WEST SEAHORSE NO. 2 WELL
GIPPSLAND BASIN

PALYNOLOGICAL EXAMINATION OF SIDEWALL CORES

by
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PALYNOLOGICAL REPORT

Client : Hudbay Oil (Australia) Ltd.

Study : West Seahorse No. 2 Well

Aim : Determination of age and distribution of kerogen types.

INTRODUCTION

Thirty five sidewall cores from West Seahorse No. 2 Well drilled in the Basin at Lat. 38°12'21.78"S, Long. 147°36'38.44"E in Vic. P-11 were processed by normal palynological procedures.

The basis for the biostratigraphy and consequent age determinations are based on Stover & Partridge (1973) and Partridge (1976).

OBSERVATIONS AND INTERPRETATION

A. Biostratigraphy

Table I summarises the biostratigraphy and age determinations for the samples studied.

Preservation of the productive samples ranged from very poor to fair, and below 1772m most samples were barren. The lithologies in these samples were generally white to pale grey argillaceous sandstones. Throughout the well, assemblages were poorly diversified with very low yields. Many samples produced only one slide for examination.

Species identified in productive samples are listed in the Appendix.

1. ?L. balmei Zone: 1796-1968m
   Assemblages from this interval were very poorly preserved and lacked sufficient diversity to be more confident of the zonal assignment. Species which suggest a correlation with the L. balmei zone include L. balmei and H. harrisii. However the low diversity, poor preservation and poor yields places some caution on this assignment. The assemblages are non-marine.

2. Malvacipollis diversus Zone: 1610-1772m
   The recognition of this zone is based on the first appearance of Cupanieidites orthoteichus with Banksieaeidites arcuatus and Verrucosisporites kopukuensis and the absence of elements of the L. balmei zone such as L. balmei. Again the diversity of these assemblages is very low and no finer subdivision of this zone is possible on the evidence available. The assemblages are of non-marine aspect.

3. Nothofagidites asperus Zone: 1407-1457m
   An increase in diversity and numerical representations of the Nothofagidites group is characteristic of this zone. In particular N. vansteenisi occurs consistently from 1457m upwards. Associated species include V. kopukuensis, T. adelaidensis and M. ornamentalis.

TABLE I

WEST SEAHORSE NO. 2

SUMMARY OF PALYNOLOGICAL DATA

Depth	SWC	Preservation	Diversity	Spore Pollen Zone	Confidence Levels	Environment
1403	51	barren	-	-	-	-
1407	50	fair	very low	?N. asperus	-	Non marine
1410	49	fair	very low	?N. asperus	-	Non marine
1411	48	barren	-	-	-	-
1412	47	fair	very low	N. asperus	-	Non marine
1413	46	barren	-	-	-	-
1427.5	40	fair	very low	?N. asperus	-	Non marine
1431	38	fair	very low	?N. asperus	-	Non marine
1433	36	fair	very low	?N. asperus	-	Non marine
1434.9	34	fair	very low	?N. asperus	-	Non marine
1436	33	fair	very low	?N. asperus	-	Non marine
1438	32	fair	very low	N. asperus	5	Non marine
1449	30	fair	very low	N. asperus	4	Non marine
1457	29	fair	very low	N. asperus	4	Non marine
1512	27	barren	-	-	-	-
1610	24	fair	very low	M. diversus	4	Non marine
1640	23	fair	very low	M. diversus	5	Non marine
1645	22	fair	very low	M. diversus	4	Non marine
1687	21	barren	-	-	-	-
1772	20	fair	very low	M. diversus	4	Non marine
1786	18	barren	-	-	-	-
1796	17	v. poor	very low	?L. balmei	3	Non marine
1803	16	barren	-	-	-	-
1811	15	barren	-	-	-	-
1826	14	barren	-	-	-	-
1841	13	barren	-	-	-	-
1844	12	v. poor	very low	?L. balmei	-	Non marine
1850	11	barren	-	-	-	-
1861	10	v. poor	very low	?L. balmei	-	Non marine
1949	7	barren	-	-	-	-
1936	8	barren	-	-	-	-
1968	6	v. poor	very low	?. L. balmei	-	Non marine
1985	4	barren	-	-	-	-
2007	3	barren	-	-	-	-
2022	2	barren	-	-	-	-

TABLE II

MATURATION LEVELS, Bujak et al. 1977

CATEGORIES	ORGANIC COMPONENTS	OIL	GAS CONDENSATE	THERMALLY DERIVED METHANE
		TAI	TAI	TAI
HYLOGEN	NON-OPAQUE FIBROUS PLANT MATERIAL OF WOODY ORIGIN } TRACHEIDS VESSELS	>2→3 (2.5-2.9)	>2→≥3 (2.3-3.2)	2→4
PHYROGEN	NON-OPAQUE NON-WOODY ORIGIN } SPORES POLLEN ALGAE ACRITARCHS CUTICLES	>2→3 (2.2→3)	2→<3+	>2⁻→4
AMORPHOGEN	STRUCTURELESS ORGANIC MATTER } FINELY DISSEMINATED or COAGULATED FLUFFY MASSES	2→<3+	2→3+	3+→5
MELANOGEN	OPAQUE ORGANIC DEBRIS	-	2+→<3	2.5-4

Notes: (1) Hylogen, Phyrogen, Melanogen 4→5: Traces of Dry Gas and Co_2

(2) Hylogen, Phyrogen, Melanogen 1→2: Biogenic methane (Marsh gas).

TAI (Thermal Alteration Index): 1+, 2-, 2 - YELLOWS
2, 2+, 3, 4 - BROWNS
4-, 5 - BLACK

TABLE III

WEST SEAHORSE NO. 2

SUMMARY OF KEROGEN DATA

DEPTH	SWC	TOM	PHYRO	AMORPO	HYLO	MELANO	TAI
1403	51	very low	5	5	-	90	ND
1407	50	very low	10	10	-	80	1+
1410	49	very low	30	10	-	60	-
1411	48	very low	10	10	Tr	80	-
1412	47	very low	30	10	-	60	1+
1413	46	very low	5	15	Tr	80	ND
1427.5	40	very low	30	5	5	60	1+
1431	38	very low	5	15	Tr	80	1+
1433	36	low	5	15	Tr	80	-
1434.9	34	low	10	-	Tr	90	-
1436	33	low	10	20	10	60	-
1438	32	low	20	10	Tr	70	2-
1449	30	low	30	10	Tr	60	2-
1457	29	moderate	60	10	10	20	2-
1512	27	barren	-	-	-	-	-
1610	24	very low	45	5	5	45	2-
1640	23	very low	80	5	-	15	2-
1645	22	moderate	50	15	-	35	2-
1687	21	barren	-	-	-	-	-
1772	20	moderate	70	-	-	30	2-
1786	18	barren	-	-	-	-	-
1796	17	low	80	5	-	15	2-
1803	16	barren	-	-	-	-	-
1811	15	barren	-	-	-	-	-
1826	14	barren	-	-	-	-	-
1841	13	barren	-	-	-	-	-
1844	12	low	20	10	-	70	2-
1850	11	barren	-	-	-	-	-
1861	10	very low	15	-	-	85	2-
1949	7	barren	-	-	-	-	-
1936	8	barren	-	-	-	-	-
1968	6	very low	20	15	-	65	ND
1985	4	barren	-	-	-	-	-
2007	3	barren	-	-	-	-	-
2022	2	barren	-	-	-	-	-

In many of the samples species numbers and diversity is extremely low and samples are tentatively allocated to this zone. However no elements of the younger Proteacidites tuberculatus zone have been recorded, and these assemblages are no older than N. asperus Zone. No finer subdivision is possible because of those same reasons. The assemblages have been entirely derived from a terrestrial source.

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 III. Spore colour is expressed as the "Thermal Alteration Index" (TAI) of Staplin (1969) according to the scale in Table II.

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 connotation. 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 contributed 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.

Total organic matter in samples from West Seahorse No. 2 Well is generally very low with TAI's less than two. Consequently the samples are considered immature for the generation of hydrocarbons and together with their very low organic matter content are believed to be poor potential source rocks.

REFERENCES

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

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

Stover, L.E. & Partridge, A.D., 1973: Tertiary and Late Cretaceous Spores and Pollen from the Gippsland Basin, southeastern Australia. Proc. R. Soc. Vict., 85: 237-286.

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APPENDIX

WEST SEAHORSE NO. 2 WELL

Depth	Species Listing
1407m	Haloragacidites harrisii Laevigatosporites cf. major Nothofagidites brachyspinulosus N. emarcidus/heterus N. vansteenisii Podocarpidites sp. Phyllocladidites mawsonii Proteacidites sp. Verrucosisporites kopukuensis
1410m	Haloragacidites harrisii Malvacipollis diversus Nothofagidites emarcidus/heterus N. vansteenisii Podocarpidites sp. Phyllocladidites mawsonii Proteacidites sp. Tricolporites adelaidensis
1412m	Cyathidites sp. Haloragacidites harrisii Lygistepollenites florinii Nothofagidites emarcidus/heterus N. flemingii N. vansteenisii Periporopollenites demarcatus Phyllocladidites mawsonii Podocarpidites sp. Proteacidites sp. P. recavus Tricolporites sp.
1427.5m	Cyathidites sp. Gleicheniidites circinidites Malvacipollis diversus Phyllocladidites mawsonii
1431m	Haloragacidites harrisi Nothofagidites emarcidus/heterus N. flemingii Phyllocladidites mawsonii Proteacidites sp. Tricolporites sp.
1433m	Cyathidites sp. Haloragacidites harrisi Malvacipollis diversus Nothofagidites emarcidus/heterus Podocarpidites sp. Phyllocladidites mawsonii

1434.9m	Cupanieidites orthoteichus Gleicheniidites circinidites Haloragacidites harrisii Lygistepollenites florinii Nothofagidites brachyspinulosus N. emarcidus/heterus Phyllocladidites mawsonii Tricolporites adelaidensis
1436m	Beaupreaidites elegansiformis Cyathidites sp. Haloragacidites harrisii Nothofagidites brachyspinulosus Phyllocladidtes mawsonii Tricolporites adelaidensis Verrucosisporites kopukuensis
1438m	Haloragacidites harrisii Malvacipollis diversus Matonisporites ornamentalis Nothofagidites asperus N. emarcidus/heterus Phyllocladidites mawsonii Polypodiidites sp. Proteacidites sp. Tricolporites adelaidensis Verrucosisporites kopukuensis
1449m	Dictyophyllidites sp. Haloragacidites harrisii Laevigatosporites cf. major Malvacipollis diversus Nothofagidites emarcidus/heterus N. flemingii N. vansteenisii Periporopollenites vesicus Podocarpidites sp. Proteacidites sp.
1457	Dilwynites granulatus Haloragacidites harrisii Ilexpollenites anguloclavatus Laevigatosporites cf. major Nothofagidites emarcidus/heterus Nothofagidites vansteenisii Podocarpidites sp. Proteacidites sp. Sapotaceoidaepollenites rotundus Tricolporites adelaidensis T. sphaerica
1610m	Cupanieidites orthoteichus Cyathidites sp. Haloragacidites harrisii Malvacipollis diversus Nothofagidites emarcidus/heterus

	Podocarpidites sp.
	Proteacidites kopiensis
	P. latrobensis
	Tricolporites scabratus
	Verrucosisporites sp.
1640m	Anacolosidites luteoides
	Cyathidites sp.
	Dictyophyllidites sp.
	Haloragacidites harrisii
	Liliacidites sp.
	Lygistepollenites florinii
	Malvacipollis diversus
	Myrtaceidites parvus/mesonesus
	Podocarpidites sp.
	Proteacidites sp.
	P. annularis
	P. kopiensis
	P. leightonii
	Stereisporites antiquisporites
1645m	Banksieacidites arcuatus
	Clavifera triplex
	Cupanieidites orthoteichus
	Cyathidites sp.
	Dilwynites granulatus
	Haloragacidites harrisii
	Intratriporopollenites notabilis
	Ischyosporites gremius
	Lygistepollenites florinii
	Malvacipollis diversus
	Nothofagidites flemingii
	Podosporites sp.
	Periporopollenites cf. demarcatus
	Podocarpidites sp.
	Polycolpites esobalteus
	Proteacidites sp.
	P. annularis
	Simplicepollis meridianus
	Stereisporites (Tripunctisporis) punctatus
1772m	Cyathidites australis
	Podocarpidites sp.
	Phyllocladites mawsonii
	Polycolpites cf. esobalteus
	Proteacidites sp.
	P. cf. incurvatus
	Rugulatisporites mallatus
	Verrucosisporites kopukuensis
1796m	Clavifera triplex
	Laevigatosporites major
	Podocarpidites sp.
	Proteacidites sp.
1844m	Lygistepollenites balmei
	Podocarpidites sp.

	Phyllocladidites mawsonii
	Proteacidites sp. (aff. parvus)
1861m	Cyathidites splendens
	Haloragacidites harrisii
	Lygistepollenites balmei
	Phyllocladidites mawsonii
	Proteacidites sp. indet.
1968m	Nothofagidites aff. emarcidus/heterus
	Phyllocladidites mawsonii
	Podocarpidites sp.
	Proteacidites cf. parvus