

**REPORT ON A STUDY OF MUSSEL-1 CONVENTIONAL CORE,
VIC/P31, OTWAY BASIN**

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BHP PETROLEUM PTY. LTD.
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PETROLEUM DIVISION

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TABLE OF CONTENTS

	Page
1 INTRODUCTION	1
2 SUMMARY	2
3 LITHOLOGICAL DESCRIPTIONS	3
3.1 Core-1	3
4 ENVIRONMENTAL INTERPRETATION	5
4.1 Core 1	5
4.2 Core 3	5
5 REFERENCES	6
6 FIGURES	7

1 INTRODUCTION

This report is based on the detailed examination of conventional core cut in Mussel-1 in the BHP Petroleum operated permit VIC/P31. The study was undertaken by S.Horan at the Victorian Department of Mines and Energy Core Library in Port Melbourne (13 July 1994).

Mussel-1 was drilled in 1967 by Esso Standard Oil (Australia) Ltd targeting the Waarre Sandstone. This unit is now as interpreted as belonging to the Shipwreck Group, the reservoir unit of the La Bella-1 gas discovery and the Minerva Field.

Lithological descriptions and environmental interpretations of the cored interval are followed by a core description sheet and a selection of wireline log data over the cored and adjacent interval. Where possible, depositional environmental inferences by Roger Morgan from palynological data have been incorporated in the environmental interpretations.

Only core 1 is described in this report as no core was recovered with core 2 and core 3 consists of poorly preserved claystone and shale. It was felt that the description for core 3 from the Mussel-1 Well Completion report could not be improved on. A copy of this description and an interpretation is included however with this report.

The results and conclusions of this study will make a contribution to the better understanding of the regional geological understanding of the Shipwreck Group.

2 SUMMARY

The interval 2097.3 to 2104 mRkb from core 1 is interpreted to represent sandstones deposited in a marginal marine/marine environment as stream mouth bar sands or in a proximal setting in an estuary. The interval 2235.7 to 2242.4 mRkb from core 3 is interpreted to represent clays/carbonaceous shale/coal deposited in a distributary bay setting.

3 LITHOLOGICAL DESCRIPTIONS

3.1 Core-1

Core-1 was cut over the interval 2097.3 to 2104 mRkb (30.2 mAmsl). The core is described interval by interval and graphically displayed in Figure 1.

2097.3-2097.6 mRkb SANDSTONE: fine to predominantly medium grained sandstone, well sorted, minor clay rip ups and laminae highlighting cross bedding, predominantly trough crossbedded with minor coarse to granule sized basal lags, scour surfaces with coarse grains and clay rip ups, trace carbonaceous rip ups towards base, individual bedsets 1-2 cm thick, probably more scours but sulphur discolouration of core.

2097.6 mRkb CLAY LAMINAE clay laminae has been scoured by overlying sandstone, the clay laminae is not continuous across the core.

2097.76-2098.15 mRkb SANDSTONE: light grey with translucent to clear quartz grains, medium grained, trace fine and coarse grained, well sorted, base is scour into more bioturbated unit beneath, at 2098.85 clay drape on scour surface (slightly inclined), throughout most of unit trough cross bedded and possibly planar? cross bedded.

2098.15-2098.85 mRkb SANDSTONE: mottled/bioturbated sandstone, light grey to occasionally light brown/grey mottled patches, with clear to translucent quartz grains, fine to predominantly medium grained, well sorted, homogenised sands, no laminations, carbonaceous and clay laminae been bioturbated and scattered, some of clay has been pyritized, inlined burrow.

2098.85 mRkb break in core, contact not clear but very argillaceous sandstone.

2098.85-2099.35 mRkb BIOTURBATED SANDSTONE; mottled bioturbated sandstone, light grey to light brown with clear to translucent quartz, fine to predominantly medium grained, occasionally coarse, moderately to predominantly well sorted, occasionally argillaceous, scattered clay and carbonaceous laminae, horizontal burrows, minor quartz granules at base, base is carbonaceous/clay laminae on top of scour, mimics scour then above this forms parallel laminae across core, scour burrowed by inclined burrow.

2099.35-2099.80 mRkb BIOTURBATED SANDSTONE: dark grey to brownish grey, fine to medium grained, poor to moderately sorted, one lense of coarse to granular sandstone with scour at base, intensely burrowed and bioturbated sandstone, 70% ophiomorpha burrows, 95% of burrows horizontal with 5% vertical to inclined, core break at top and doesn't match core above it.

2099.8-2099.88 mRkb BIOTURBATED SANDSTONE: fine to medium grained sandstone, mm thick clay laminae beneath scour.

2099.88-2100.00 mRib BIOTURBATED SANDSTONE: core rubble, as above but a lot more clay.

2100.00-2100.28 mRkb SANDSTONE: bioturbated in places, light grey to occasionally light brown with clear to translucent quartz, fine to predominantly medium grained, well sorted, common carbonaceous/clay laminae highlighting trough cross bedding.

2100.28-2100.91 mRkb SANDSTONE: light grey to light brownish grey, with translucent to clear quartz, medium grained, moderately to well sorted, abundant clay laminae, possible clay drapes?, minor flaser bedding, abundant bioturbation, common horizontal and vertical burrows, minor Ophiomorpha burrows.

2100.91-2101.6 mRkb SANDSTONE AND CLAYSTONE: core rubble, light to medium grey sandstone with dark grey claystone, Sandstone; predominantly medium grained, commonly coarse grained, trough cross bedded, flaser bedding, bioturbated, interbedded with clay beds and laminae on tens mm scale, bioturbated, horizontal and vertical burrows.

4 ENVIRONMENTAL INTERPRETATION

4.1 Core 1

The interval 2097.3 to 2104 mRkb from core 1 is interpreted to represent sandstones deposited in a marginal marine/marine environment as either stream mouth bar sands or sands from a proximal estuary setting.

Roger Morgan interpreted a claystone sample from 2100 mRkb as having been deposited in a marginal marine environment (Morgan 1992) on the presence of dinoflagellates (3% of all palynomorphs) of low to moderate diversity (six different species). This is supported by the presence of intensive bioturbation, horizontal/vertical burrows and Ophiomorpha trace fossils. Ophiomorpha trace fossils are thought to form on sandy shoreline environments in either shoreface, offshore tidal shelf sands or estuarine environments (Pollard et al 1993).

The presence of trough cross bedded sandstones, flaser bedding, scours and the moderately to well sorted sandstones is not inconsistent with a marine to marginal marine depositional environment. These sedimentary structures are not diagnostic of a particular environment but in a marginal marine/marine environment could be found in a stream mouth bar from a delta or river, or in a proximal setting in an estuary.

4.2 Core 3

The interval 2235.7 to 2242.4 mRkb from core 3 is interpreted to represent clays/carbonaceous shale/coal deposited in a distributary bay setting.

Roger Morgan interpreted claystones from 2236 and 2238 mRkb to have been deposited in a marginal marine environment (Morgan 1992) on the presence of dinoflagellates (2 and 3% of total palynomorphs present) with low to moderate diversity of species (5 species counted at both depths). The presence of coal with claystone with evidence of marine influence requires an environmental setting which alternates from marine to non-marine such as one would get in a distributary bay.

5 REFERENCES

Lunt,C.K. 1970: ESSO Mussel-1 Well Completion Report.

Morgan,R.1992: New palynology of Mussel-1, Otway Basin Australia. July 1992. BHP P unpublished report.

Pollard,J.E., Goldring,R., Buck,S.G., 1993: Ichnofabrics containing Ophiomorpha: significance in shallow water facies interpretation. Journal of Geological Society of London. Vol 150: p 149-164.

6 FIGURES

Key to sedimentary structures

Lithological modifiers

Mussel-1 Core 1 Core graphic log (1:25)

GR-SP-SN-IND-SONIC wireline log (1:200)

GR-CAL-RHOB wireline log (1:200)


























Mussel-1 Core 3 Core graphic log

GR-SP-SN-IND-SONIC wireline log (1:200)

GR-CAL-RHOB wireline log (1:200)






















KEY TO SEDIMENTARY STRUCTURES

H	H	homogenous
		trough cross bedding
		hummocky cross stratification
		wave oscillation ripple
		current ripple lamination
		flaser bedding
	L	lenticular bedding
		dewatering feature
		rip up clasts
		scour surface
		wavy inclined
		dwelling burrow
		bioturbation
		ophiomorpha burrow
		gastropod
		shell debris
		brachiopod
		bivalve
		cephalopod
		load and flame structure
		microfoundering feature
		load casts
		mud crack
		fracture
		plant stems
		rootlets



LITHOLOGY MODIFIER ONLY

		concretions
		siderite cement
		calcite cement
		dolomite cement
		glauconite
		carbonaceous
		coal
		pyrite
		pebble lag
		shale
		sand
		siltstone
		limestone

PERMIT: VIC P30			DATE: 13-07-1994		CORE NO.: 1	Page:						
AUTHOR: Simon Horan			INTERVAL: 2097.3 - 2104.0									
RIG:			CUT: 6.7		RECOVERED: 3.7							
K.B.:		W.D.:		CORE BARREL & MUD TYPE:								
DEPTH (m)	LITHOLOGY	SHOWS			GRAIN SIZE					SEDIMENTARY STRUCTURE	LITHOLOGICAL DESCRIPTION	
		T U	F	G	SILT	V.FINE	FINE	MEDIUM	COARSE			V.COARSE
2097												TOP CORE 1
2098												<p>SANDSTONE (2097.3-2098.15) light grey, fine to predominantly medium grained, well sorted, trough cross bedded, minor clay rip ups</p> <p>SANDSTONE (2098.15-2099.35) light grey to light brown, fine to predominantly medium grained, well sorted, bioturbated, horizontal, vertical and inclined ? burrows</p>
2099												BREAK IN CORE
2100												<p>BIOTURBATED SANDSTONE (2099.35-2100.28) light to predominantly dark grey, fine to predominantly medium grained, poor to moderately sorted, bioturbated horizontal burrows with Ophiomorpha burrows, minor trough cross bedded and laminations</p>
2100												<p>SANDSTONE (2100.28-2100.91) light grey to light brownish grey, fine to medium grained, moderately to well sorted, bioturbated minor horizontal/vertical burrows, Ophiomorpha burrows</p>
2100												<p>SANDSTONE AND CLAYSTONE (2100.91-2101.6) core rubble; light to medium grey sandstone, fine to medium grained, well sorted, trough cross bedded, bioturbated, dark grey claystone.</p>
2101.6												
2101												

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MUSSEL-1

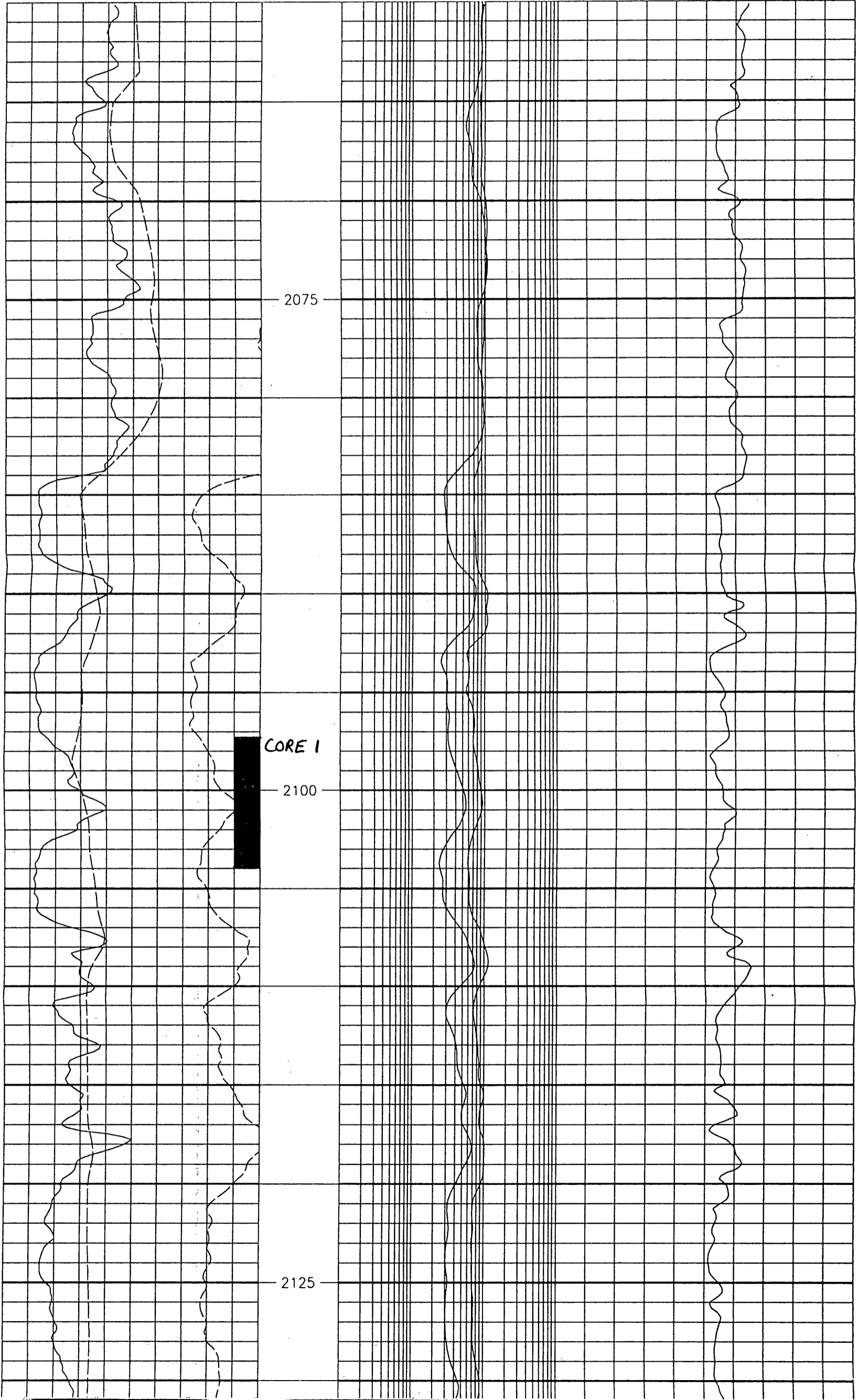
-80 SP 20
MV
0 GR 150
GAPI
8 CAL I 18
INCH

DEPTH

0.1 IND 100
OHMM

0.1 SN 100 500
OHMM

SONIC 100
US/M



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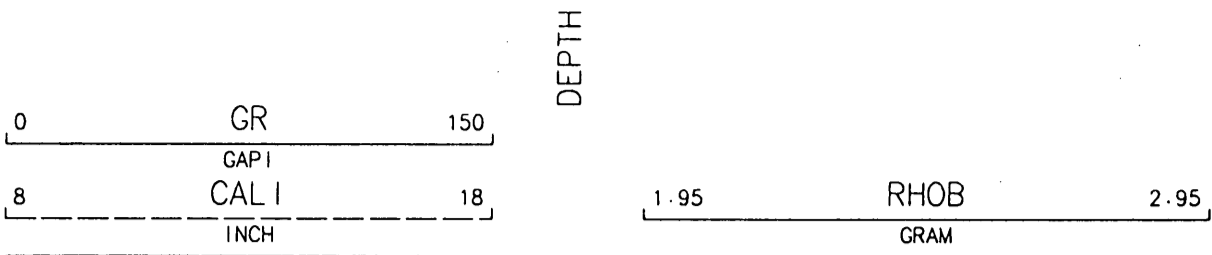
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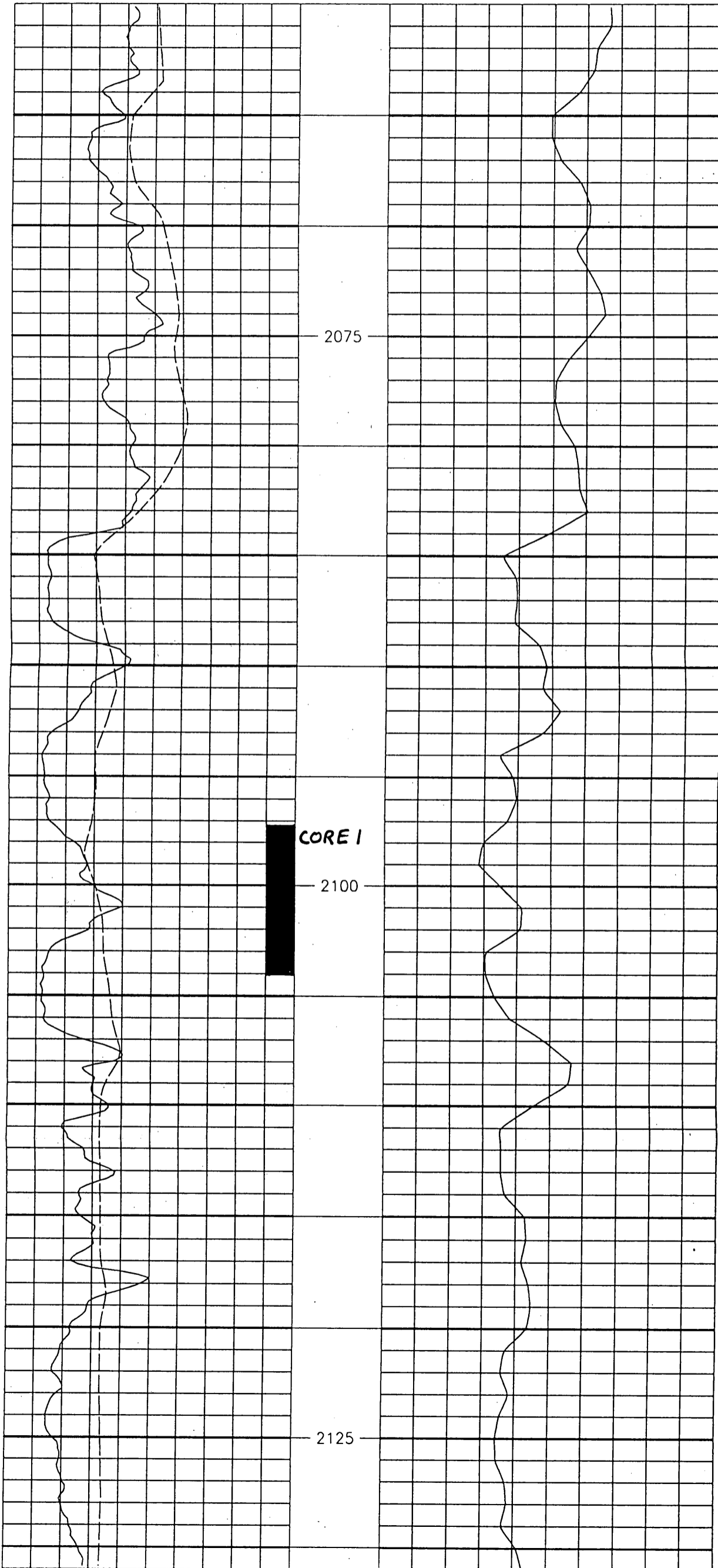
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MUSSEL - 1



DEPTH



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ESSO STANDARD OIL (AUSTRALIA) LTD.

CORE DESCRIPTION after Lunt 1970

Core No. 3

2235.7 - 2242.4 m RL4b

WELL: MUSSEL #1.

Interval Cored 7335-7357 ft., Cut 22 ft., Recovered 9 ft., (44%) Fm. WAARRE?

Bit Type C20, Bit Size 8 5/16 in., Desc. by H. STEAD Date 4/9/1969.

Depth & Coring Rate (min./ft.)	Graphic (1" = 5')	Shows	Interval (ft.)	Descriptive Lithology
0 - 20			<p>7335 - 7336'</p> <p>7336 - 7336.3'</p> <p>7336.3 - 7343'</p> <p>7343 - 7344'</p> <p>7344 - 7357'</p>	<p><u>Shale</u>; med dk. gy; massive; hard; mod. fissile. with abund. fine mica.</p> <p><u>Claystone?</u> med. gy.; hard; massive; with 10% clear, f-peggle sized qtz grains & 20% chlorite inclusions set in a dense matrix of clay with min. dispersed pyrite. (Note: only one rounded piece of this rock was recovered but is almost certainly a thin interbed between the shales.); very cleismic.</p> <p><u>Shale - carbonaceous</u>; med dk. gy - black, massive laminated; hard - v. hard; mostly very fissile; with occas. v. fine silty laminae; with freq. wavy, discontinuous thin coal laminae which have over partly replaced by pyrite. Increase in carbonaceous content towards base. Slight gas bleed.</p> <p><u>Coal</u>; dk. brn - blk; dull - vitreous; very brittle & fractured.</p> <p>No Recovery.</p>

REMARKS:

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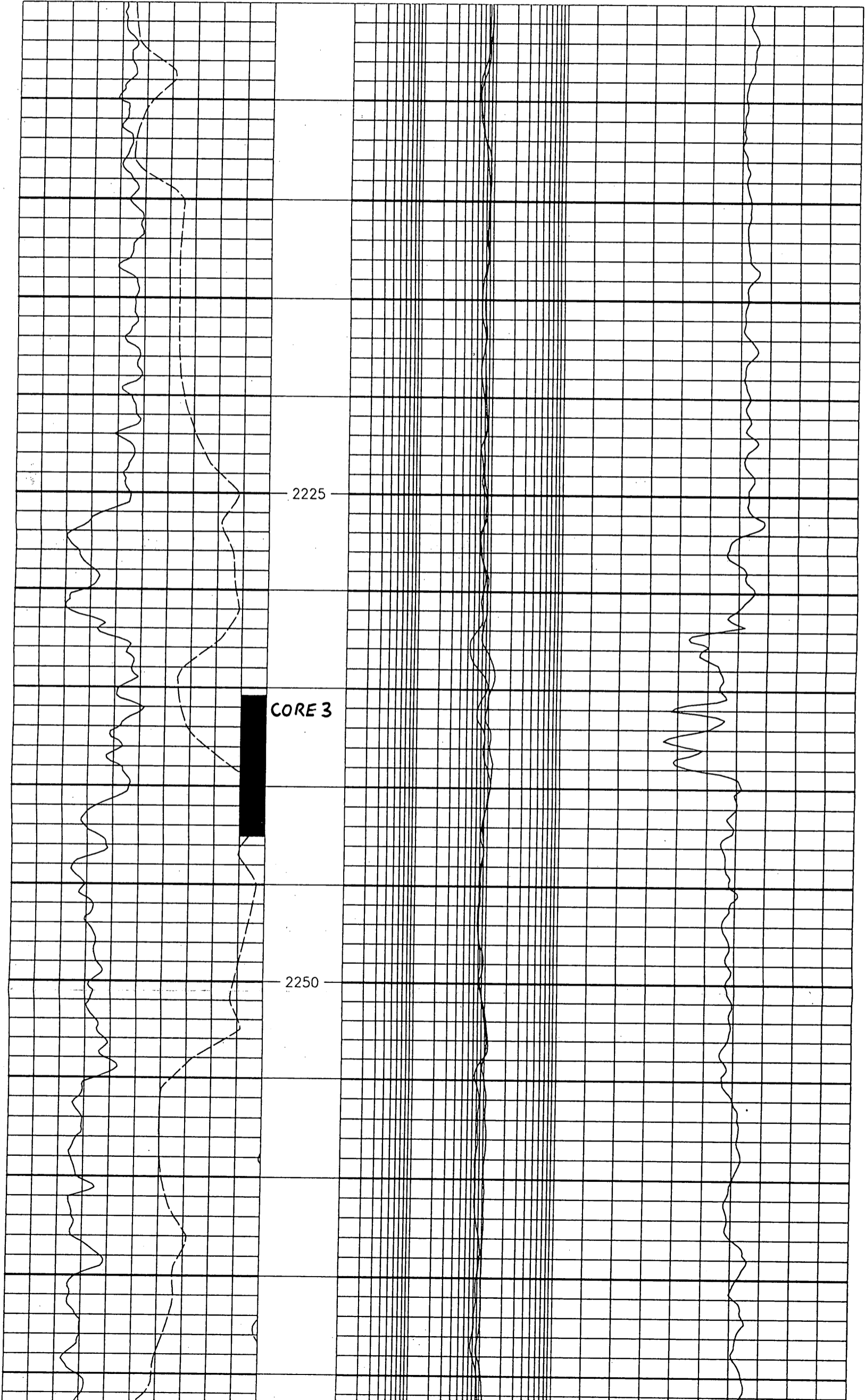
-80 SP 20
MV
0 GR 150
GAPI
8 CAL I 18
INCH

DEPTH

0.1 IND 100

OHMM
0.1 SN 100 500

SONIC 100
US/M



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MUSSEL-1

