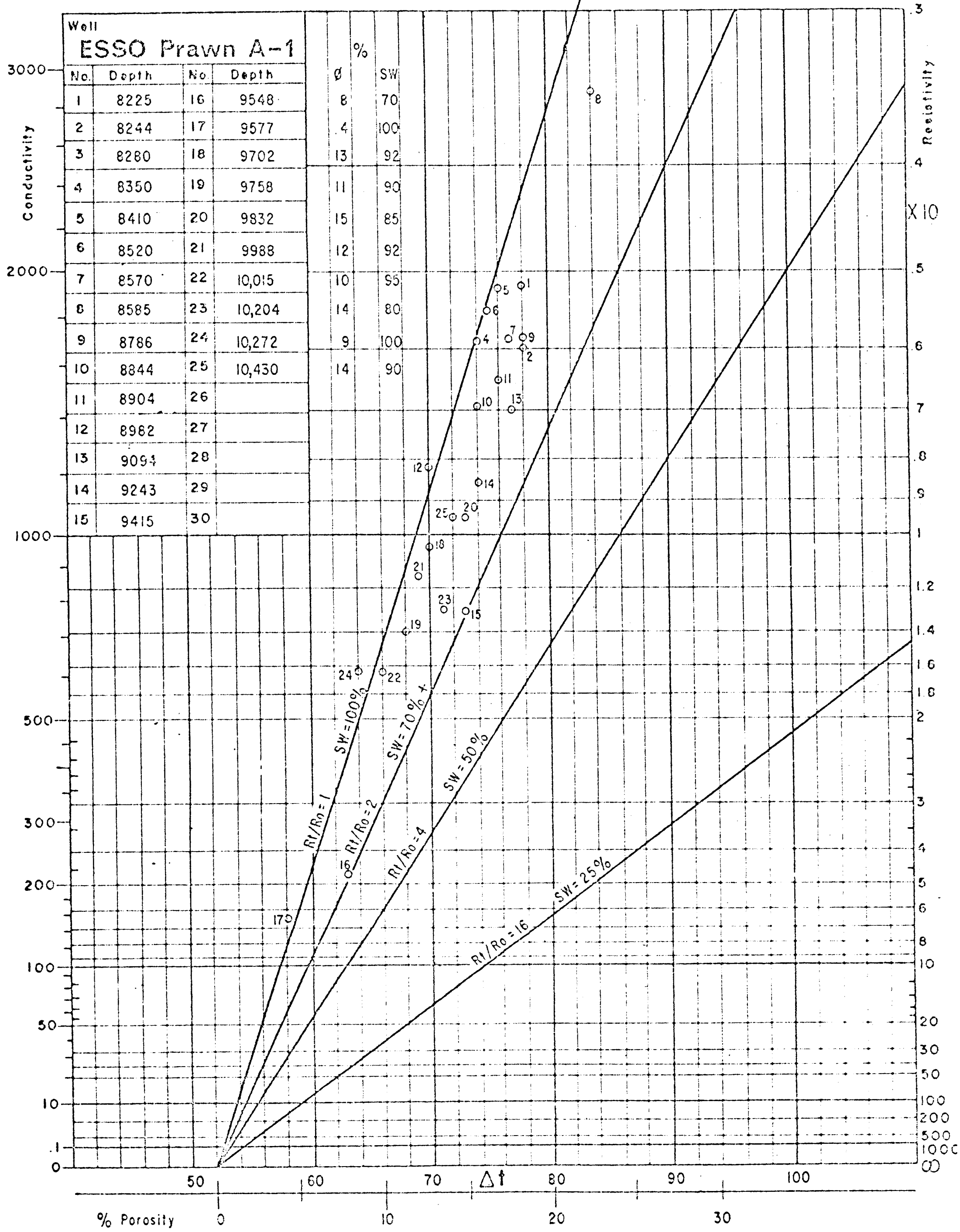
CHART D

ANALYSIS BY: B.L.CULP

03

RESISTIVITY VELOCITY LOG - GULF COAST TYPE

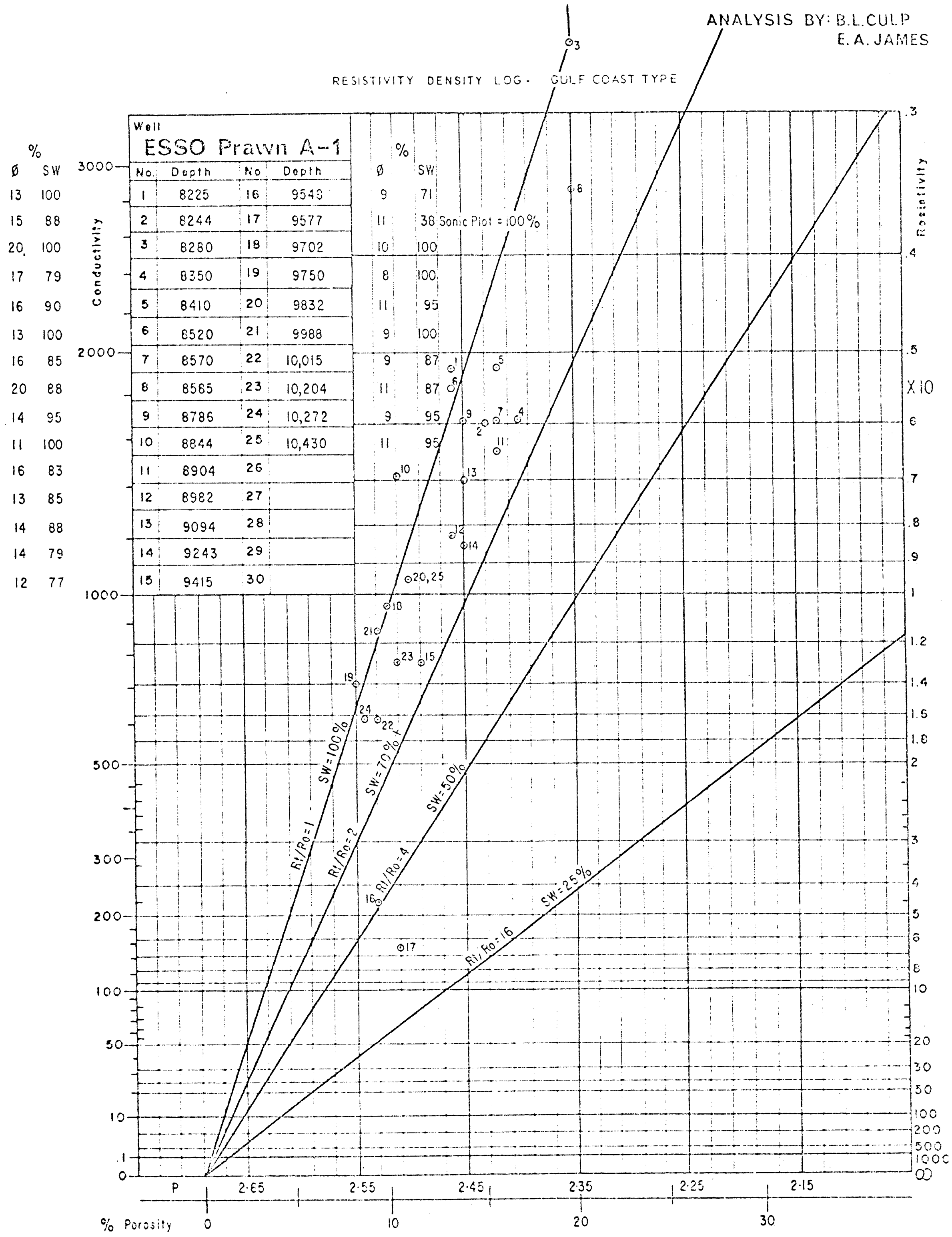


Well
ESSO Prawn A-1

Ø	SW	No.	Depth	No.	Depth	Ø	SW
19	92	1	8225	16	9548	8	70
19	85	2	8244	17	9577	4	100
20	100	3	8280	18	9702	13	92
16	100	4	8350	19	9758	11	90
17	98	5	8410	20	9832	15	85
16	100	6	8520	21	9988	12	92
18	90	7	8570	22	10,015	10	95
23	92	8	8585	23	10,204	14	80
19	86	9	8786	24	10,272	9	100
16	92	10	8844	25	10,430	14	90
17	90	11	8904	26			
13	100	12	8982	27			
18	82	13	9094	28			
16	85	14	9243	29			
15	70	15	9415	30			

CHART D'

ANALYSIS BY: B.L.CULP
E.A. JAMES



Well: ESSO Prawn A-1

% Ø	SW	No.	Depth	No	Depth	% Ø	SW
13	100	1	8225	16	9543	9	71
15	88	2	8244	17	9577	11	38 Sonic Plot = 100%
20	100	3	8280	18	9702	10	100
17	79	4	8350	19	9750	8	100
16	90	5	8410	20	9832	11	95
13	100	6	8520	21	9988	9	100
16	85	7	8570	22	10,015	9	87
20	88	8	8565	23	10,204	11	87
14	95	9	8786	24	10,272	9	95
11	100	10	8844	25	10,430	11	95
16	83	11	8904	26			
13	85	12	8982	27			
14	88	13	9094	28			
14	79	14	9243	29			
12	77	15	9415	30			

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