

Natural Resources and Environment



AGRICULTURE • RESOURCES • CONSERVATION • LAND MANAGEMENT

FLATHEAD-1 (G.B.) WELL SUMMARY

(OFFS HORE)

1 Folio No	2 Referred to	3 Date	4 Crearing Officer's Initials	1 Folio No.	2 Referred to	3 Date	4 Clearing Officer's Initials
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FILE COVER INSTRUCTIONS FOR ACTION OFFICERS

- (1) FOLIO NUMBERS: Each subject paper attached to a file is to be given a consecutive number by the attaching officer. Papers must not be removed from or attached to a file without approval.
- (2) REFERRAL TO OTHER OFFICERS: When an Officer completes action on the file and further action is required by some other Officer, please initial Column (4) and on the next vacant line, enter the relevant folio number in Column (1), indicate to whom the file is to be forwarded in Column (2) and record the date in Column (3).
- (3) BRING UP MARKINGS: When action on a file is required at a later date, the officer will initial Column (4) and, on the next vacant line, enter the relevant folio number in Column (1), then write "B/U" followed by the action officer's name in Column (2) and the date the file is required in Column (3).
- (4) PUTAWAY MARKINGS: When ALL action on a file is completed the officer concerned will initial Column (4) and, on the next vacant line, write "P/A" in column (2).

REGISTRY MUST BE NOTIFIED OF ANY FILE MOVEMENTS BETWEEN OFFICERS

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FLATHEAD 1

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FLATHEAD-1.

Purpose of Well

Flathead 1 was drilled to evaluate the hydrocarbon potential of an east-west trending fault line closure on the upthrown side of a regional wrench fault. The primary objectives were the sandstones of the Latrobe Complex and underlying sandstones of the Strzelecki Group.

Statistical Summary

Lease:

Vic-P/1, Shot Point 8524, Line EH-120A.

Latitude:

38° 01' 21"

Longitude:

'148° 32' 04"

Elevation:

Sea Level Datum, Rotary Table 31'

Water Depth:

1741

Total Depth:

34961

Spud Date:

April 25, 1969.

Completion Date:

May 26, 1969.

Well Status:

Plugged and abandoned as a non-commercial oil discovery.

Generalised Lithology

e Gippsland Formation consisted of soft grey, fossiliferous marl interbedded with occasional thin skeletal limestones from the sea floor down to a depth of 1468'. The underlying Lakes Entrance formation was represented by 74' of glauconitic siltstone. The interval 1542-1564' contained porous and permeable quartzose sandstones of the Latrobe Complex. These sandstones were well rounded, coarse grained and conglomeratic. The underlying Strzelecki Group consisted predominantly of lithic-feldspathic sandstone. with an abundant clay matrix, interbedded with occasional thin coal beds. These sandstones in general exhibited poor permeability, in comparison to sandstones of the Latrobe Complex.

FLATHEAD -1.

Geologic Summary

Flathead 1 was located 12 miles north of the Tuna Field and 32 miles southeast of the town of Lakes Entrance. It was drilled to a total depth of 3496' on a structure consisting of a faulted east-west trending anticline (Plates I, 2, and 3). The fault which strikes east-west is tentatively interpreted to be a right lateral wrench fault, with intermittent movement and structure occurring from Lower Cretaceous to Upper Miocene

The Lakes Entrance "greensand" which apparently uniformly drapes the structure is composed of mostly tight glauconitic siltstone with thin permeable sands (based on sidewall core examination). Structural closure, as mapped on the top of the Lakes Entrance "greensand", is indicated to be approximately 500' +. The area of closure extends over 12 square miles (Plate I). The present structural configuration appears to be Miocene or younger in age.

porous and permeable Latrobe sandstone complex was originally anticipated to be about 350' thick, however, only 22' of the Latrobe section were present in the well. Due to thinness, the Latrobe cannot be defined on the seismic section and the reflection mapped is the Lakes Entrance "greensand". Most of the Latrobe core was too unconsolidated for analysis, however, a few samples yield porosities from 34% to 41% and permeabilities of 300 Md to 1200 Md. These sediments do appear to thicken away from the structure. Underlying sandstones of the Strzelecki Group appear for the most part to be clay-choked and poor reservoir rocks. However, the upper 200 ft. of Strzelecki, does have fair to good porosity and permeability. From core analysis over most of this interval porosity ranges from 25% - 35% and permeability from less than 10 Md to greater than 500 Md. Considering only those sands with a permeability of 100 millidarcies or greater to be potentially oil productive, 35' net sand occur in the 85' gross of Strzelecki down to the lowest recorded oil at 1649' K.B. This is in addition to the 22' of net sand in the Latrobe. The time of oil accumulation is postulated to be post Oligocene.

FLATHEAD - 1.

Hydrocarbon Potential

Oil shows were encountered in the cuttings and cores from the top of Lakes Entrance formation at 1468' down through the Latrobe Complex sandstones and into sandstones of the Lower Cretaceous Strzelecki group, to a depth of 1649'. Permeable and porous sandstone of the Latrobe Complex with excellent oil fluorescence and cut was encountered at 1542'. Conventional cores were then continuously taken from 1545' down into the water leg to a depth of 1716' (Plate VII - I.E.S.). Core analyses indicated the sandstones to have oil saturations ranging from 5 to 22% in conjunction with good permeability and porosity values down to a depth of 1649'. Approximately 40' of shale was cored between the lowest oil and highest water and a precise contact is indeterminate.

Eleven wireline tests were later performed in an attempt to evaluate the hydrocarbon aring section. Of the eleven wireline tests attempted, only FIT tests at 1648' and 1545' recovered a scum of oil, with the remaining tests recovering mud filtrate (Plate VII - I.E.S.). Because of the unsatisfactory results obtained by use of wireline testing methods 9 5/8" casing was later set to a depth of 1953' and conventional production tests were performed.

Production test No. 1 was completed through perforations 1607-1652' with no formation fluid being recovered by swabbing, even after treating the well with mud acid. This test was in sandstones of the Strzelecki Group. Upon completion of the test the interval was cemented.

Production test No. 2 was completed through perforations 1542-1564 in sandstones of the Latrobe Complex. The well did not flow after perforating and approximately 16 barrels of either formation water or filtrate and some hydrogen sulphide gas was swabbed from the well without any trace of oil being present. The formation was then treated with 20 barrels of mud acid which was swabbed back with still no trace of oil. At this point the well was plugged and abandoned.

nce no formation oil was recovered on either Production Test 1 or 2, oil saturated teres were sent to Core Laboratories and flushed with hot water and pentane in an attempt to gain information concerning the A.P.I. gravity of the crude. Oil was recovered having a corrected gravity of 14.6 API and a viscosity of 50 centipoise, which was described as "dark, heavy and smelling of tar". This oil sample may not be representative formation oil. Several weeks passed between the time of core recovery and the time of analysis, and it seems likely that some of the lighter ends had escaped.

INTERP.









PE900004

COMPLETION REPORT

FLATHEAD I



Purpose of Well	2
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Generalised Lithology	2
Geologic Summary	3
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LIST OF ILLUSTRATIONS

Plate I - Structural Contour Map - 1st Reflection (Top Greensand).

> II - Structural Contour Map - 2nd Reflection (near or within the Lower Cretaceous-Strzelecki Group).

III - Structure (Local) - Top Latrobe Complex.

V - Geologic Cross-section A-A^t.

VI - Geologic Cross-section B-B'.

VII - I.E.S. (plotted).

VIII - Time-Depth Curve.



Purpose of Well

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Statistical Summary

Lease: Vic-P/1, Shot Point 8524, Line EH-120A.

Latitude: 38° 01' 21"

Longitude: 148° 32' 04"

Elevation: Sea Level Datum, Rotary Table 31'

Water Depth: 174'
Total Depth: 3496'

Spud Date: April 25, 1969. Completion Date: May 26, 1969.

Well Status: Plugged and abandoned as a non-commercial oil discovery.

Stratigraphy

Summary

Flathead I was drilled to a total depth of 3496' penetrating the following sediments (Plate VII).

Age	Group or Formation	Interval
Miocene-Oligocene	Gippsland Formation	Sea Floor - 1468'
Oligocene	Lakes Entrance Fm.	1468-1542
Unconformity		
Eocene-U. Paleocene Unconformity	Latrobe	1542-1564
Lower Cretaceous	Strzelecki Group	1564-3496 T.D.

Note: Interval depths are from the electrical log. Subtract 31' K.B. to obtain subsea values.

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This is an enclosure indicator page.

The enclosure PE900017 is enclosed within the container PE904908 at this location in this document.

The enclosure PE900017 has the following characteristics:

ITEM_BARCODE = PE900017
CONTAINER_BARCODE = PE904908

NAME = Structure Map

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = SEISMIC

SUBTYPE = HRZN_CONTR_MAP

DESCRIPTION = Flathead 1 Structure Map on Top of

Lakes Entrance ""Greensand"". Plate 1.

REMARKS =

 $DATE_CREATED = 31/08/69$

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE900019 is enclosed within the container PE904908 at this location in this document.

The enclosure PE900019 has the following characteristics:

ITEM_BARCODE = PE900019
CONTAINER_BARCODE = PE904908

NAME = Structure Map

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = SEISMIC

SUBTYPE = HRZN_CONTR_MAP

DESCRIPTION = Flathead 1 Structure Map Inner

Strzelecki Mapping Point (Well tops on

actual Strzelecki tops). Plate 2.

REMARKS =

 $DATE_CREATED = 31/08/69$

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE900016 is enclosed within the container PE904908 at this location in this document.

The enclosure PE900016 has the following characteristics:

ITEM_BARCODE = PE900016
CONTAINER_BARCODE = PE904908

NIAINER_BARCODE - FE904900

NAME = Isochron Map

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = SEISMIC

SUBTYPE = ISOCHRON_MAP

DESCRIPTION = Flathead 1 Flathead area Isochron map

of Greensand- Strzelecki interval.

 $((x,y)^{2})\mathcal{E}_{t}(x,y) = (x,y)^{2} + (x,y)^{2}$

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Plate 4.

REMARKS =

DATE_CREATED = 31/08/69

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE900018 is enclosed within the container PE904908 at this location in this document.

The enclosure PE900018 has the following characteristics:

ITEM_BARCODE = PE900018
CONTAINER_BARCODE = PE904908

NAME = Structure Map

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = SEISMIC

SUBTYPE = HRZN_CONTR_MAP

DESCRIPTION = Flathead 1 Structure Map Top of Latrobe

Complex. Plate 3.

REMARKS =

 $DATE_CREATED = 31/08/69$

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE904909 is enclosed within the container PE904908 at this location in this document.

The enclosure PE904909 has the following characteristics:

ITEM_BARCODE = PE904909
CONTAINER_BARCODE = PE904908

NAME = Geological Cross Section A-A'

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = CROSS_SECTION

 ${\tt DESCRIPTION = Flathead \ 1 \ Geological \ Cross \ Section}$

A-A'. Plate 5.

REMARKS =

DATE_CREATED = 31/08/69

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE904910 is enclosed within the container PE904908 at this location in this document.

The enclosure PE904910 has the following characteristics:

ITEM_BARCODE = PE904910
CONTAINER_BARCODE = PE904908

NAME = Geological Cross Section B-B'

BASIN = GIPPSLAND PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = CROSS_SECTION

DESCRIPTION = Flathead 1 Geological Cross Section

B-B'. Plate 6.

REMARKS =

 $DATE_CREATED = 31/08/69$

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE904911 is enclosed within the container PE904908 at this location in this document.

The enclosure PE904911 has the following characteristics:

ITEM_BARCODE = PE904911
CONTAINER_BARCODE = PE904908

NAME = Time-Depth Curve

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = VELOCITY_CHART

DESCRIPTION = Flathead 1 Time Depth Curve. Plate 7.

REMARKS =

DATE_CREATED = 9/03/70

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

2. LITHOLOGY

Lithology:

865 to 1040 feet: 1

Marl: light green, fossiliferous, massive, soft, slightly glauconitic, interbedded with coquina and trace sand.

1040 to 1130 feet:

Marl as above, interhedded with coquina and limestone, hard, micritic, skeletal.

1130 to 1340 feet:

Limestone interbedded with marl. coquina and trace sand.

1340 to 1525 feet:

Mudstone: light grey to light green, very soft to moderately firm, non-calcareous, grades to shale.

Shale: light green to light grey, soft, non-fissile, silty.
Siltstone: medium to dark brown, hard, glauconitic, non-calcareous

1525 to 1545 feet:

Sandstone: unconsolidated, very fine to coarse-grained, rounded to sub-angular grains, pale yellow fluorescence and weak cut.

Core No.1 1545 to 1549 feet; cut 4 ft, recovered 2 ft:

Barrel jammed.
Recovered 2 feet of unconsolidated sand, very fine to coarsegrained, good fluorescence, cut and odour.

Core No.2 1549 to 1555 feet; cut 6 ft, recovered 6 ft.

<u>Sandstone</u>: few thin shale streaks, good fluorescence, odour and cut.

Core No.3 1555 to 1576 feet; cut 21 ft, rec. 16 ft:

13 feet massive <u>sandstone</u>: fine to coarse grained, light brown, bright yellow fluorescence, good cut and odour.

2 feet cross-hedded sandstone, shows as above,

Core No.4 1576 to 1607 feet; cut 31 ft, rec. 31 ft:

Top 6 inches Shale.

7 feet Shale.

3 inches Sandstone no show.

1 foot Sandstone; no show.

2 feet Shale.

1 foot Sandstone; no show.

1 foot <u>Siltstone</u>.

2½ feet Sandstone; no show.

Bottom 14½ feet Shale interbedded with sandstone with shows.

CONT. 1607 to 1660 feet; <u>No.</u>5 cut 53 ft, rec. 47 ft: 3 feet Interbedded sandstone and shale with fluorescence, cut and odour. 2 feet Sandstone and some shale; good fluorescence. Sandstone: massive, good show. 3 feet 3 inches Shale. 1 ft 9 ins Sandstone: massive, good show. 9 feet Interbedded sandstone and shale; good show. 4 feet Sandstone with shale laminae; good show. Siltstone: light grey, no shows. 6 inches 2 ft 6 ins Interhedded sandstone and siltstone; good show in sandstone. Sandstone: massive, fine to 10 feet medium-grained, fluorescence, odour, cut and bleeding gas. Shale: with some coal. ll feet 1660 to 1716 feet; cut 56 ft, rec. 56 ft: Core No.6 Shale: medium grev, silty, 4 feet slightly carbonaceous, rare plant debris, blocky. Sandstone quartz to quartz wacke, 1 foot light grey, very fine to fine grained, sub-angular, well sorted, abundant lithics and clay, poor visible porosity, slightly friable, no shows. 26 feet Shale as above. 15½ feet Sandstone as above, no shows Sandstone: dolomitic, no shows. 1 feet Sandstone: non dolomitic, 1 feet slightly friable, no shows, Sandstone: dolomitic. 11/2 feet Sandstone: non dolomitic, friable, 4½ feet no shows. Sandstone: dolomitic. 1½ feet 1716 to 1840 feet: Sandstone: mixed as above, some with calcareous cement. Claystone: white, soft, fissile, 1840 to 1980 feet: light grey, waxy blocky shale. trace sand.

Sandstone as above, noted trace 1980 to 2000 feet: pink and green chert, fine to medium grained.

Clay and shale with occasional 2000 to 2070 feet: coal streaks.

Cuttings lost. 2070 to 2092 feet:

Lithology: CONT

2092 to 2142 feet: Drilled while cleaning up hole.

2142 to 2810 feet: Mainly shale, grey, blocky, minor

quartzwacke, very fine to mediumgrained, abundant lithics and unweathered feldspar, interstitial clay and dolomitic cement, poor porosity and permeability, rare

thin <u>coal</u> bed.

2810 to 3472 feet: Interhedded siltstone and shale

with some quartzwacke.

Core No.7, 3472 to 3494 feet, cut 22 feet, rec. 22 feet

3472 to 3493 ft 6 ins: <u>Sandstone</u>, arkosic, slightly dolomitic, very fine to fine-grained with some medium-grained, abundant lithics and feldspar, poor porosity, no shows.

3493° 6" to 3494°: Shale, grey to light grey, carbon-aceous, hard:

No significant gas readings.

Test Results:

F.I.T. No.1, 1648 feet - 2000 ccs filtrate, scum of oil.

No.2, 1644 feet - 1500 ccs filtrate.

No.3, 1555 feet - 3500 ccs mud - packer failure.

No.4, 1498 feet - 1000 ccs filtrate

No.5, 1645 feet - 2000 ccs filtrate, scum of oil,

No.6, 1484 feet - 1700 ccs filtrate.

No. 7, 1567 feet - mis-run.

No. 8, 1567 feet - mis-run.

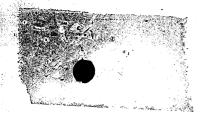
No. 9, 1567 feet - 1700 ccs filtrate.

No.10, 1625 feet - mis-run.

No.11, 1625 feet - 2000 ccs filtrate.

Production test - 1607 to 1652 feet - nil returns (see above).

2.1 CORE DESCRIPTION



ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No.



WELL: FLATHEAD - 1

Interval Cored 1545-1549 ft., Cut

ft., Recovered 2 ft., (50 %) Fm. LATROBE

Bit Type C-14, Bit Size

in., Desc. by J. BLACK

	Depth & Coring Rate (min./ft.)	Graphic (1" == 5')	Shows	Interval (ff.)	Descriptive Lithology
45	0 10 20 30 40			SAND-Cleak	FROSTY WHITE QTZ F/CRSE W few WELL
					PEBB. TO 3 cm. UNCONSOL. SUBANG TO SUB RN
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	REMARKS:	MALES ME MERCHANISM PROGRAMMENT THE PROPERTY OF	MEANING CANCENSINGS		

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No.



WELL: FLATHEAD # 1

Interval Cored /549-/555 ft., Cut 6

ft., Recovered

6

ft., (100 %) Fm. 24T12013E

	Bit Type C-2	Z , Bit	Size	in., Desc. by J. BLACK Date 4/5/69
	Depth & G Coring Rate (min./ft.)	raphic " 5") Show	s Interval (ft.)	Descriptive Lithology
	0	····	1549-50/2	SAND - BRN WH. F/m & SUBBNG OTZ WYCON-
50				SOL. W/ few 1/2" BRN-gry consold shale
	· · · · · · · · · · · · · · · · · ·			Streaks. SD. has 6000 EL., 6000 CUT, FAIR
				ODOR, STAINED.
	.0.		1 '	1/2 SAND - AS ABOVE BUT SPOTTY FL. 6000
55		?:::6:	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	CUT, FAIR ODOR.
	,		15531/2 - 56	. SAND - Cl. & FROSTY WH. F/V. CRSE OTZ
			103012 33	
				W/ few Q72 Pebbles To 3 CM. 6000 FL 600P CUT & ODOR!
				600p EUT & 000E.
	• • •			
	• •			
٠.		,		f = f(x)

ESSO STANDARD OIL (AUSTRALIA) LTD. CORE DESCRIPTION



•		•	WELL: Flotherd-1
erval Cored	1555-15	75 81.,	Cut 20 ft., Recovered 16 ft., (%) Fm. Latrobe
Туре	- 22	, Bit Siz	to 8 1/6" in., Desc. by R.V. Hicks Date 4 May 190
		r	
Depth & Coring Rate	Graphic (1" = 5')	Shows	Interval (ft.) Descriptive Lithology
(min./ft.)	(, 0)		
	00000	0	
	·· - Ħ.		1555-56 Conglomerate, granule to pebble size
	7		rounded after chert fragments, spotty
	A.		flour due to flushing
	7.		
	· A · · A		1556-1569 Sandstone (Quartewacky) It. fon to It gray
			w/ green cost ± 60% gtz grs abundant lithic
	. Δ.		withd felds chart i butife detrital asphalt.
	7 4 4		grains, rd to e size, sit yes it to foce on
	.□		sub rd, med world wholy plugging abuna
	7 4		poor vis por perm. friable, good even yel-y
			green flour, good to ex flush ; rib ent, g odor.
	a. :		Mossive.
			1569 - 1510 34 Sandstone as, thin law of large sca
			X bedding
			15mm 3/4-1571 Shale - m H
			150034-1571 Shale - m It gg, muca, waxy, micro X-lam with It gy silfstone mica, w/sho.
			79 2113,410 3110
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ARKS:		•	

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Туре	C-ZZ	, Bit Si	e 8 5/16 in., Desc. by R.V. Hicks Date 4 May 190
Depth & Coring Rate (min./ft.)	Graphic (1" = 5")	Shows	
			1576-1576/2 interlaminated shale i sandstone shale in
			waxy v fine mica, from laminated
H + H + H		, i	1576/2-84 Shale as
			13 /012-04 Shale 44
	1		
	20	6	1584-1584.25 55 w/ shale lamin, 55. Vf, It gg, abdt lith
		τ	dy choked pois de'k, g flour yel, cut, goods
- - -	<u> </u>	,	1584.25 - 1586 Shale aa.
			1586-1587 Sandstone ut-f Itgy an N.S.
	M M M		1587-1589 Shale aa
			1589-1596 Silfstone in 1797 N.S.
			1540-1542.5 Sandstone ut gr, abdt. lithies & dogs
			biotite comman, sub ang, w sutd, p &! K.
		€	1592.5-1607 Shale as w/ interlaminated ss
		_	and thin beds of sandstone 4-6" thick
$\ \cdot\ $		Ø	Sandstone - ut f, subang to suled as 54.
			about lithics and cly, weathered felds
	21.11.11	69	5/k i green chart common sands w/
		6	g even yel flour, gent i odor
	7.7.7	6	
	-		
	_		
		ä	
	<u>Lina</u>		
AARKS:			
•	,	·	

esso standard oil (australia) ltd. CORE DESCRIPTION

ared Cored (1627-1660 ft., Cot. 5.3 ft., Rocovered 5.7 ft., (100 %) Fm. ATROBA Type. C-11. Bit Siro 0 5/16 im., Doss. by RV. Hicks. Date 5 MAY 19. Deptih & Graphic (im., ft.) Descriptive Lithology (min, ft.) Lot. 1007-1610 intertains 55 ft.h. 55 gt.wash, st. world, sub-an intertains 50 ft.h. 50 gt.wash, st. world, sub-an intertains 50 ft.h. 50 gt.wash, st. world, sub-an intertains 50 ft.h. 50 gt.wash, st. world, sub-an intertains 50 ft.h. st. world, sub-an intertains 50 ft.h. st. world, sub-an intertains 50 ft.h. 50 gt.wash, st. world, st. world, stand 50 gt.wash, st. world, st.		•	•	•		WELL: FLATHEAD - !
Type C-11 , Bit Sire & Stock in, Dose, by Relitables Date 5 MAY 18. Depth & Coring Rate (11-5) Shows Interval (11.) Descriptive Lithology MOT-1010 Interlance St. 45h. se-glawack, eth worth, sub-an it gay, lith i sleg comment, for 4th, for gat them front gas shall be shall be side. Shale - Shale - Shale maga, make the shall be side. Shale - Shale - Shale maga, make, least four tents are shall be side. Shale - Shale - Shale maga, make, least four tents are shall be side. 1615-1617 Sandstone as a state as for shall be shall be side. 1615-1617 Sandstone as a state as for shall be shall	1	Carad	1607-16	40 4	Cut (5.3 St Pacayared 5	53 # 1 100 % Fm LATROBE
Depth & Crisplate (1"=5) Shows Interval (11) Descriptive Lithology (Interval (11) 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1007 1000 1007						
Coing Rate (min, /th.) 1007	Type		C-//	., Bit Siz	e 8 3/16 in., Desc. by 7	R.V. HICE'S Date 5 MAY 196.
Coing Rate (min, /th.) 1007	Dent	15 &	T	T		
Manufall 1607 16	Coring	g Rate		Shows	Interval (ft.)	Descriptive Lithology
16 1. 10 1.	(min.	./ft.)	(1 3)			
MOT-1610 Interior as fish as explained, it worth, and an it is a construction of the first of th				4 _		
1 gg, 1th i clay common, for deth, for gal flow, for cat, go Shale - dk gray, carb mica 10.00 10.12-10.12 Se of occ this sh lam, 1tho as 10.12-10.15 Se th gray glownet, or - what ledds, biolife clay common, pear vis deth, Good Plan tent. 10.15-10.15-10.15-10.15 Shele, in gay, mica, lem to fis. 10.15-10.15-10.15-10.15 Shele, in gay, mica, lem to fis. 10.15-10.15-10.15-10.15 Shele, in gay, mica, lem to fis. 10.15-10.16	++	10	. ~ - 17/2	19	1607-1610 interlam ss & st	ss- atzwack, vt, world, sub ang
Shale - dk gry, canh mice 101-12 Ss. of occ thin sh lam, litho an 1012-1015 Ss. of occ thin sh lam, litho an 1012-1015 Ss. of occ thin sh lam, litho an 1012-1015 Ss. of occ thin sh lam, litho an 1012-1015 Ss. of occ thin sh lam, litho an 1012-1015 Ss. of occ thin sh lam, litho an 1012-1015 Ss. of occ thin sh lam, litho an 1012-1015 Shale, may, mica, lam to fis. 1012-1016 Interlam ss is to ss. of occ the occ thin side of the occ thin and the occ thin side occ the occ thin side occ thin coal sthe occ thin coal state occ thin state occ thin coal state occ thin state occ		12	18: a']		
1618-1615 Se. Morry oftenack, which ledder biolished color of common, pror in Both, Good Plant of cut. 1618-1618-25 Shele, many, mue, lem to fis. 1618-1618-1617 Sandstone as a 1618-1618-1617 Sandstone as a 1618-1618-1617 Sandstone as a 1618-1618-1617 Sandstone as a 1618-1618-1618 Shele, as fish, se fished to fish of shelp to fish of shelp to fished	\vdash	+++			· · · · · · · · · · · · · · · · · · ·	
1612-1615 Se, Herry glewack, with which ladds, brothile clay a clay common, provint of the Great Plane death of the class of the control of the class of the control of the control of the class		15		† 2	•	
cloq common, pror vis 81k (rood flour & cut. 1615-1615.25 Shele, in qu, mica, lon to fis. 1615-25-1617 Sanditone aa 1617-1626 interlan ssish ss fit wash, st for any mica, K-6 1617-1626 interlan ssish, ss fit wash, st for any mica, K-6 1617-1626 interlan ssish, ss fit wash, st for any mica, K-6 1617-1626 interlan ssish, ss fit wash, st for any mica, K-6 1620-1630 Se welf out sh lan, st sh clast to Mi-1 1630-1630-5 Stista, will ga, Mi. 1630-1630-6 Stista, will ga, Wi. 1630-1630-6 Stista, will ga, Wi. 1630-1630-6 Stista, will ga, Mi. 1630-1630-6 Stista, will ga, Wi. 1630-1630-6 Stista, will ga, will ga, Wi. 1630-1630-6 Stista, will g		1 1		1 4	1610-12 35. w/ occ than	sh lam litho aa
cloq common, pear in Off, trood floor cont 165-1615-25 Shale, may, muca, lean to fix. 165-1617 Sandstone as 1615-162-1617 Sandstone as 1617-1626 Interlam se of sh. se - (gtewach) ell-vf. 18 1617-1626 Interlam se of sh., sh., sh., may mica, k-b 1618-1630 Se, all out sh. lon, of sh. clast to 19"-1" 1620-1630 Se, all out sh. lon, of sh. clast to 19"-1" 1630-1630-5 St. fet, v. H. of N.S. 1630-1630-5 St. st., v. H. of N.S. 1630-1630-5 St., v. H. of N.S. 1630-1630-6 St., s., s., s., s., s., s., s., d. of s., d. of s., s., d. of s., s., d. of s., s., d. of			l ·		1612-1615 Ss, It gry, gtz.	wack, ut-t, which telds, biotite,
1615-1615.25 Shale, may, muca, lear to tis. 1615-1615.25 Shale, may, muca, lear to tis. 1615-1617 Sandrone as 1617-1626 Interlam so ish, as Ifterack) off-uh, the 1615-1630 So, caf oct sh lam, o' sh clast to 1/9"-1" 1626-1630 So, caf oct sh lam, o' sh clast to 1/9"-1" 1626-1630 So, caf oct sh lam, o' sh clast to 1/9"-1" 1630-1630.5 St to the did st short of ss as N.S. 1630-1630.5 St to the did st short of ss as N.S. 1630-1630.5 St to the did st short of ss as N.S. 1630-1630 Sh to the did st short of ss as N.S. 1630-1630 Sh to the did st short of ss as N.S. 1630-1646 Ss. 11 gg, f-m, subang-subah, w sold (glows abundant lith i cloy, p air gik, g yel flow 1640-1660 Sh, mgg to dkgy, v finely lam o' x-b- 1640-1660 Sh, mgg to dkgy, v finely lam o' x-b- 1640-1660 Sh, mgg to dkgy, v finely lam o' x-b- 1640-1660 Sh, mich common, oic shin coal stk.					clay common, poor	vis & tk, Good flour & cut.
1615.25-1617 Sandstone as 1617-1626 Interlam so ish, as - (gtewack) ell-uf, the 1617-1626 Interlam so ish, as - (gtewack) ell-uf, the 1617-1626 Interlam so ish, as - (gtewack) ell-uf, the 1617-1626 Interlam so ish, as - (gtewack) ell-uf, the 1626-1630 So, colock sh loon, e' sh clast to 1/9"-1" 1626-1630 So, colock sh loon, e' sh clast to 1/9"-1" 1630-1630.5 Sltston, v ll eg NS. 1630-1630.5 Sltston, v ll eg NS. 1630-1630.5 Sltston, v ll eg NS. 1630-1630.5 Sltston e an 1630-1630.5 Sltston, v ll eg NS.		44				
1017-1020 interlam ss & sh , ss (stream) struct 11 11 11 11 11 11 11 11 11 11 11 11 11		2	F. Ill's F.	1	,	
w setd, same ely, g. sha, Sh m qy mica, X-b 120-1630 So, cof oa sh lam, g' sh clast to 1/9"-1" ss, vf-f, It fen-Ity, about tithic s'clay, g. sh 1630-1630.5 St ston v Il gy NS. 1630-1630.5 Johnshild st st shon g' ss an NS. 1632-1630.5 St ston an 1633-1630.5 Johnshild st st shon g' ss an NS. 1630-1640 Ss. Il gy, f-m, subang-subod, w sold (gtows abundant lith g' clay, p ais \$9tk, g yel flow q. cut, q. odor, blooding 056 1640-1660 Sh, m gy bo dkgg, v finely lam o' X-ba carb, mica commen, occ thin coal stk.	$\vdash \vdash$	- - ,		1.		
126-1630 So cof oa sh lom g' sh clast to 19"-1" 55, wf f, it fen-thyn, about tithic s' clay, g, sh 16305-1630.5 Sthsta, v Il gy NS. 16305-1630.5 Sthsta as 16325-1636 Jahredd sthsta g' ss as N.S. 16325-1636 Jahredd sthsta g' ss as N.S. 1630-1646 Ss. Il gy, fm, subang-subad, w sold (gtzwa abundant lith g' clay, p air 8th g yel flow g. cut, g oder. bleeding 056 1646-1660 Sh, m sy to dk gy, v finely lam g' x-ba carb, mics commen, occ this coal sth.	\vdash		m m m	7		
55, ut-f, it ten-thy, about lithics sidey, q. she 150-1630.5 Sthate, ut gy NS. 1630-1630.5 Sthate, ut gy NS. 1630-1630.5 Sthate ship so an NS. 1630-1630.5 Sthate aa 1630-1630.5 Sthate aa 1630-1646 Ss. It gy, for, subang-subod, w sold (glows abundant lith sidey, p ais gik, g yel flow. 9. cut, g oder, blooding OSG 1646-1660 Sh, m sy to dk gy, v finely lem i x-be carb, mics commen, occ this coal stk.		++		1		
1030.5 - 1630.5 Stylen, v Hay NS. 1630.5 - 1632.5 Jeterbeld stylen of ss an NS. 1632.5 - 1636.5 Stylen an 1632.5 - 1636.5 Styl		3	m m	0		
1630.5-1632.5 Johrhold stirting so an MS. 1630.5-1632.5 Johrhold stirting so an MS. 1632.5-1636 Johrhold stirting so an MS. 1630-1646 Ss. 1690, from, subang-subod, world, Cateward of the sclop, pair of the graph of the sclop, pair of the graph of the sclop, pair of the graph of the school of						
10325-1038.5 Sttsten aa 10335-1036 Interbedd sttsten of 55 for 1030-1046 Ss. If any, from, subang roubed, world. (gtzwar abundant lith of clay, pais & fk, gagel flows q. cut, godor, bleading OSG 1046-1060 Sh, may to dk any, v firstly lam of X-60 carb, mich commen, occ thin coal stk.					1630-1630.5 Slfstn, VH	9 4 NS.
1635-1636 Jahredd stholm i so en 1636-1646 Ss. It gy, frm, subang-subrd, w sold. (gtown of subrance) 1636-1646 Ss. It gy, frm, subang-subrd, w sold. (gtown of subrance) 1646-1660 Sh, m gy to dk gy, v finely lem i x-6- 1640 1640 1640 1640 1640 1640		11				
1635-1636 Johnbold storm & ss & ea 1636-1646 Ss. It gy, f-m, subang-subod, w sold, (gtown abundant lith & clay, p ois & & g yel flow g. cut, g odor, blooding O& G 1646-1660 Sh, m gy to dk gg, v finely lam & x-6- 1660 1660 1660 1660		44	=		11032.5 - 1038.5 Sltsfn 44	
1636-1646 Ss. It gy, fon, subang-subod, w sold (gtows abundant lith sicloy, p ois \$5'k, q yel flour g. rul, g oder, blooding OGG 1646-1660 Sh, m gy to dk gy, v finely lam o' x-be carb, mich commen, occ this coal stk.				1 '		t ss sa
abundant lith & clon, p ois & & k, q yel flow g. cut, q odor, blooding O&G 1046-1060 Sh, m gy to dk qq, v finely lem o' X-60 carb, mich common, occ thin coal stk.	├┼	++				
1646-1660 Sh, my to dk gq, v finely lem i x-6- carb, mich common, occ thin coal stk.	\vdash	++	4-			
160 1660 Sh, my to dkgy, v finely lem o' X-60 rarb, mich common, occ thin coal stk.		++				
1660 rarb, mich common, occ thin coal stk.			15-2		•	
160 1660 rarb, mich common, occ thin coal stk.			111 B		1646-1660 · Sh, mgg to	dkgy, v finely lam of X-6da
	 	- 6	1/4/40	+		-
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ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

			WELL: FLATHEAD-1
nterval Corec	1660-17	16 ft.,	Cut 56 ft., Recovered 56 ft., (100 %) Fm. LATROSE
			to 8 5/16" in., Desc. by R.V. HICKS Date 5 MAY 1960
Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.) Descriptive Lithology
)			
	A THE		1660-1664 Shale m grey slfy, sl carb, rare
	· · · · · · · · · · · · · · · · · · ·	.	plant debris, blky
++++	- M		1669-1665 Sandstone (Quartewacky) It gray, vt-fg
			subong world, about lithics & clay N.
+++			1665-1691 Shale 49
	- M	,	
1	=		
	s.4' "		1691- 1706.5 Sandstone, Egtzwacky) wt-focem, saba.
	4		
++++	PAP		well sold, Lithius butife, clay abdt, poor
	. B		
	4. 6		
	B		1706.5 -1708 Sandsfore dolic, It gy, uf-t, sub any
	3.0.4		w sorth, Lithice common, hd, tt, NS
+++	1 1 1 A		1708-1709.5 Sandstone Non dolic, aq
	4 4 4 8		1709.5-1711 Sandstone dolic aq
16	2.2.2.0		1711-1714.5 Sandstone non delic aq
		•	1714.5-1716 Sandstone dolic an
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MARKS:			

ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION

Core No. Z

Depth &				by R.V. Hicks Date 11 May 19
Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
34.17				
1			2012 - 3093.5 Com	defune (arkosic) very slightly
				censh grey, very fine to fi
			_	edium, angular to sub angula
				lite green and red feldspor
		•	_	and possible some plagaclase
		Ì	• /	
		1	<u> </u>	mon, intersheal clay, course
	· · .			ene detrital coal grains
		•		in this bands along depos
				es in lower parties of con
		•		from 200 to horizon find perto.
			- Indicating	Seach environment
		.		
	· ·	Ì		
		ŀ		e, medium light grey in contr
		ŀ		brown grey carbonaceous sha
		ŀ		small horresonfal burrows at
3494	13	ŀ	contact.	forge (fo 1") sand filled by
		ŀ	westical f	uson overlying sand Probab
		ł	(ndicating	black and short face environ
 		ı		
		•		
		\$		
		•		
MARKS:		•		

2.2 SIDE WALL CORES

	OF 3 PA	PROB. PROD.												*						•	la g	A.			5		
GEOLO	PAGE	SHOW						,		ar severatur as				turbuses.	N MET ATURADE MET										Marine State		With the same
<u> </u>	31	CUT FLUOR.							·				- Breedy washing a company					VIII									
SUN NO.	REC.					alliveno nytopogy	-	alle alle a secondore			PULTURA I	and the same and	Zakukaan ka										-				FORMUNETONISM
69 LOG RUN NO.	ATT. 34	CUT N COL			`					-	•		· · · · · · · · · · · · · · · · · · ·		- THE STATE AND ADDRESS OF								***************************************				O dražnavej
	AT	OUA				MIRAL MOTEON SC					ut sales Circ di Paris de construit.		An an all descrived		A2407-4544		mahomatiza tizz	William we know associ									NEWS PROPERTY
UATE 30/4,		SENCE COL									ear II water to the				O-TO DESCRIPTION OF SEC							-	MINOR GENERAL				MEN MONEY S
UATE	120	FLUORESENCE ST INT CC			i de la company de la comp			~*************************************			YERON MINIS		************														MORE OF A PORTUGA
	Ž.	ā						-						*****				PER MINISTER MANAGEMENT					: Will Control on the				
SERV.CO. Schlup	STATE	R FIDO				Section					******* *****************************				(anti-1919)			-					ar as Challana	·			Luciosares se
. co.	SI	.c. obor		Carried Sec. Spirit		o manda na C			and the same of th				James Recommended (SANS-SANS-SANSON			**************************************					ak interioriye				Numero est un
S E E		IS CALC	7.	enspulseer vagsgal free (7	THE TENENCH LOS	7		7		7	7		7		7.			7			7	-	7			STONY STERNING W
	9	S Y CONS			•			1345/2000			**************************************	-							zandrom seremen				kinesik (Shorrak)				errolekkirizen
	5/000	DISS R CLAY	2.		ठे	on substitution of the same of	€ .	an terior de la constante de	25		ż	- Ca		24		f.	Q. A. C. S					37.	Markova artis ere	37			Na specimi stud
#]	61205	COLOR	11.qv.		: /+ GRA		17.9m.		: 14. GRA	,	1+. gm	THE RESIDENCE OF THE PARTY OF	-	17.9rm		buff Wh.			17.		21 11 11 11 11 11 11 11 11 11 11 11 11 11	ctom arx.		Harn	-		
SIBLUMALL CORE DESCRIPTIONS WELL FLATIFAL	REF." FIE	NO. DEPTH REC LITHOLOGY	1 1337 134 Shale - 14. GRY, V.SOFT	CALC,	2 1320 1/2 Shale - 14. GRM. 11. Soft N.CALE.	foss, MASS Clayey, Plastic	4	V. FOSS. SOFT - M. FIRM.	155,50ET.	RECOV. SEE SPL 34	1270 124 Shale- Ham, CALC, Foss Soft	1254 134 Shale-Med GRY, CALC. N. 4055	-	101	W/ f-VF, a. V. GLAUC., V. FOSS	14 W/ 30% SPI		falk Mich. Tr. f.a. So. V. foss	-	Sugary textune TIE glau		77	TR. 0/246, W/OK 15, FRAG	ai8111	-	of DK gru Sh, glawc?	

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SOE	SIDENALL CORE DESCRIPTIONS	DESC	SRIPTIONS WELL FLATHEAD	/# (SER	SERV. CO. 5CH,	um	DATE 30/4/69	39/15	LOG HUN NO.	N NO. /	, 1	GEOLOGIST	J BLA
			REF.# FIELD 61	PPS TANG		STATE	110	Ris	. V	ATT.34	REC. 3	/ PAGE	2	OF 3 PAGE
ž O.	ОЕРТН	REC	LITHOLOGY	SS	CONS CALC	ODOR	FL FIDO DIST	UORESEN	يا	QUAN COL	CUT FLUOR		SHOW	ROB, PROD.
/3	1205	2"	<u> </u>		7									-
			FAIRIV FI									•		
14/	1194	. /	SHALE - /+ GRY, 3	LT-6121	7.									•
			Foss	,										-
15/	787	7"	SHALE-M.GRY,	4. GRV	V.						·			
7	1/67	13/	SHALE-M. GRY. F.FIRM.		7	DOMESTIC TO			•					·
							a participan						•	
2/	1150	13,	SHALE-	,		UTBOOK K KINGBOOK		•					#1.000.000 0.000 .00	
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FLATHEAD - 1 Side Wall Cores





1374	Rec. 2" Mudstone to Marl. Very light green grey. Glauconitic, with abundant skeletal debris.
1400	No Recovery
1417	Rec. 2" Mudstone as above.
1436	No Recovery
1455	Rec. 2" Mudstone as above
1464	No Recovery
1476	Rec. 2" Siltstone brown very argillaceous (almost silty shale) very fine mica, poor visible porosity and permeability, very faint yellow florescence very poor cut.
1484	Rec. 2" Siltstone as above, with good cut
1499	Rec. 2" Siltstone brown very glauconitic, very argillaceous, very faint spotty florescence, very poor cut, poor visible porosity and permeability
1495	Rec. 1 3/4" Siltstone brown very glauconitic, argillaceous, dull spotty yellow florescence slow cut, poor visible porosity and permeability.
1498	Rec. 2" Siltstone, brown, glauconitic argillaceous, soft, friable, show as above.
1508	Rec. 2" Siltstone as above.
1516	Rec. 2" Siltstone as above.
1525	Rec 1 3/4" Siltstone as above with slight visible porosity and permeability, very faint yellow florescence, slow cut.
1533	Rec. 2" Siltstone as above.
1538	Rec. 2" Siltstone as above.
1543	Rec. 2" Siltstone to very fine grained sandstone, light tan grey, slightly argiflaceous, friable, fair visible porosity and permeability.
1948	Rec. 3/4" Sandstone very light grey, (salt and pepper sandstone) very fine grained, sub angular, well sorted, friable, good porosity and permeability. No show.
1965	Rec. 1½" Shale, light grey, silty, waxy, soft.
2042	Rec. 121 Shale as above.
2253	Rec. 1 1/8" Shale, medium grey, blocky soft.
2324	Rec. 1 1/8" Shale, medium light grey, slightly silty, waxy, with scattered carbonaceous debris.
2430	Rec. l_2^{11} Shale, as above.
2775	Rec. 3/4" Shale, medium dark grey carbonaceous blocky.

FLATHEAD - 1 S.W.C

Rec. ½" Shale, as above.

Rec. 3/4" Shale, black, very carbonaceous

Rec. 3/4" Shale, medium dark grey, silty, micaceous, blocky.

Rec. 3/4" Shale as above.

2.3 CORE ANALYSIS RESULTS

Petroleum Teck ogy Laboratory, Bureau of Mineral Resources, Geray and Geophysics, Canberra

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. ____FLATHEAD_No. 1______

DATE ANALYSIS COMPLETED OCTOBER 15, 1975

				ı .		. 1	Pa	ge i	1 01
Sample "cut" in tetrachlorethylene		ροου	pood	N.	paod			pood	fair
Fluorescence of freshly broken	core	Dull irregu-	Good even	N 3 1	Good even	Fair irregu-	Dull irregu- lar yellow	Dull even	Dull yellow
Acetone	lest	Strong	/.strono				Trace	Fair	Trace
Core Water Salinity	(p.p.m.	N.D.	. O.						N.D.
ace)	011	17.1	26.0	2	15.2	8.5	9*4	20.6	13.0
Fluid Saturation (% pore space)	Water	57	33	27.	£ 1	29	69	52	43
Average Density (gm/cc.)	Dry Apparent Bulk Grain	N.D. N.D. 1.92 2.94	N.O. N.O. 1.71 2.69	56 2.11 2.77	31 1.84 2.56	N.D. 240 >1.83 2.69	<0.1 N.D. 1.99 2.67	4.2 N.D. 1.90 2.60	4.8 5.1 2.02 2.67
	Dry Bulk	1.9%	7,	2.11	78		1,99	1.9(2.03
Absolute Permeability (Millidarcy)	=	O.N	Z	56	<u> </u>	240	○ N	2 N.D.	3 5.1
Absolute Permeabi (Millida	>	O N	2	90	16	N C	Ö	4	4.
Average Effective Porosity	two plugs (% Bulk Vol.	32.9	36.4		<u> </u>	31.8	25.6	26.9	25.0
Lithology		Sst;f.gr.to	Sst;m.gr.	158987# Sc+v f or	1603'0" Sletearen.	Sst;m.gr.	Slst:aro.	Sst;m.gr. arg.grwke.	Sst;f.gr. 1631'4" arg.
	To	1554 101	Sst;m.gr.	1589171	1603 101	161110#	161717# Slst.arg.	1625 "0"	Sst;
Sample Depth	From	2 155310#		†	}				5 1630°4"
Core No.		2	~	†	-4	1	1	Ω.	ß

Remarks: - Core No. 1 - insufficient sample

General File No. 62/399 74/1076 Well File No.

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General File No. 624/395% 74/1076

Well File No.

logy and Geophysics, Canberra cology Laboratory, Bureau of Mineral Resources, G Petroleum Tec.

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. FLATHEAD No. 1

DATE ANALYSIS COMPLETED _OCTOBER_15__1975.

1		N.		1	3				1	
	one in the test and in the contract of the con	ימחקופ יכער זו נפנרמכווטרפנווץופופ	falr		N1]	N. 1		[] 	N.S.	N1]
-	escence eshly an	9 1 9	Good even	Dull irregu- lar yellow	-	N. J.	Trace dull	2	. I	N3.
	Acetone	lest	Trace			-		-	. (N 11
	Core Water Salinity	(p.p.m. NaCl)	N.D.	N.D.	N. D.	N.D.	N.D.	N.D.	N.D.	N.D.
	Fluid Saturation (% pore space)	011	1.0		[]	Z N	-	NIJ	N: J	N 1.1
1 1 1 1 1 1	Fluid Saturation (% pore sp	Water	53		r ₄ 3	99	23	47	59	
	erage insity im/cc.)	Dry Apparent Bulk Grain	1,88 2,65	90 2, 69	1.97 2.66	1.96 2.67	2,69	1.97 2.67	1.7 5.2 1.97 2.66	42 2.69
1	\$ 6 5	Dry Bulk			1.97	1.96	2.52	1.91	1,97	2.42
1	Absolute Permeability (Millidarcy)	Ŧ	0.51 6.8*	6,9		3.7	<0.1 < 0.1 2.52 2.69	56	5.2	K0.1 < 0.1 2.
į	Absolute Permeabi (Millida	>	0.51	ර ර	6	5.5	<0.1	105	1.7	K9.
	Average Effective Porosity	two plugs (% Bulk Vol.	27.3	29.3	26.3	26.5			25.9	
	Lithology		Slst	Sst;m.gr. grwke	Sst;f.gr. grwke	Sst;m.gr. orwke	170412# as above	Sst;f.gr.to 1709	Sst;f.gr. oryke	Sst;f.gr. grwkg
		Jo	1652111 Slst	Sst;m.	Sst;f. 1692*0" grwke	Sst;m.	170412#	1709 69#	1713'0" Gryke	Sst.f. 3476'0" grwke
	Sample Depth	From	16521111	166310"	169111#	169710#	17031711	1709 10"	1712111	
į	Core No.		7.	ပ					Ç	7

Remarks: - * - Fractured

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and Geophysics, Canberra bgy Laboratory, Bureau of Mineral Resources, Ge Petroleum Tech

CORE ANALYSIS RESULTS

(i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. FLATHEAD NO. 1

DATE ANALYSIS COMPLETED OCTOBER 15, 1975

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	Sample "cut" in tetrachlorethylene		N11						
	orescence freshly ken	core	N3.1						
	Acetone	lest	12						·
	ge Fluid Core Fluid ty Saturation Water of of .c.) (% pore space) Salinity Acetone bro	(p.p.m. NaCl)	N.D.						TT
	on space)	110	=						·
	Fluid Saturati (% pore	Water	27	1					
	ige ty :c.)	Dry Apparant Bulk Grain	2.61						T
	Average Density (gm/cc.)	Dry Bu 1k	2,39		1				
	Absolute Permeability (Millidarcy)	=	<0,1 < 0,1 2,39					<u> </u>	-
	Absolu Permea (Milli	>	<0,1			!			
	Average A Effective P Porosity (two plugs (% Bulk Vol.	8 , 6						
	Lithology		Sst;fogr. grwke						
	v _	10	347987#						
	Sample Depth	From	347912# 347917# grwke		-				
	Core No.		7						

Remarks: -

General File No. x8x/8800x 74/1076

3. PETROCAAPHY AND CLAY MINERALOGY



Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063 Phone Adelaide 79 1662 Telex AA 82520

> Please address all correspondence to P.O. Box 114 Eastwood SA 5063 In reply quote:

OIL and GAS DIVISION

5 AUG 1980

amdel.

29 July 1980

GS 3/205/0

Phillips Australian Oil Company, GPO Box 2066, PERTH, WA 6001.

Attention: N.C. Tallis

FLATHEAD -1.

REPORT GS 235/81

YOUR REFERENCE:

Letter of 14 July 1980

MATERIAL:

3 sandstones

IDENTIFICATION:

1545-48; 1555-61; 1569

DATE RECEIVED:

15 July 1980

WORK REQUIRED:

Petrography and clay mineralogy

Investigation and Report by: Drs Brian Steveson and Roger Brown

Manager, Geological Services Division: Dr Keith J. Henley

for Norton Jackson Managing Director

jd/5:1

Pilot Plant: Osman Place Thebarton S.A. Telephone 43 8053 Branch Laboratory: Perth

1. INTRODUCTION

Three small friable sandstone fragments were received from Phillips Australian Oil Company with a request for petrography, X-ray diffraction analysis and SEM/EDAX studies.

Results of petrography and clay mineralogy have been given to the client by telephone; if SEM/EDAX work is needed more of each sample will be required. The samples submitted were as small as can be used for clay mineralogy investigations by X-ray diffraction.

2. PETROGRAPHY

Sample: 1545-1548; TSC30002

Rock Name:

Lithic sandstone

Thin Section:

Approximately 25% of the volume of this rock consists of detrital grains of quartz and feldspar; much of the remainder of the thin section The diversity of the clay consists of clays or secondary minerals. is strong evidence that the material is derived from original rock fragments and does not represent an argillaceous matrix deposited with the sand-grade grains. The rock is, consequently, an immature sandstone which contains a large proportion of labile rock fragments; during compaction and lithification many of the softer of these fragments have been compressed between the more rigid quartz and feldspar grains and any original porosity in the sand has been choked by this clay material filling pore throats. X-ray diffraction analysis suggest that the rock contains a significant amount of natrojarosite (a hydrated sodium iron sulphate mineral), barite and gypsum. It is likely that the barite has been derived from drill mud and the introduction of this into the rock may well have caused some reduction in porosity but it is thought that this is likely only to have been a minor effect compared with the choking of the original pores caused by the abundance of clay in the original sandstone.

The quartz grains have a wide size range up to about 0.4 mm. The average size is approximately 0.15 mm. Most of the grains are distinctly angular in shape although there is, exceptionally, a range towards subround grains. Feldspar is fresh and both microcline and plagioclase could be identified in the rock. The feldspar comprises probably less than 2% of the overall volume of the sample, however.

Between these quartz and feldspar grains is a heterogeneous mosaic of clay. In plane polarized light there are slight differences in colour and texture which serve to show the outline of original detrital rock fragments. These are similar in size to the grains of quartz and most are equant and more or less angular in shape. Most of the clay grains contain extremely fine-grained material but in some there is evidence of intermixing of clays and quartz on a fine scale. Some probably also contain gypsum but this could not be identified optically. Some of the clay grains have, under crossed nicols, a texture which pseudomorphs a well developed cleavage and these grains are interpreted as being derived from the virtually complete

alteration of original mica flakes. It is likely that, in the original sand, rock fragments and mica flakes comprise considerably more than 50% of the material.

The sandstone contains some equant irregular patches of translucent dark yellow material which is interpreted as being natrojarosite. The most likely interpretation of this material is that it was derived from the oxidation of pyrite and that the sodium in the natrojarosite was derived in some way from seawater (there being no other obvious source of sodium in the sandstone system).

The sample is, therefore, an extremely lithic sandstone and it is thought likely that the low porosity and permeability of the rock derived from the effect of squeezing clays into original pore throats during compaction. There has clearly been some introduction of barite into the sandstone but it is thought that this contributed only to a small extent to reduction of the sands original porosity. The presence of a considerable suite of clay minerals indicates the heterogeneity of the lithic material and the presence of natrojarosite is thought to be a result of oxidation and alteration of pyrite associated with marine conditions.

Sample: 1555-1561; TSC30003

Rock Name:

Lithic sandstone

Thin Section:

This rock is similar in most respects to that described immediately above but it contains a little identifiable carbonate which appears to be of authigenic origin but the patches of dark material derived from the alteration of pyrite are absent. Fragments of quartz and feldspar comprise about 30 to 35% of the rock and the remainder consists of heterogeneous clays essentially of lithic origin.

The quartz and feldspar fragments (and a few quartzite fragments also) range in size up to about 0.4 mm but the material is fairly ill-sorted about an average size of approximately 0.15 mm. Feldspar is more abundant than in the rock described above and most fields of view contain one or two feldspar crystals. Most of these appear to be very slightly altered turbid potassium feldspar with somewhat less plagioclase. The grains of quartz and feldspar are generally distinctly angular in shape. Quartzite fragments are commonly finely granular rocks probably of metamorphic origin. In one place in the section there is a micrographically intergrown aggregate of quartz and ?potassium feldspar such - as characterises high-level igneous intrusive rocks.

These detrital components occur in matrix of heterogeneous clays and fine-grained quartz. This material is essentially of lithic origin and consists of rock fragments similar in size to the quartz and feldspar grains which have been slightly deformed during compaction of the rock. Most of the grains are brownish, partly altered clays and some contain finely intergrown quartz and feldspar. The heterogeneity of this material is the key to realising that it is of detrital origin and is not either authigenic or derived from an original argillaceous mud deposited with the quartz and feldspar.

The rock contains a little authigenic carbonate which occurs as dark reddish patches (?of siderite) up to about 0.2 mm in size. Some of these patches have a radiating appearance with finer material near the

centre and coarser material round the outside; the material has probably partly replaced adjacent fine-grained clay materials during a relatively late period of diagenesis of the rock.

This is an immature fine-grained sandstone containing abundant fine-grained clay fragments probably of sedimentary or metasedimentary rocks mainly. During compaction the more plastic rock fragments have been compressed between rigid quartz and feldspar grains and by this process original pore throats have been choked with clay material. Subsequently there has been a little authigenesis of carbonate but this has probably contributed only a little to the reduction in the original porosity.

Sample: 1569; TSC30004

Rock Name:

Sandy siltstone

Thin Section:

The bulk of the thin section consists of a turbid aggregate of fine-grained clay material which is distinctly heterogeneous over the area of the thin section. By analogy with the two samples described above, it is thought likely that much of the material was deposited as small silt-grade rock fragments which have subsequently been compressed, distorted and possibly slightly recrystallized. As a result of these processes, clay has been forced into pore throats particularly during compaction between the more rigid quartz and feldspar grains. This has been the principal process by which porosity in the original silt has been significantly decreased. The rock contains small amounts of authigenic kaolinite and a little authigenic carbonate; the growth of these two minerals probably contributed only a small amount to porosity reduction.

Quartz and feldspar grains are of approximately coarse silt-grade and comprise of the order of 30% of the volume of the rock. As is characteristic of grains of this size, the quartz and feldspar fragments are angular in shape. The grains are well separated from each other and there is no way in which they form any kind of framework. Feldspar is commonly a little difficult to identify but rather turbid grains and some showing a little twinning are clearly both feldspar and it is possible that there is rather more of this mineral present than is apparent from optical examination alone.

The quartz and feldspar occur in a aggregate of brown argillaceous material which shows colour and texture variations over a scale of about 0.1 to 0.2 mm. This is thought to reflect the origin of the clay as detrital material. Most of the material has a low birefringence and is possibly somewhat stained by ferruginous material. In some places clay shows a bulk extinction and hence there is some orientation of the flakes but in other grains there are more equigranular textures and in some of these there is fine-grained quartz intergrown with the clay. Most of the fragments are of metasedimentary or sedimentary fine-grained rock. One or two fragments, however, have textures which could well be derived from the alteration of original volcanic rock fragments.

The thin section contains a brownish authigenic carbonate which is present as small patches, some of which show a radial texture. Elsewhere there are rather coarse-grained aggregates of ?kaolinite and it is thought that these represent a trace amount of authigenic kaolinite which probably developed in the rock relatively early in its diagenetic history (before the porosity was markedly reduced).

5/7 AMDEL

As in the case of the rocks described above, the low porosity of this sample appears to be function of the amount of clay originally deposited in the sediment; this material has been deformed and possibly somewhat dispersed during compaction of the rock and this has resulted in a significant reduction of pore space as a result of choking of pore throats with clays.

3. X-RAY DIFFRACTION ANALYSIS

3.1 Procedure

Portion of each sample was powdered finely and used to prepare an X-ray diffractometer trace which was interpreted by standard procedures, to give the mineralogy of the bulk material.

Weighed subsamples were taken and dispersed in water with the aid of deflocculants and an electric blender, and allowed to sediment to produce a $-4~\mu m$ e.s.d. size fraction by the pipette method. The resulting dispersions were examined by plummet balance to determine their solids contents, and were then used to produce oriented clay preparations on ceramic plates. Two plates were prepared per sample, both being saturated with Mg++ ions, and one in addition being treated with glycerol. When air-dry, these were examined in the X-ray diffractometer.

3.2 Results

The results are given in Table 1, which lists the following:

- (a) The mineralogy of the total sample, as derived from examination of the bulk material, with supporting evidence as available. The minerals found are listed in approximate order of decreasing abundance, using the semiquantitative abbreviations given. Coverage of clays may be incomplete, and for full clay mineralogy Section (c) should be consulted. This Section (a) is for information on non-clay minerals and to give a general idea of the makeup and proportions.
- (b) The proportion of the sample found to separate into the $-4~\mu m$ size fraction, as determined by the plummet balance. The figure obtained applies only to the pre-treatment and dispersion conditions used.
- (c) The mineralogy of the -4 μm fraction, given as Section (a).

TABLE 1: MINERALOGY BY X-RAY DIFFRACTION ANALYSIS

D Mo D SD K A A-SD M Q A A C Tr-A Tr:	Sample Mineralogy of bulk:	(1) Q B NJ F Gy M Cal?	1545-48 D A Tr-A Tr-A Tr-A Tr-A	(2) 155 Q F K C M	CD CD A A	(3) F C C	1569 A-SD A A A A A A A A
Mineralogy: Miner	fract. % of		9	2	ω		
Barite Chlorite CCHOrite CCHOrite CCHOrite MM Mica/illite CCAlcite Feldspar NJ Natrojarosite Gypsum Q Quartz SD = Tr	Mineralogy:	O NJ B K K	D SD A-SD A A	0 0 x x x	D A A A Tr-A		Ф О
Barite K Kaolinite D = Chlorite M Mica/illite (smectite) Calcite Mo Montmorillonite (smectite) Feldspar NJ Natrojarosite Gypsum Q Quartz SD = A = A = A = A = A = A = A = A = A =	1				Semiquantitat	1 (2	Abbreviations:
Feldspar NJ Natrojarosite Gypsum Q Quartz CD = Co-dominal which are equal amounts and component is judged and a Accessory between the component of the component of the component of the component is judged as a component of the component of th	Barite Chlorite Calcite	Kaolinite Mica/illit Montmorill	t e		II	nant. abunc	Dominant. Used for the most abundant, regardless percentage level.
= Sub-domina component is judged Accessory between the	reldspar Gypsum	Natrojaros Quartz	ite		U		ninant. Used for two (on inating components, both are judged to be present amounts.
= Accessory between tl					11	lomina onent(idged	ant. The next most abundant (s) providing its percentage level above about 20.
		•		-	II II	بر کر	 Components jud he levels of roug Components judged

7/7 AMDEL

Barite is estimated in sample 1 as 10 to 20% and in sample 3, 5 to 10%. These are very approximate estimates; accurate measurement of the proportion $\frac{1}{2}$ of barite should be obtained from a barium analysis.

4. PALYNOLOGY

OIL and GAS DIVISION

PALYNOLOGY OF SAMPLES FROM CORES 6 AND 7,

FLATHEAD-1 (ESSO, GIPPSLAND BASIN)

W545

0 1 JUL 1985

JUNE 1985

PALYNOLOGY OF SAMPLES FROM CORES 6 AND 7, FLATHEAD-1 (ESSO, GIPPSLAND BASIN)

As part of a review of the Gippsland Basin cores 6 (Latrobe Fm.) and 7 (Strzelecki Fm) of Flathead-1 were sampled for palynology and maturity studies. Of the 10 samples available, 8 were selected for preparation. All gave an acid-insoluble residue of plant remains and palynomorphs. Results were as follows:

1662 - 1696 ft. (6 core samples): rich and varied assemblages of pollen and spores, well-preserved. The presence of COPTOSPORA PARADOXA, CLAVATIPOLLENITES HUGHESII, CUPULIFEROIDOPOLLENITES cf. PARVULUS, DICTYOTOSPORITES COMPLEX, CRYBELOSPORITES STRIATUS, LYCOPODIUMSPORITES INTRAVERRUCATUS and L. CIRCOLUMENUS, together with the absence of PROTEACIDITES spp. and NOTHOFAGIDITES spp suggests a base Late Cretaceous (Uppermost Albian (= Vraconian) to ? Turonian) age. Some Triassic reworking was noted.

No dinoflagellates or other marine indicators were present. Acritarchs were found at 1696 ft. and these may indicate brackish conditions. The assemblages as a whole, including the types and sizes of the plantremains suggest a non-marine, fluvial/lacustrine environment of deposition. Sporomorph-colours, both under transmitted white light and using U.V. incident light indicate that the organic matter is immature for hydrocarbon generation. One sample, at 1676 ft. is very organic rich (6 millilitre of 0.M per 10 grams of sediment) and is of source rock quality. Type of organic matter: humic.

3487 - 3493 ft. (2 core samples) : assemblages, although rich in specimens, were of very poor diversity and lacked markers.

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Bisaccates and MICROCACHRYIDITES ANTARCTICUS were most common. Of the spores present BACULATISPORTES COMAUMENSIS, CICATRICOSISPORITES AUSTRALIENSIS, LEPTOLEPIDITES VERRUCATUS, NEORAISTRICKIA TRUNCATA and a single DICTYOTOSPORITES SPECIOSUS were noted. All are longer ranging types, and although the assemblages are definitely not older than Lower Cretaceous it is impossible to be more precise.

No dinoflagellates or other marine indicators were present and in fact the general aspect of assemblages and plant remains is typically that of a freshwater swamp environment.

Sporomorph-colours indicate that the organic matter is early mature for hydrocarbon generation. Both samples are organic rich but especially at 3493 ft. (7 millilitres O.M. per 10 grams of sediment). Type of O.M.: humic.

SHELL COMPANY OF AUSTRALIA LIMITED

Exploration and Production

Oil and Gas

Melbourne, 22 May 1985

PALYNOLOGY REPORT

ON

FLATHEAD -1

BY

LEWIS E. STOVER

Palynology Report 1970/24

June 1970.

FLATHEAD-1

INTRODUCTION

As part of a regional study of microplankton from the <u>Nothofagidites</u> asperus Zone in the Gippsland Basin, dinoflagellate bearing samples from Flathead -1 at 1495 and 1516 feet were studied. Evans & Mulholland, 1969 (Palynology Report 1969/8) provisionally assigned an Oligocene age to both samples.

SUMMARY

<u>Sample</u>	Drill Depth	Age	Dinoflagellate Zone
swc	1495 feet	Oligocene or younge	r Unnamed
swc	1516 feet	M/L Eocene	D. extensa

COMMENTS

Spores, pollen and dinoflagellates are sparse in the sample from 1495 feet. Except for Epicephalopyxis indentata and Operculodinium centrocarpum - both long ranging forms - no definitive Late Eocene dinoflagellates were observed. Specimens of Nothofagidites dominate the spore-pollen fraction.

A considerably more diverse palynomorph assemblage was recovered from the sample at 1516 feet. The spores and pollen suggest that the sample is from the older part of the N. asperus Zone and this contention is supported by the dinoflagellates. The sample contains Peridinium eocenicum and Leptodinium reticulodotum, both of which begin in Taylors late Middle Eocene N zonule in the Browns Creek section. The sample also contains Diphyes colligerum which has also been identified in Tuna -3 at 4500 feet and in Bream -3 at 6447 feet.

L.E. STOVER.

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BASIN)

As part of a review of the Gippsland Basin cores 6 (Latrobe Fm.) and 7 (Strzelecki Fm) of Flathead-1 were sampled for palynology and maturity studies. Of the 10 samples available, 8 were selected for preparation. All gave an acid-insoluble residue of plant remains and palynomorphs. Results were as follows:

1662 - 1696 ft. (6 core samples): rich and varied assemblages of pollen and spores, well-preserved. The presence of COPTOSPORA PARADOXA, CLAVATIPOLLENITES HUGHESII, CUPULIFEROIDOPOLLENITES cf. PARVULUS, DICTYOTOSPORITES COMPLEX, CRYBELOSPORITES STRIATUS, LYCOPODIUMSPORITES INTRAVERRUCATUS and L. CIRCOLUMENUS, together with the absence of PROTEACIDITES spp. and NOTHOFAGIDITES spp suggests a base Late Cretaceous (Uppermost Albian (= Vraconian) to ? Turonian) age. Some Triassic reworking was noted.

No dinoflagellates or other marine indicators were present. Acritarchs were found at 1696 ft. and these may indicate brackish conditions. The assemblages as a whole, including the types and sizes of the plantremains suggest a non-marine, fluvial/lacustrine environment of deposition. Sporomorph-colours, both under transmitted white light and using U.V. incident light indicate that the organic matter is immature for hydrocarbon generation. One sample, at 1676 ft. is very organic rich (6 millilitre of 0.M per 10 grams of sediment) and is of source rock quality. Type of organic matter: humic.

3487 - 3493 ft. (2 core samples) : assemblages, although rich in specimens, were of very poor diversity and lacked markers.

Present BACULATISPORTES COMAUMENSIS, CICATRICOSISPORITES AUSTRALIENSIS,

LEPTOLEPIDITES VERRUCATUS, NEORAISTRICKIA TRUNCATA and a single

DICTYOTOSPORITES SPECIOSUS were noted. All are longer ranging types, and although the assemblages are definitely not older than Lower Cretaceous it is impossible to be more precise.

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Melbourne, 22 May 1985

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FLATHEAD-1

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W .J. PALEY

Latrobe Group

Cores 3,4 and 6 (1570', 1583', 1693'): Middle to Late Albian

All the above samples showed the same basic spore and pollen assemblage. Gymnospermous trisaccate and bisaccate pollen grains dominate the assemblage, e.g. Podocarpidites ohikaensis, P.cf.ellipticus, Podosporites microsaccatus (Core 4), and Alisporites grandis (Core 3). Common spores include the abundant Cicatricosisporites australiensis, Cyathidites australis, Lycopodiumsporites austroclavatidites, L. nodosus and Aequitriradites spinulosus. Spores found in core samples 3 and 4 but not in 6 include Osmundacidites wellmanii, Foveotriletes cf. parviretus, Ceratosporites equalis and Foraminisporis dailyi. The latter species is not found later than Albian. In finer detail, each assemblage differs slightly. Only in core sample 3 are Schizosporis reticulatus, Rouseisporites reticulatus, Pilosisporites cf.notensis and Foraminisporis asymmetricus (Barremian-Albian) noted. In core sample 4, Velosporites triquetrus and Leptolepidites major are found. In core sample 6, the assemblage differs with the appearance of Klukisporites scaberis, Pilosisporites parvispinosus (Barremian-Albian), Rouseisporites radiatus, Araucariacites australis and Dictyotosporites cf. speciosus. The latter species is used by Dettmann and Playford 1969 as a zone fossil. They give a stratigraphic range of Valanginian to Aptian. Morgan and others, however, extend this to the Early Albian. The occurrence of D.cf.speciosus with Coptospora paradoxa in core sample 6 would, on the Dettmann and Playford zonation scheme, give a precise age as Latest Aptian, i.e. earliest Coptospora paradoxa zone. The work of Burger, Morgan and others, however, suggests a Middle Albian to earliest Late Albian age. Coptospora paradoxa also occurs in core sample 3. This, together with the occurrence of Crybelosporites striatus in core samples 3, 4 and 6, places these assemblages in the Coptospora paradoxa zone.

Core 7: 3490' Early Albian

The spore and pollen assemblage resembles the Late Albian assemblages of core samples 3, 4 and 6 in containing common trisaccates and bisaccates. Spores, which are found in numbers, include Cicatricosisporites australiensis, the zone fossils Crybelosporites striatus and Foraminisporis wonthaggiensis (Valanginian to Albian). Other species noted include Cyathidites australis, Foraminisporis dailyi, Pilosporites parvispinosus, Aequitriradites spinulosus, Osmundacidites wellmanii, Lycopodiumsporites austroclavatidites, Cicatricosisporites hughesi, Rouseisporites reticulatus, R. simplex and Araucariacidites australis. The presence of Dictyotosporites filosus, together with the absence of Coptospora paradoxa, indicates a Middle to Late Aptian age, according to the zonation of Dettmann and Playford 1969, or an Early Albian age after the zonation scheme by Burger, which is used in this report.

DISCUSSION

W. J. PALEY

The greater part of the Gippsland Basin lies off the coast of South East Victoria. Published information (Stover and Evans 1973) indicates that the basin is fault bounded to the north and south forming a graben structure. The basin has been folded by N.W.to S.E. compressional forces, producing a series of anticlinal folds, trending approximately N.E. to S.W. usually subparalleling the Victorian coastline.

Fig.1 shows the relative offshore positions of each well in this study. Fig.2, a cross section, attempts to correlate the ages of the Labtrobe Group and Strzelecki Group in each well across the basin. The base of the Oligocene is used as the standard time horizon and, with the exception of Barracouta-1, this is the base of the Gurnard Formation (Oligocene). Only the age diagnostic species have been inserted on the cross section. Few time lines can be drawn with certainty, since only a few spot samples were provided for the study. Time lines in fig.2 are, therefore, tentative. Even so, the overall impression of basinal sedimentation is illustrated. Deposition seems to be greatest and apparently continuous in the Barracouta-1 area, with both condensed sequences and non-deposition occurring along the margins of the north and south platforms.

The unconformity shown on the Flathead-1 graphic log may represent a transgressive event. On palynological evidence, the hiatus is of brief duration and if present must be restricted to Early to Middle Albian times. Morgan 1980 and Burger 1980 record an Early to Middle Albian transgression in Australia, which had an effect on microfloral assemblages. Unfortunately, there is only a slight change in microfloral composition across the unconformity, and no marine indicators were found. In the assemblage above the unconformity, there was no palynological evidence for a Late Cretaceous or Early Tertiary age, thus reducing the possibility of the Albian microfloras being reworked assemblages.

In the graphic log of Perch-1 the samples are thought to be mislabelled. Their probable position has, therefore, been corrected in fig.2.

The interpretation of palaeoenvironments based upon spore and pollen content was not attempted in this report. Spores and pollen tend not to be as facies controlled as dinocysts and acritarchs, and may be found in several depositional environments. Dinocysts and acritarchs, with a few exceptions, tend to be confined to marine or brackish water conditions. Thus their presence in a microfloral assemblage indicates a marine influence in the depositional environment.

There are a number of Australian zonation schemes available for use in age dating studies in the Cretaceous and Tertiary. All the schemes used in this report use first and last appearance datums of particular spore and pollen species. The zonation scheme of Stover and Evans 1973 is used in this report for dating of the Campanian to Eocene whilst the Dettmann and Playford 1969 zonation scheme is used for the Cenomanian to Campanian. Burger 1973 and 1980 (in press) and Morgan and co-workers 1980 (in press) have revised the Lower Cretaceous part of the Dettmann and Playford scheme. The Burger and Morgan zonation schemes, used in this report, are approximately half a stage younger for Albian and Aptian stages. Morgan places the

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W. J. PALEY

Coptospora paradoxa zone and the Crybelosporites striatus zone in the Late and Early Albian respectively. Burger shows a similar division but places the C. paradoxa zone in the Middle Albian. In contrast to these zonation schemes Dettmann and Playford 1969 place the C. striatus zone in the Late Aptian and the C. paradoxa zone in the Uppermost Aptian to early Late Albian.

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RATINGS:

- 0; SWC or CORE, EXCELLENT CONFIDENCE, assemblage with zone species of spores, pollen and microplankton.
- SWC or CORE, GOOD CONFIDENCE, assemblage with zone species of spores and pollen or microplankton.
- SWC or CORE, POOR CONFIDENCE, assemblage with non-diagnostic spores, pollen and/or microplankton.
- CUTTINGS, FAIR CONFIDENCE, assemblage with zone species of either spores and pollen or microplankton, or both.
 CUTTINGS, NO CONFIDENCE, assemblage with non-diagnostic spores, pollen and/or
- microplankton.

NOTE: If a sample cannot be assigned to one particular zone, then no entry should be made. Also, if an entry is given a 3 or 4 confidence rating, an alternate depth with a better confidence rating should be entered, if possible.

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Determination of J is in disagreement with observed spore-poller and amoflagellates from SWC at 1516' which give Middle Eocene, Lower N. asperus Zone age

Disturbed sequence in F & G.

Note: If highest or lowest data is a 3 or 4, then an alternate 0, 1, 2 highest or lowest data will be filled in if control is available.

If a sample cannot be interpreted to be one zonule, as apart from the other, no entry should be made.

0	SWC	or	Core	m	Complete	assemblage	(very	high	confidence)	, .
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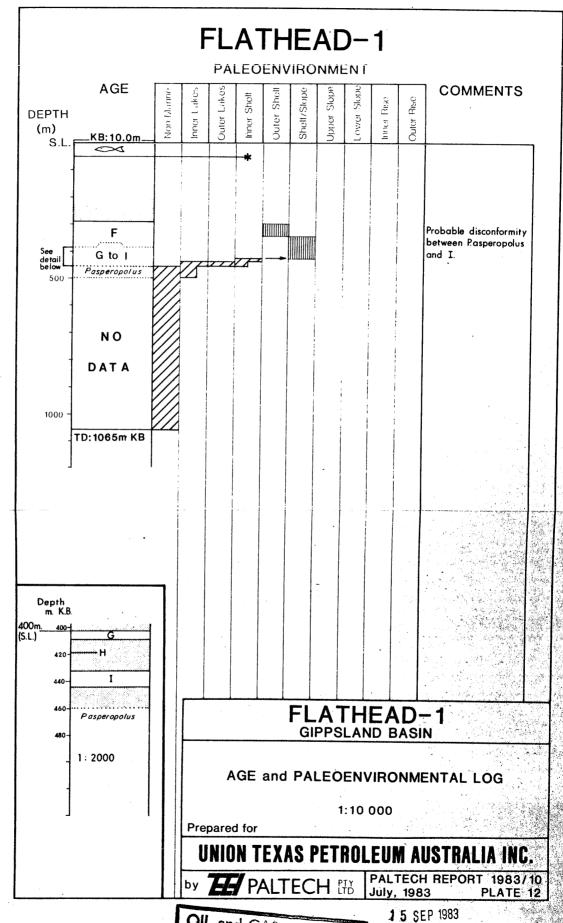
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¹ SWC or Core - Almost complete assamblage (high confidence).

² SMC or Core - Close to zonule change but able to interpret (low confidence).

³ Cuttings - Complete assemblage (low confidence).

⁻ Incomplete assemblage, next to uninterpretable or SWC with depth suspiction (very low confidence). 4 Cuttings



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3/3

5. WELL LOG ANALYSIS

WELL LOG ANALYSIS

Sunfish No. 1

Emperor No. 1

Flathead No. 1

Hugh Crocker April 1979

Logs Available

Sunfish No.1

<pre>Induction/SFL/S.P.</pre>	2786	-	75 59 '
<pre>Induction/SFL/S.P.</pre>	7250	-	8156'
BHC Sonic/Gamma Ray	620	-	2777'
BHC Sonic	2786	_	7513'
BHC Sonic	7300	_	8167'
Density/Neutron/Gamma Ray	5300	-	7564'
Density/Neutron/Gamma Ray	7156	-	8176'
H.R. Dipmeter.	5300	_	7521'
Formation Tester - Runs 1	through 21		
Baroid ppm log	680	_	8175'

Flathead No.1

Induction/Electrical 825 - 3495'
BHC Sonic/Gamma Ray 825 - 3490'
Comp Density/Gamma Ray 1326 - 3497'
Gamma Ray/Neutron 1326 - 2326'
Formation Tester - Runs 1 through 11
Corelab Coregraph 865 - 3494'
Core description 1 through 7
BMR Core analysis 1 through 7
Sidewall core description 1 through 35

General

Only Sunfish No.1 has a fairly complete modern logging suite and therefore we shall deal with this well first and rather thoroughly. Then, based upon data from Sunfish No.1, we shall treat the remaining two wells. Of course, the interpretation is less exact when logging programmes are limited. We shall use Sunfish No.1 to determine the petrophysical characteristics of these sands and to estimate the reliability of the assumptions made, calibrate the logs in water sands, and to apply as many crosschecks as we may.

In all wells we have chosen zones where porosity may be developed based upon any of the following:

- low gamma ray reading
- S.P. development from the shale base line.
- Porosity seen on the Sonic, Density or Neutron logs.
- Separation between the shallow and deep resistivity tools.

All log values are read and listed in a Table for each well. Charts referred to in the text are those of the 1977 Schlumberger Chartbook.







































Formation Water

The S.P. shows a positive displacement from the shale baseline opposite the clean sand (Gamma Ray log) 1542 - 1564 but there is also a positive displacement opposite the Gamma Ray peak immediately above 1536 - 1542 hence this positive peak is probably due to some abnormal effect such as electrokinetic/osmostic potential rather than the normal electrochemical potential. If we ignore the positive displacement opposite this sand then the S.P. is almost featureless.

All tests have been unsatisfactory and water recovered from FIT tests have had around 8000 ppm NaCl salinity. This approximates the salinity of the mud filtrate and would account for the lack of SP development. Of couse, it is also likely that the FIT recovered only filtrate. Hence, we have no conclusive data on formation water salinity. Since we need Rw to calculate water saturation in the pore space we shall arbitrarily assume that there is little resistivity contrast between mud filtrate and formation water.

Clay Content

The available Neutron log is an early GNT model for which local calibration in terms of porosity are needed. Unfortunately we have no clean water filled sands that are needed for this purpose. Nevertheless in Figure 1 we have made the calibration plot of Neutron counts per second versus Density derived porosity on a linear log grid since.

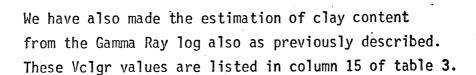
$$N = A \log \emptyset + B$$

from which

$$\phi_{\rm n} = 10 \qquad (\frac{1332 - N}{500})$$

We have listed N counts per second and \emptyset_n in columns 7 and 10 of table 3 respectively.

Then using Density and Neutron we have found clay content as seen by these tools and as previously described for the Sunfish well. This Volnd is listed in column 14.



Again, because we doubt the accuracy of the Volnd values, we prefer to use the Volgr values for subsequent computing.

Porosity

For completeness sake we have listed Sonic readings (column 11) and using the Wiley time average formula calculated the Sonic porosity of column 12. It is clear that the range of values 43 - 71 is ridiculous but at these depths is not surprising since these rocks are quite unconsolidated and the Wiley equation is inapplicable. We could attempt to correct \emptyset_S but the correction would be greater than the final value and therefore very unsatisfactory.

As already discussed this early Neutron requires local calibration in clean waterfilled sands. Since we cannot make such calibration we prefer not to rely too heavily upon the Neutron log porosity.





Hence we are left with the Density log. The cuttings, sidewall samples and core descriptions clearly point to a very complex lithology. This is evident on the Density log by very rapid changes of Density. If we are to proceed we must make some simplifying assumptions. It seems that 1465 - 1530 is reasonably homogenous and characterised by silt, argillaceous sands with glauconite very abundant throughout. For this interval a suitable grain density would be 2.65 g/cc. Below 1540 there is little glauconite but the lithology is quartzwacke sandstones and often conglomeratic. For these sands a suitable grain density of 2.68 seems applicable. We shall use these values to compute Density porosities \mathfrak{D}_d .

Next we have computed a clay correction to the density porosity as previously described and listed this \emptyset_{dc} in column 16. We have used a clay density of 2.25 g/cc.

Since the evidence strongly points to oil rather than gas being present and since also we have no reliable Neutron log to distinguish between oil and gas we think it would be unwise to correct the Density for hydrocarbons. Even if we used a hydrocarbon Density of 0.7 it would affect the \emptyset_{dc} value very little.



For such shallow unconsolidated sands the Humble formula for the formation resistivity factor is unsuitable. We have no clean water filled sands from which we could find the constants a and m

$$F = a/p^m$$

Hence we must rely upon experience of similar sands elsewhere. We think a = 1 and m = 0.5 is probably appropriate.

Using the Indonesian equation and the following;

We compute Sw of column 18 table 3.

It is clear that water saturations are high throughout, and clean oil production is unlikely even in the clean sand. To increase the oil saturation in the clean sand we would require:

Vcl decreased - It is already zero

Rcl decreased - This only is effective if Vcl present

Rt increased - the induction log in this range is usually reliable and must be close to Rt.

Rw decreased - as already explained under S.P.

discussion, its likely that Rw Rnf

not less than Rnf hence we cannot

easily decrease Rw 0.352 m.

Hence we must accept that means we have some extraordinary condition of which we are unaware that the oil saturation is only some 30% in the clean sand

Permeability

The FIT tests are all inconclusive and only recovered small amounts of water in the production tests.

- 1) 1607 1652 produced nothing
- 2) 1542 1564 produced 16 ths of water of 8500 ppm NaCl and a little H₂S gas without evidence of oil.

Hence the permeability of these rocks is questioned. No satisfactory general relationship between log response and permeability exists although some locally developed ones have proved valuable. Qualitatively we may assess the permeability by assuming the clay minerals to be dispersed and then

$$q = \frac{Vc1}{\emptyset + Vc1}$$

if q exceeds 40% then commercial permeability has ceased to exist.

Of course, this cannot apply in thinly lanimar sands but for these rocks it is probably as good a guide as can be found. Hence we have computed q of column 17 table 3. We note that only the clean sand 1543 - 1563 has any hope of being permeable.









































Conclusion

- 1. 1465 1530. Argillaceous sands, silt with abundant glauconite. Impermable but with average 45% oil saturation.
- 2. 1543 1563. Clean sand, often conglomeratic essentially without glauconite. Average porosity 22.8%, oil saturation 29%.
- 3. Below 1563. Silt and shales non permeable.

6. F.I.T. Test Data

BASIC DATA

Test Data - FLAT HEAD #1

PRODUCTION TEST I through perts 1607-1652 Rec No formation fluid after fined acid treatment and swabbing.

PRODUCTION TEST-II —through parts-1542-1564'
Rec. 16 hbls water and hydrogen sulphide gas NaCl
of Rec water 8500ppm Mud filrate at 8500ppm
No trace of Oil.

oil Frf 0.79 at 66°F. Cl 8200ppm.Mud Cl 8500ppm. FP Opsi FSIP500psi HP 1030psi

FIT-2 1694' Rec. 1500cc filtrate, Rrf. 1.03 at 64° CL 5-00 ppm FP Crost FSID 2

-FIT-B-1555'-Rec-3500cc Mud-lost packer seat.

FIT- 1498' Rec 1000cc mud filtrate Rrf (196 at 78° CL5500ppm FP Opsi -FSIP Opsi-HP 1000psi

FIT-5 1545 Rec 2000cc filtrate, scum of oi, Rrf 0.70 at 72°-C1 9500 ppm
FP Opsi FSIP 700psi HP 930psi

FIT 6 1484 Rec. 1500cc filtrate FP (psi FSIP Opsi HP 1000 psi

FIT-7 1567' Tool malfunction

FIT-\$ 1567' Tool malfunction

FIT-9 1567' Rec 1700cc filtrate Rrf 0.66at 74° CL 8500ppm FP Opsi ESIP Opsi-HP 980psi

THT-10 1625 Tool malfunction

FIT-| 1 | 1625 Rec. 1200cc filtrate FP Opsi-FSIP 780psi-HP 1000psi

Also
1. All wire line logs
2. Corelab Mud Log
3. Corelab Coregraph
4. Sample descriptions
5. Core a S.W. Core descriptions
NOT composite log

This is an enclosure indicator page. The enclosure PE904912 is enclosed within the container PE904908 at this location in this document.

The enclosure PE904912 has the following characteristics:

ITEM_BARCODE = PE904912

CONTAINER_BARCODE = PE904908

NAME = Flathead 1 F.I.T. Data

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = FIT

DESCRIPTION = Flathead 1 Formation Interval Test

(F.I.T.) Data.

REMARKS =

DATE_CREATED =

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1 CONTRACTOR = Schlumberger

CLIENT_OP_CO = Esso Australia

7, ENCLOSURES

This is an enclosure indicator page. The enclosure PE603210 is enclosed within the container PE904908 at this location in this document.

The enclosure PE603210 has the following characteristics:

ITEM_BARCODE = PE603210
CONTAINER_BARCODE = PE904908

NAME = Flathead 1 Grapholog

BASIN = GIPPSLAND PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = MUD_LOG

DESCRIPTION = Flathead 1 Grapholog (Mudlog)

REMARKS =

DATE_CREATED =

 $DATE_RECEIVED = 21/05/69$

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR = Core Laboratories, INC.

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page.

The enclosure PE601363 is enclosed within the container PE904908 at this location in this document.

The enclosure PE601363 has the following characteristics:

ITEM_BARCODE = PE601363
CONTAINER_BARCODE = PE904908

NAME = Well Completion Log

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = COMPOSITE_LOG

DESCRIPTION = Flathead 1 Well Completion Log

REMARKS =

 $DATE_CREATED = 11/05/69$

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR =

CLIENT_OP_CO = Esso Australia

This is an enclosure indicator page. The enclosure PE900011 is enclosed within the container PE904908 at this location in this document.

The enclosure PE900011 has the following characteristics:

ITEM_BARCODE = PE900011 CONTAINER_BARCODE = PE904908

NAME = Completion Coregraph

BASIN = GIPPSLAND

PERMIT = VIC/P1

TYPE = WELL

SUBTYPE = DIAGRAM

DESCRIPTION = Flathead 1 Completion Coregraph
 REMARKS = Cores 3-7. Cores 1 and 2 too

unconsolidated for analysis.

DATE_CREATED = 11/05/69

DATE_RECEIVED =

 $W_NO = W545$

WELL_NAME = Flathead-1

CONTRACTOR = Core Laboratories, INC.

CLIENT_OP_CO = Esso Australia