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HAMMERHEAD-1 WELL

PALYNOLOGICAL EXAMINATION AND
KEROGEN TYPING OF SIDE WALL CORES

BY

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GIPPSLAND BASIN

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PALYNOLOGICAL EXAMINATION AND KEROGEN TYPING OF SIDEWALL CORES

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Palynological Report

CLIENT : Shell Development (Australia) Pty. Ltd.

STUDY : Hammerhead No. 1 Well, Gippsland Basin.

AIMS : Determination of age and distribution of kerogen types and spore colour.

INTRODUCTION

Thirty sidewall cores from Hammerhead No. 1 Well drilled in the Gippsland Basin at Lat. 38°10'34.23"S, Long. 149°49'59.30"E in Vic. P-19 were processed by normal palynological procedures.

The basis of the biostratigraphic and consequent age determinations are based on Stover and Partridge (1973) and Partridge (1976).

OBSERVATIONS AND INTERPRETATION

A. Biostratigraphy

Table 1 summarises the biostratigraphy and age determination for the samples studied. Table II indicates the distribution of species encountered in the sequence.

Several samples from this well are barren of plant microfossils and this is mostly due to unfavourable lithologies. These are dominated by light grey to white argillaceous sandstones and claystones generally representing oxidising environments of deposition.

Many samples yielded only three or four grains per slide and these may very easily be contaminants and thus the samples have been logged as barren. In any event the species recorded were invariably long ranging forms of minimal biostratigraphic value.

The oldest assemblages recovered, from between 2104 and 2123m yielded poorly diversified assemblages with Australopollis obscurus and Cyathidites splendens which indicate that the sequence is no older than the Tricolpites longus Zone.

The next reasonable assemblages from between 1623 and 1862.5m and at 2049m are likewise very poorly diversified with elements such as Latrobosporites ohaiensis and Lygistepollenites balmei which indicate a correlation with zones Tricolpites lilliei or younger.

The youngest possible age for the sediments between 2123 and 1623m is Paleocene, Lygistepollenites balmei Zone. There is however insufficient evidence to be certain of either the biostratigraphic correlation or age.

The uppermost sample to yield diagnostic species occurs at 1429m and the assemblage includes Tetracolporites verrucosus, Proteacidites angulatus and Cyathidites splendens. Again the assemblage contains few specimens and few species. However the age is no younger than L. balmei and is no older than T. longus.

TABLE I

WELL NAME: Hammerhead #1

DEPTH (M)	SAMPLE TYPE	PRESERVATION	DIVERSITY ZONE	SPORE/POLLEN LEVEL	CONFIDENCE	ENVIRONMENT
1316.5	SWC 63	Barren		-	-	
1340	SWC 61	Barren		-	-	
1395	SWC 55	Barren		-	-	
1402	SWC 53	Barren		-	-	
1429	SWC 48	Good	V. poor	No younger than L. balmei	3	?Non-marine
1441	SWC 46	Barren		-	-	
1482	SWC 45	Barren		-	-	
1499	SWC 41	Barren		-	-	
1509	SWC 40	Fair	V. poor	indeterminate	-	
1515	SWC 39	Barren		-	-	
1516	SWC 38	Barren		-	-	
1526	SWC 37	Barren		-	-	
1538	SWC 36	Barren		-	-	
1546	SWC 35	Barren		-	-	
1557.5	SWC 34	Barren		-	-	
1567	SWC 33	Barren		-	-	
1598	SWC 32	Barren		-	-	
1623	SWC 31	Fair	V. poor	No older than T. lilliei	3	Non marine
1846	SWC 15	Poor	V. poor	"	3	Non-marine
1862.5	SWC 14	V. poor	V. poor	"	3	Non-marine
1946	SWC 12	V. poor	V. poor	indeterminate	-	
1948	SWC 11	V. poor	V. poor	"	-	
1952	SWC 10	Barren		-	-	
1966	SWC 9	Barren		-	-	
2037	SWC 8	Barren		-	-	
2049	SWC 7	Fair	V. poor	No older than T. lilliei	3	Non-marine
2068	SWC 6	Barren		-	-	
2085	SWC 5	Good	V. poor	indeterminate	-	
2104	SWC 4	Fair	V. poor	?T. longus	3	Non-marine
2123	SWC 1	Poor	V. poor	?T. longus	3	Non-marine

Confidence levels: 1. Cuttings sample, low diversity ± contaminants. 2. Cuttings sample, good assemblage.
3. Core or sidewall core, low diversity, ± contaminants. 4. Core or sidewall core,low diversity
5. Core or sidewall core, good assemblage.

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TABLE II

HAMMERHEAD NO. 1 WELL

DISTRIBUTION OF SPECIES

	Depth (m)	1429	1846	1862	1946	1948	2049	2085	2104	2123
Cyathidites splendens		x					x		x	x
Podocarpidites sp		x	x	x	x		x	x	x	x
Proteacidites angulatus		x								
Tetracolporites verrucosus		x								
Dilwynites granulatus			x							
Lygistepollenites balmei			x							
L. florinii			x							x
Microcachryidites antarcticus			x			x				
Nothofagidites senectus			x							
Parvisaccites catastus cf.			x							
Phyllocladidites mawsonii			x							
P. verrucosus			x							
Podosporites sp.			x	x	x	x				
Proteacidites spp indet.			x	x						x
Rugulatisporites mallatus cf.			x							
Tricolpites gillii			x							
Tricolporites sp. indet.			x							
Cyathidites australis				x	x			x	x	
?Amosopollis cruciformis					x	x			x	x
Falcisporites similis					x					
*Cicatricosisporites hughesi						x				
*C. ludbrooki						x				
Dictyophyllidites sp.						x				
Laevigatosporites sp.						x				
Podocarpidites ellipticus						x				
Ceratosporites equalis							x	x		
Gleicheniidites circinidites							x			x
Latrobosporites ohaiensis							x			
Australopollis obscurus									x	x
Camerozonosporites bullatus									x	
Tricolpites longus									x	
Podosporites microsaccatus										x

* Reworked Cretaceous species

None of the samples which yielded palynomorphs contained marine dinoflagellates and the conclusion is that these samples are of non-marine origin.

B. Kerogen Types and Spore Colouration

During routine palynological processing of sidewall cores an unoxidised kerogen sample was taken and the nature of the kerogens and spore colouration are documented in Table V. Only those samples which yielded spore/pollen assemblages have been examined. Spore colour is expressed as the "Thermal Alteration Index" (TAI) of Staplin (1969) according to the scale in Table IV.

TABLE III

Thermal - Alteration Index	Organic matter/spore colour
1 - none	fresh, yellow
2 - slight	brownish yellow
3 - moderate	brown
4 - strong	black
5 - severe	black and evidence of rock metamorphism

Total organic matter (TOM) is expressed semi-quantitatively in the scale- abundant, moderate, low, very low, barren. Samples classed as having abundant or moderate amounts of TOM would be expected to have TOC's (total organic carbon) greater than 1%.

In this report four classes of organic matter are recognised - amorphogen, phyrogen, hylogen and melanogen and these terms are more or less synonymous with amorphous, herbaceous, woody and coaly. For reasons as outlined by Bujak et al. (1977) the former terms are preferred because they do not have a botanical connotation. The thermal alteration index scale follows that of Stapliln (1969) and as outlined by Bujak et al. (1977). At a TAI of 2+ all four types of organic material contribute to hydrocarbon generation whereas at a TAI of 2, only amorphogen forms liquid hydrocarbons. The upper boundary defining the oil window is at a TAI of approximately 3 but varies according to the organic type. Above TAI 3+ all organic types only have a potential for thermally derived methane.

The section is characterised by very low TOM's and the dominant kerogen type is melanogen. Three samples have high amorphogen which is dominantly finely divided organic matter. In very low yielding sediments this is insignificant with regard to source rock potential.

Where spore colour was determined it is indicative of immaturity.

All of the evidence suggests that this section in the early Tertiary is immature and does not contain sufficient organic material of a favourable nature to be considered as a potential source rock for the generation of hydrocarbons.

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TABLE IV

HAMMERHEAD NO. 1 WELL

Distribution of Kerogen Types and Spore Colour in Selected Samples

DEPTH	TAI	TOM	PHYRO. %	AMORPHO. %	HYLO. %	MELANO. %
1846	2	moderate	20	60	Tr	20
1862	2+	v. low	5	5	Tr	90
1946	2+	v. low	5	10	5	80
1948	2+	low	15	45	10	30
1952	N.D.	v. low	-	80	-	20
1966	N.D.	low	5	15	Tr	80
2037	N.D.	v. low	5	-	-	95
2049	N.D.	low	Tr	10	Tr	90
2068	2^-	v. low	15	-	5	80
2085	2^-	moderate	20	-	Tr	80
2104	2^-	low	5	25	-	70
2123	1^+	v. low	5	80	Tr	15

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