WEST SEAHORSE NO. 1 WELL

PALYNOLOGICAL EXAMINATION OF SIDEWALL CORE

by

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WESTERN MINING CORPORATION LIMITED

PALYNOLOGICAL REPORT

CLIENT: Hudbay Oil (Australia) Ltd.

STUDY: West Seahorse No. 1 Well, Gippsland Basin.

AIMS: Determination of age of sediments from 53 sidewall cores.

INTRODUCTION

Fifty three sidewall cores from West Seahorse No. 1 Well drilled in the Gippsland Basin at Lat. 38° 12'17.17"S, Long. 147°37'21.7"E in Vic P-11, were processed by normal palynological procedures.

The basis for the biostratigraphic and consequent age determinations are based on Stover and Partridge (1973) and Partridge (1976). The current nomenclature of zones and their correlation with the geological time scale is presented in Figure 1.

OBSERVATIONS AND INTERPRETATION

Table 1 summarizes the distribution of palynomorph species that have significant time ranges during the Late Cretaceous and Early Tertiary. Long ranging species have been omitted.

Table II summarizes the interpreted biostratigraphy and age determinations based on the observations collated in Table I. Many of the samples from this well are barren of plant microfossils and this is mostly due to unfavourable lithologies being samples. The lithologies that dominate these barren samples are light grey to white argillaceous sandstones and claystones and these would generally represent oxidising environments.

In general the assemblages were not well preserved and were mostly very sparse with regard to numbers of microfossils although many samples yielded moderate amounts of organic matter. Poorly preserved assemblages are predominant in the lower section of the well in the Late Cretaceous and Paleocene sections whereas assemblages in the Malvacipollis diversus Assemblage Zone are reasonaby well preserved but are very sparse. The organic matter in these samples consists mostly of inertinite-like material suggestive of at least some oxidation during deposition.

These two factors result in many samples being classed as "indeterminate". For the same reasons it has not been possible to more finely subdivide the assemblages into "Lower", "Middle" or "Upper" units.

Nothofagidites senectus Zone - two samples at 2468 and 2403.1m are identified as this zone. In particular the assemblages include Nothofagidites senectus, Tricolpites sabulosus, Aequitriradites sp. aff. A. verrucosus and Krauselisporites aff. K. jubatus. Diagnostic species from the succeeding unit are absent. The assemblage is non-marine.

Figure 1

Correlation of Gippsland Basin zonations

with the geological time scale (From Partridge, 1976)

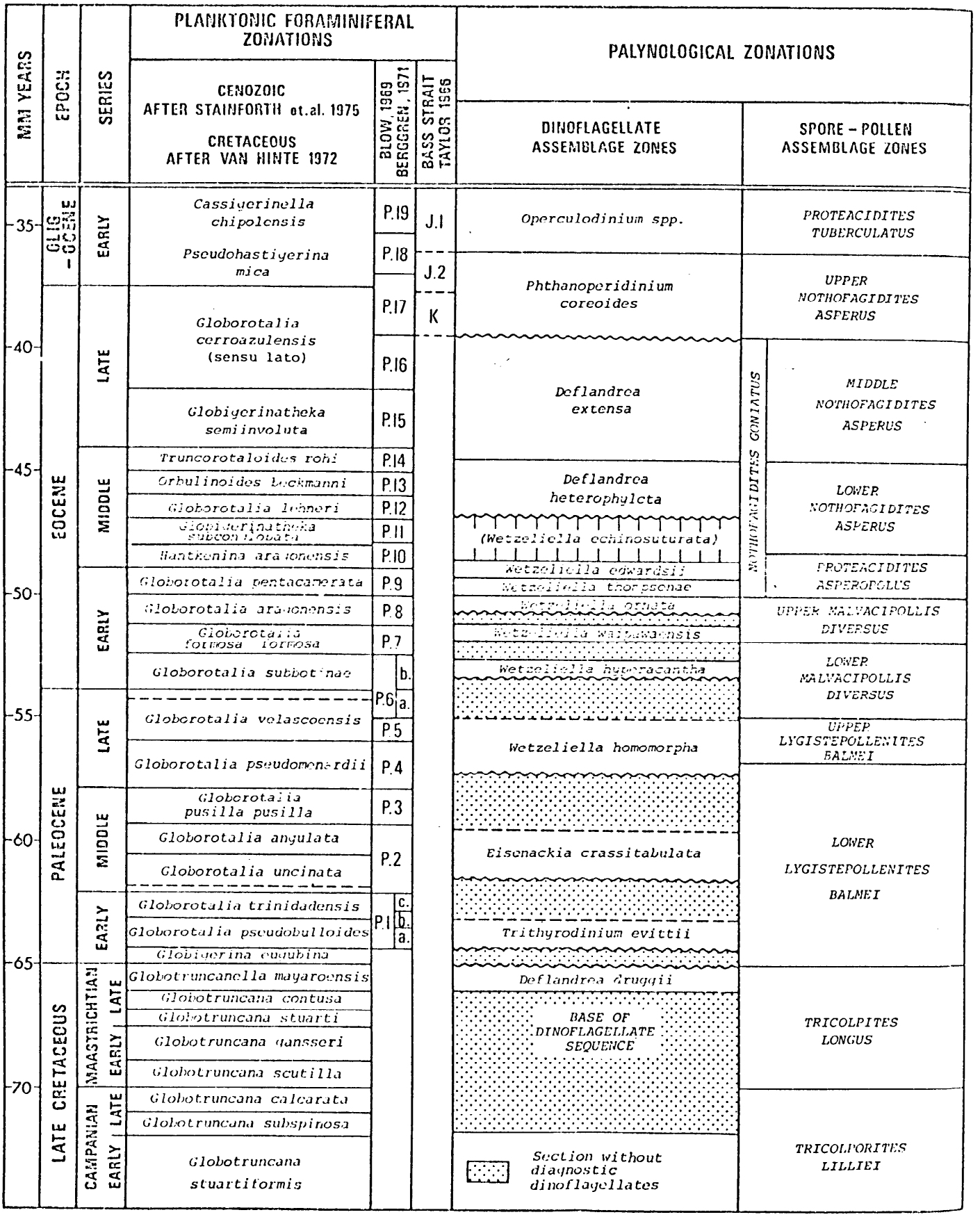

TABLE 1

West Seahorse No. 1 Well

Distribution of selected species

Species \ Depth in metres	2468.0	2403.1	2204.5	2125.1	2103.1	2083.2	1894.2	1872.0	1855.3	1778.0	1648.2	1594.9	1512.8	1487.2	1475.5	1460.5	1435.8	1434.0	1423.4	1422.4
Aequitriradites cf A. verrucosus	X	X																		
Krauselisporites cf K. jubatus	X																			
Tricolpites sabulosus	X	X																		
Nothofagidites senectus	X	X																		
Gambierina rudata	X	X	X	X	X	X	X													
Proteacidites amolosexímus	X	X																		
Tricolpites lilliei			X																	
Tricolpites confessus			X																	
Lygistepollenites balmei			X	X	X	X	X	X	X	X										
Latrobosporites ohaiensis			X	X	X	X	X		X	X										
Triporopollenites sectilis			X	X	X	X														
Nothofagidites endurus			X	X	X															
Proteacidites scaboratus			X	X	X	X	X			X										
Gambierina edwardsii				X	X	X	X		X	X										
Tricolpites gillii				X	X	X	X			X										
Tricolpites longus				X																
Tetracolporites verrucosus					X		X		X											
Herkosporites elliottii						X	X		X	X		X		X						
Phyllocladidites reticulosaccatus					X	X	X		X											
Proteacidites angulatus							X		X	X										
Dilwynites granulatus								X	X	X										
Austalopollis obscurus								X	X	X										
Simplicepollis meridianus								X	X											
Nothofagidites flemingii									X	X		X	X	X						
Rugulatisporites mallatus										X		X								
Malvacipollis diversus											X	X	X	X		X	X	X	X	X
Cupanieidites orthoteichus											X	X	X			X		X	X	X
Verrucosisporites kopukuensis											X	X		X		X			X	
Liliacidites lanceolatus											X	X						X	X	
Proteacidites pachypolus													X	X		X		X		
Kuylisporites waterbolki														X		X				
Santalumidites cainozoicus															X	X		X	X	
Tricolporites adelaidensis															X		X		X	X
Periporopollenites demarctus																	X	X		X

TABLE II

WEST SEAHORSE NO. 1 WELL

SUMMARY OF BIOSTRATIGRAPHY AND AGE DETERMINATIONS

SWC No.	Depth in Metres	Biostratigraphic Unit	Age
44	1403.6m	Indeterminate	
68	1405.0m	Indeterminate	
43	1408.4m	Indeterminate	
67	1409.0m	Indeterminate	
55	1411.2m	Indeterminate	
54	1416.0m	Barren	
40	1418.7m	Barren	
65	1422.4m	? M. diversus	Late Paleocene to Early Eocene
39	1423.4m	? M. diversus	Late Paleocene to Early Eocene
38	1432.2m	Barren	
64	1434.0m	? M. diversus	Late Paleocene to Early Eocene
30	1435.8m	? M. diversus	Late Paleocene to Early Eocene
62	1460.5m	M. diversus	Late Paleocene to Early Eocene
25	1475.5m	M. diversus	Late Paleocene to Early Eocene
24	1484.6m	Indeterinate	
36	1487.2m	? M. diversus	Late Paleocene to Early Eocene
22	1498.4m	Indeterminate	
32	1512.8m	? M. diversus	Late Paleocene to Early Eocene
15	1530.2m	Barren	
60	1574.2m	Barren	
11	1594.9m	? M. diversus	Late Paleocene to Early Eocene
8	1648.2m	M. diversus	Late Paleocene to Early Eocene
7	1651.8m	Barren	
6	1662.5m	Barren	
31	1665.0m	Barren	
58	1726.0m	Barren	
57	1738.2m	Barren	
56	1741.0m	Barren	
53	1778.0m	L. balmei	Paleocene
52	1787.5m	Barren	
51	1796.8m	Barren	
50	1801.5m	Barren	
49	1855.3m	L. balmei	Paleocene
48	1872.0m	L. balmei	Paleocene
47	1881.5m	Barren	
46	1894.2m	L. balmei	Paleocene
45	1913.6m	Barren	
43	1933.4m	Barren	
41	1947.2m	Barren	
40	1968.4m	Indeterminate	
36	2031.8m	Indeterminate	
35	2072.1m	Indeterminate	
34	2083.2m	L. balmei	Paleocene
33	2103.1m	No older than T. longus	?Maastrichtian
32	2125.1m	No older than T. lilliei	?Campanian
30	2171.8m	Barren	
29	2204.5m	T. lilliei	Campanian
28	2211.3	Barren	
19	2332.2m	Indeterminate	
12	2403.1m	N. senectus	Senonian
11	2409.9m	Barren	
3	2468.0m	N. senectus	Senonian
1	2486.9m	Barren	

Tricolpites lilliei Assemblage Zone - The base of this zone is marked by the first appearance of T. lilliei at 2204.5m. Associated species include Lygistepollenites balmei, Gambierina rudata, Tricolpites confessus and Latrobosporites ohaiensis. The zone extends to 2125.1m and is non-marine.

?Tricolpites longus Assemblage Zone - One sample at 2103.1m yielded a sparse assemblage which cannot be accurately placed. It is no older than the T. longus assemblage but may belong to the younger Lygistepollenites balmei Assemblage Zone. The assemblage includes Gambierina spp., Tetracolporites verrucosus and Phyllocladidites reticulosaccatus. The last named species would tend to argue for a correlation with the L. balmei zone but there is insufficient evidence to confirm this. The unit is non-marine.

Lygistepollenties balmei Assemblage Zone - this unit extends from 2083.2m to at least 1778.0m and the section contains many either barren or indeterminate samples. The base of the zone is marked by the consistent occurrence of Haloragacidites harrisii, Phyllocladidites reticulosaccatus, Herkosporites elliottii, Rugulatisporites mallatus and Simplicepollis meridianus. Nothofagidites flemingii ocurs at 1855.3m suggesting that the upper part of the L. balmei zone is present. There are however no other criteria in the samples to support a finer zonation of the unit in this well. The zone in this well is non-marine.

Malvacipollis diversus Assemblage Zone - The assemblage from 1648.2m contains both Malvacipolis diversus and Cupanieidites orthoteichus indicating a correlation with this zone. Other elements in this zone include Proteacidites pachypolus, P. kopiensis, Kuylisporites waterbolki often abundant Haloragacidites harrisii and frequent Nothofagidites spp. The presence of Santalumidites cainozoicus at 1475.5m would suggest that this sample is within the Upper M. diversus zone. As mentioned previously the residues from this part of the section consist almost entirely of inertinite-like matter with very few spores and pollen. Consequently no further subdivision of this zone is possible. Indeed the extreme paucity of identifiable microfossils from betwen 1418.7 and 1403.6m hinders any correlation of these samples. However it is unlikely that they are much younger from those at about 1422m. The kerogens are essentially similar and indicate that the same lithological unit is represented between 1422 and 1403m.

No marine microfossils were recorded from this unit.

REFERENCES

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Partridge, A.D., 1976: The Geological Expression of Eustacy in the Early Tertiary of the Gippsland Basin. J. Aust. Petrol. Expl. Assoc., 16: 73-79.

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KEROGEN TYPES AND SPORE COLOURATION

FROM SELECTED SIDEWALL CORES

by

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WESTERN MINING CORPORATION LIMITED

PALYNOLOGICAL REPORT

Client: Hudbay Oil (Australia) Ltd.

Study: West Seahorse No. 1 Well, Gippsland Basin.

Aims: Kerogen typing and spore colouration.

INTRODUCTION

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

TABLE I

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 content) 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 connatation. The thermal alteration index scale follows that of Staplin (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.

INTERPRETATION

The best potential source rocks occur between 1430 and 1770m where high organic yields have been recorded. These occur within the M. diversus assemblage zone and are only very marginally mature to immature for hydrocarbon generation. However amorphogen is often the dominant organic matter and may produce hydrocarbons at a low temperature regime.

The organic matter near the base of the well in the Late Cretaceous section is very variable in TOM with some samples yielding moderate amounts. This section is also more mature and the kerogens tend to be dominated by phyrogen which when mature would be expected to source liquid hydrocarbons.

In general the thermal maturity of West Seahorse No. 1 appears to be low and little if any hydrocarbons would appear to have been generated from this section.

TABLE II

WEST SEAHORSE NO. 1 WELL

DISTRIBUTION OF KEROGEN TYPES AND SPORE COLOUR IN SELECTED SAMPLES

Depth (m)	TAI	TOM	Amorpho.	Phyro.	Hylo.	Melano
1422.4	1+	v. low	95	5	Tr	Tr
1423.4	1+	v. low	90	5	Tr	5
1434.0	2-	abundant	60	10	10	20
1435.8	2-	moderate	50	10	10	30
1460.5	2-	abundant	90	5	Tr	5
1475.5	2-	abundant	Tr	10	20	70
1487.2	2-	moderate	Tr	10	20	70
1512.8	2-	moderate	Tr	75	15	10
1594.9	2-	v. low	Tr	50	5	45
1648.2	2-	abundant	Tr	30	10	60
1778.0	2	moderate	Tr	90	Tr	10
1855.3	2	low	Tr	5	5	90
1894.2	2	low	5	20	5	70
2083.2	2	low	Tr	55	15	30
2125.1	2	v. low	-	5	5	90
2332.5	2	low	-	75	5	10
2703.1	2	moderate	-	80	10	10
2468.0	2+	moderate	-	30	5	65

Kerogen macerals are given as a percentage. Less than 5% is recorded as a trace (Tr).

REFERENCES

Bujak, J.P., Barss, M.S., and Williams, G.L., 1977: Offshore East Canada's Organic Type and Color and Hydrocarbon Potential. Oil Gas J., 45 (14): 198-202.

Staplin, F.L., 1969: Sedimentary Organic Matter, Organic Metamorphism and Oil and Gas Occurrence. Bull. Can. Pet. Geol., 17: 47-66.

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