APPENDIX-2

PALYNOLOGICAL ANALYSIS OF KIPPER-1, GIPPSLAND BASIN

by

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INTERPRETATIVE DATA SECTION

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INTRODUCTION

One hundred and six samples, comprising 67 sidewall cores, 21 conventional cores and 18 cuttings samples from Kipper-1 were processed and examined for spore-pollen and dinoflagellates. Only 11 samples were barren. Residue yield was generally moderate, while preservation was poor to fair below the volcanics at 1893-1989m and generally fair to good above them. Similarly, in the Late Cretaceous section below the volcanics diversity is generally low for both spore-pollen and dinoflagellates, while in the latest Cretaceous to Tertiary above the volcanics diversity, although variable is better.

Lithological units and palynological zones from the base of the Lakes Entrance Formation to T.D. are summarised below. Interpretative data with zone identifications and confidence ratings are recorded in Table-1 and basic data on residue yield, preservation and diversity are recorded in Table-3. The occurrence of spore-pollen and dinoflagellate species are tabulated on the accompanying three range charts.

+9-1 m

SUMMARY TABLE
KIPPER-1

AGE	UNIT	SPORE-POLLEN / KEY MICROPLANKTON ZONES ZONES	DEPTH (m)
Oligocene-Miocene	Seaspray Group	*P. tuberculatus*	1412.5
	1419.5m		
Middle Eocene	Gurnard Fm.	Lower *N. asperus*/*A. diktyoplokus*	1427.6-1433.4
	1435.0m		
Early	Flounder Formation	*P. asperopolus*	1436.2-1454.4
	1461.0m		
Early Eocene	Latrobe Group (coarse clastics)	Lower *M. diversus*	1478.0-1486.0
Early Eocene		Lower *M. diversus*/*A.hyperacanthum*	1493.0
Paleocene		Upper *L. balmei*	1506.0-1562.5
Paleocene		Lower *L. balmei*	1603.0-1646.0
Paleocene		Lower *L. balmei*/*T. evittii*	1727.0
Maastrichtian		Upper *T. longus*/*M. druggii*	1733.5
Maastrichtian		Upper *T. longus*	1760.0-1855.0
Campanian		*T. lilliei*	*1895.0
	1893.0m		
	Volcanics		
	1989.0m		
Campanian-Santonian	Latrobe Group (coarse clastics)	*N. senectus*	1995.0-2080.0
		T. apoxyexinus	2135.0-2196.5
	2279.0m		
Santonian-Turonian	Kipper Formation	*P. mawsonii*	2296.5-2862.0
	TD. 2875.0m		

* Pick for *T. lilliei* Zone is based on cuttings sample.

GEOLOGICAL COMMENTS

1. The lowest 600 metres of section in Kipper-1 is composed predominantly of carbonaceous siltstones and shales (based on sidewall core descriptions) and has a consistent log character. As such it is recognised as a discrete lithological unit referred to as the Kipper Formation of the Latrobe Group. The whole unit is assigned to the P. mawsonii Zone which has an age range of Turonian to just into the base of the Santonian (Helby, Morgan & Partridge, in press). Low diversity microplankton assemblages composed of dinoflagellates, acritarchs and algae suggest a restricted marine influence. Some lithological support for this interpretation is indicated by the presence of limestone or carbonate in the formation as sampled by sidewall core at 2756.5m.

2. A moderately diverse microplankton assemblage occurs in the T. apoxyexinus Zone over the interval 2187.5-2192.0m and is referred to the informal Chatangiella perforata Zone. The assemblage is more diverse than indicated by the few species recorded on the range chart, as many of the microplankton could not be adequately named. Attention is drawn to this zone because it may have significance to the source potential or as a correlation horizon in the deeper parts of the Latrobe Group.

3. Kipper-1 has probably the thickest and best sampled sequence for palynological analysis of the Santonian to Turonian interval in the Gippsland Basin. Overall the composition of the spore-pollen assemblages from the P. mawsonii and T. apoxyexinus Zones are very similar. Although the distinct log break at the top of the Kipper Formation lies at the boundary between the two zones and may represent an unconformity it is not possible to demonstrate from the palynology whether any section is missing.

4. Predrill the top of the Strzelecki Group was predicted at 2079mKB. This is equivalent to the boundary between the N. senectus and T. apoxyexinus Zones. Although there is no obvious lithological change on the electric logs there may be an unconformity between the zones. Both the P. mawsonii and T. apoxyexinus Zones contain restricted marine microplankton assemblages which are not recognised in the overlying N. senectus Zone, indicating a shift in facies. Further the lack of key species in the T. apoxyexinus Zone suggest that it may represent only the lower portion of that zone. These broad palynological differences suggest some Santonian section may be missing in Kipper-1.

5. The 96 metres of volcanics(?) in Kipper-1 is tightly controlled by the palynological age dating. If extrusive, the volcanics are Campanian.

6. The Cretaceous/Tertiary boundary in Kipper-1 are picked at 1731.5m between the M. druggii and T. evittii dinoflagellate Zones (Helby, Morgan & Partridge in press).

7. The Latrobe Group coarse clastic facies of sands, shales and coals extends into the Early Eocene Lower M. diversus Zone; a sequence similar to the adjacent Tuna-3. The Upper and Middle M. diversus Zones and possibly part of the Lower M. diversus Zone are missing at unconformity at the top of the coarse clastics. This erosional event on the north-north-eastern flank of the Tuna-Flounder Channel is likely to be latest Upper M. diversus Zone in age.

8. All samples analysed from cores-2 and 3 are from the P. asperopolus Zone and are typical of assemblages from the Flounder Formation. Similarly the samples from core-1 are all Lower N. asperus Zone and typical of assemblages from the Gurnard Formation. Assuming core depths are correct the palynology data favours a log pick for the base of the Gurnard Formation at 1434.0 or 1435.0m.

9. A significant unconformity also occurs at the top of the Latrobe with Early Miocene Seaspray Group resting on probable Middle Eocene Gurnard Formation.

BIOSTRATIGRAPHY

The zone boundaries have been established for Tertiary zones using the criteria of Stover & Partridge (1973), and subsequent proprietary revisions, and follows Helby, Morgan & Partridge (in press) for Cretaceous zones.

Phyllocladidites mawsonii Zone: 2296.5 - 2862.0 metres

This zone is a new name proposed by Helby, Morgan & Partridge (in press) for the Clavifera triplex Zone of Dettmann & Playford (1969). The zone has been renamed and the original definition modified because the spore C. triplex has not proved a reliable indicator species. The base of the zone is defined, and recognised in Kipper-1, by the oldest occurrence of P. mawsonii. The oldest occurrence of Proteacidites spp. is an associate indicator for the base of the zone, while the youngest occurrence of Appendicisporites distocarinatus and youngest consistent occurrence of Cyatheacidites tectifera are used to pick the top of the zone. Helby, Morgan & Partridge (in press, fig. 33) also show the youngest consistent occurrence of Interulobites intraverrucatus as occurring within the P. mawsonii Zone. In Kipper-1 the occurrence of this spore is sporadic and it ranges into the base of the overlying zone. The discredited zone indicator Clarifera triplex was only recorded in the highest sample at 2296.5m. Sporadic acritarchs, dinoflagellates and algal bodies occurring in the Kipper Formation are of no age significance.

Tricolporites apoxyexinus Zone: 2135.0 - 2196.5 metres

The base of the zone is defined by the oldest occurrence of Tricolporites apoxyexinus Partridge (in press). Unfortunately, this species was not recorded in Kipper-1, and in general is rare in the Gippsland Basin. Instead a local base to the zone is taken at the oldest occurrence of Tricolpites labrum (manuscript name), albeit with lower confidence. The oldest occurrences of Lygistepollenites florinii (which normally first occurs in the upper part of the P. mawsonii Zone) at 2245.5m, Tricolpites sabulosus and Larobosporites amplus also support this zone assignment. The sidewall core at 2187.5m gave a moderate concentration and moderate yield of microplankton suggesting a significant marine incursion in the Santonian. The interval 2187.5-2192.0m is referred to the informal Chatangiella perforata dinoflagellate Zone. Neither the species nor the zone have yet been described.

Nothofagidites senectus Zone: 1995.0 - 2080.0 metres

The N. senectus Zone is identified from two low yielding sidewall core samples and six cuttings samples. Although the exact limits of the zone may be uncertain the better assemblages obtained from the cuttings samples confirm the presence of approximately 100 metres of this zone in Kipper-1. The Zone is characterised by consistent Nothofagidites senectus in association with Tricolpites labrum and T. sabulosus.

Tricolporites lilliei Zone: 1895 - 1900 metres (cuttings).

The cuttings sample at 1895-1900m assigned with poor confidence to the T. lilliei Zone is considered to represent the maximum age of the sediments immediately above the top of the volcanics at 1893m. The spore-pollen assemblage is considered to be slightly caved rather than derived from the volcanic interval. A T. lilliei Zone age is preferred on the presence of Tricolporites lilliei and Tricolpites labrum. A younger T. longus Zone age is however still possible.

Upper Tricolpites longus Zone: 1733.5 - 1855.0 metres.

The base of this zone is picked with low confidence at the oldest occurrence of the spore Stereisporites (Tripunctisporis) punctatus in cuttings at 1850-1855m. A pick of higher confidence based on the same spore is from core-5 at 1832.5m. The top of the zone is picked at 1735.5m on the youngest occurrence of Quadraplanus brossus. The latter sample is also assigned to the Manumiella druggii Zone on the presence of several specimens of that species.

Lower Lygistepollenites balmei Zone: 1603.0 - 1727.0 metres.

The Lower L. balmei Zone is recognized by its overall assemblage characteristics, particularly the consistent presence of L. balmei, Australopollis obscurus and Gambierina rudata. Confidence in the pick of the base of the zone is increased by the presence of dinoflagellates including Trithyrodinium evittii the key species of the basal Danian T. evittii Zone. The top of the zone is chosen with lower confidence at the highest productive sample below the oldest occurrences of key Upper L. balmei Zone species.

Upper Lygistepollenites balmei Zone: 1506.0 - 1562.5 metres

Two samples are assigned to this zone on the basis of the oldest occurrences of Proteacidites annularis, Malvacipollis subtilis and Proteacidites incurvatus. The bottom sample is also assigned to the Apectodinium homomorphum Zone on the presence of that dinoflagellate.

Lower Malvacipollis diversus Zone: 1478.0 - 1493.0 metres

The base of the zone is represented by a substantial assemblage change and key spore-pollen and dinoflagellates characteristic of the condensed section or transgression at the Apectodinium hyperacanthum dinoflagellate Zone. Most notable is the mangrove palm pollen Spinozonocolpites prominatus (see Partridge, 1976) and the pantropically distributed spore Crassiretitriletes vanraadshoovenii. Other important spore-pollen are Intratriporopollenites notabilis, Cupanieidites orthoteichus and common Malvacipollis diversus. Samples at 1478.0m and 1486.5m have poorer assemblages but are still assigned to the Lower M. diversus Zone on the prominence of M. diversus. The sample at 1464.0m cannot be assigned confidently to a zone on the basis of the assemblage it contains. It is however very likely to still lie in the Lower M. diversus Zone as it lies below the highest coal within the well at 1461-1462m, and is therefore undoubtedly below the base of the Tuna-Flounder Channel.

Proteacidites asperopolus Zone: 1436.2 - 1454.4 metres.

All samples from cores-2 and 3 are referrable to the P. asperopolus Zone. Key and consistently occurring species, in order of importance for diagnosing this zone are: Conbaculites apiculatus, Santalumidites cainozoicus, Proteacidites asperopolus, P. pachypolus and Myrtaceidites tenuis. Two additional important but rare pollen are Clavastephanocolporites meleosus at 1440.44m and Bombacacidites bombaxoides at 1438.0m. Microplankton are generally present in only low concentrations and moderate diversity but they do support the Early Eocene age. The important zone fossil Kisselovia thompsonae was only found in the one sample at 1440.44m. The sporadic occurrence of this important dinoflagellate is typical of wells in the northern end of the Tuna-Flounder Channel. It is considered likely that the 24 metres of Flounder Formation can all be referred to the K. thompsonae Zone.

Lower Nothofagidites asperus Zone: 1427.6 - 1433.4 metres

The three samples from core-1 yielded similar assemblages referrable to both the Lower N. asperus spore-pollen Zone and Areosphaeridium diktyoplokus dinoflagellate Zone. No attempt was made to record the full spore-pollen suite because of the definitive associated dinoflagellates and acritarchs. Therefore diagnostic pollen are restricted to Proteacidites recavus at 1433.4m and Gothanipollis bassensis at 1427.6m. The most important microplankton are Areosphaeridium diktyoplokus and Tritonites tricornus (manuscript name).

Proteacidites tuberculatus Zone: 1412.5 metres

The occurrence of the spore Foveotriletes lucunosus and a moderately diverse dinoflagellate assemblage suggests a correlation with the middle or upper subdivision of the zone (Stover & Partridge, 1973, p. 243). The palynology is consistent with the Early Miocene H1 foraminiferal zone reported by Hannah (1986).

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TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA FROM KIPPER-1

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
SWC 111	1412.5	*P. tuberculatus*		1	*Foveotriletes lucunosus* present
Core-1	1427.6	Lower *N. asperus*	*A. diktyoplokus*	0	*Tritonites tricornus* present
Core-1	1430.7	Lower *N. asperus*	*A. diktyoplokus*	1	
Core-1	1433.4	Lower *N. asperus*	*A. diktyoplokus*	0	*Tirtonites tricornus* present
Core-2	1436.2	*P. asperopolus*		1	Depth to top of Core-2 uncorrected
Core-2	1436.6	*P. asperopolus*		2	
Core-2	1437.0	*P. asperopolus*		2	
Core-2	1437.5	Indeterminate			Virtually barren
Core-2	1437.72	*P. asperopolus*		2	
Core-2	1438.0	*P. asperopolus*		1	*Bombacacidites bombaxoides* present
Core-2	1438.6	Indterminate			Sample barren
Core-2	1439.0	Indeterminate			Virtually barren
Core-2	1440.44	*P. asperopolus*	*K. thompsonae*	0	
Core-2	1442.8	Indeterminate			
Core-2	1444.5	*P. asperopolus*		1	
Core-2	1445.4	*P. asperopolus*		2	
Core-3	1449.8	*P. asperopolus*		1	
Core-3	1453.8	*P. asperopolus*		1	
Core-3	1454.4	*P. asperopolus*		1	
SWC 108	1457.5	Indeterminate			Sample barren
SWC 107	1464.0	Indeterminate	Indeterminate		

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA FROM KIPPER-1

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
SWC 106	1478.0	Lower *M. diversus*		2	
SWC 105	1486.5	Lower *M. diversus*		2	Dominated by semi opque kerogen
SWC 104	1493.0	Lower *M. diversus*	*A. hyperacanthum*	0	
SWC 103	1506.0	Upper *L. balmei*		1	
SWC 100	1562.5	Upper *L. balmei*	*A. homomorphum*	2	
SWC 99	1576.6	Indeterminate			Virtually barren
SWC 98	1603.0	Lower *L. balmei*		2	
SWC 96	1646.0	Lower *L. balmei*		2	
SWC 92	1727.0	Lower *L. balmei*	*T. evittii*	0	
SWC 91	1733.5	Upper *T. longus*	*M. druggii*	0	
SWC 90	1743.0	Indeterminate			Barren
SWC 89	1760.0	Upper *T. longus*		1	
Cuttings	1765-70	Upper *T. longus*		3	Common *S. (Tripunctisporis) punctatus*
SWC 87	1797.0	Indeterminate			Virtually barren
SWC 86	1805.0	Upper *T. longus*		1	
Cuttings	1825-30	Upper *T. longus*		4	
Core-5	1832.5	Upper *T. longus*		1	
Core-5	1835.0	Upper *T. longus*		2	Freq. *T. lilliei*
Core-5	1840.6	Upper *T. longus*		2	
Cuttings	1850-55	Upper *T. longus*		3	Some contamination
Cuttings	1875-80	Indeterminate			

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA FROM KIPPER-1

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
SWC 84	1872.0	Indeterminate			
Cuttings	1885-90	Indeterminate			Contamination high
Cuttings	1895-1900	*T. lilliei*		4	
SWC 60	1990.0	Indeterminate			Barren
Cuttings	1995-2000	*N. senectus*		3	
SWC 58	1998.0	*N. senectus*		2	
Cuttings	2000-2005	*N. senectus*		3	
SWC 57	2008.0	*N. senectus*		2	Contaminated from *T. longus* Zone
Cuttings	2015-20	*N. senectus*		3	
SWC 56	2025.0	Indeterminate			Barren
Cuttings	2045-50	*N. senectus*		3	
Cuttings	2050-55	*N. senectus*		3	
SWC 54	2052.0	Indeterminate			
Cuttings	2075-80	*N. senectus*		4	
Cuttings	2085-90	Indeterminate			
SWC 53	2088.0	Indeterminate			
SWC 79	2095.0	Indeterminate			Barren
Cuttings	2135-40	*T. apoxyexinus*		3	
SWC 49	2143.0	Indeterminate			Virtually barren
SWC 47	2155.0	*T. apoxyexinus*		2	
SWC 43	2187.5	*T. apoxyexinus*	*Ch. perforata*	2	
SWC 42	2192.0	*T. apoxyexinus*	*Ch. perforata*	2	

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
SWC 41	2196.5	T. apoxyexinus		2	
SWC 40	2209.5	Indeterminate			Barren
SWC 37	2234.0	T. apoxyexinus-P. mawsonii			
SWC 36	2245.5	T. apoxyexinus-P. mawsonii			
SWC 32	2296.5	P. mawsonii		2	
SWC 78	2307.0	Indeterminate			
SWC 31	2320.0	P. mawsonii		1	
SWC 30	2342.5	P. mawsonii		1	
SWC 77	2357.0	Indeterminate			
SWC 76	2381.0	Indeterminate			
SWC 27	2396.0	P. mawsonii		1	
SWC 75	2408.0	P. mawsonii		2	
SWC 74	2420.0	P. mawsonii		1	
SWC 25	2442.0	Indeterminate			
SWC 24	2451.0	P. mawsonii		1	
SWC 73	2460.0	P. mawsonii		1	
SWC 72	2483.0	P. mawsonii		1	
SWC 71	2493.0	P. mawsonii		2	Freq. algal remains
SWC 21	2500.0	P. mawsonii		2	
SWC 70	2519.0	P. mawsonii		2	

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA FROM KIPPER-1

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENTS
SWC 19	2538.0	Indeterminate			
SWC 18	2559.0	P. mawsonii		2	
SWC 69	2581.5	P. mawsonii		2	
SWC 16	2601.0	Indeterminate			
Cuttings	2605-10	Indeterminate			
SWC 15	2617.0	P. mawsonii		1	
SWC 68	2635.5	P. mawsonii		2	
SWC 12	2661.0	P. mawsonii		1	Mud contamination
Cuttings	2685-90	P. mawsonii		3	Common algal remains
SWC 66	2686.0	P. mawsonii		2	Abundant algal remains
SWC 10	2697.0	P. mawsonii		2	
SWC 9	2709.0	P. mawsonii		2	
SWC 65	2730.0	P. mawsonii		1	
Cuttings	2730-35	Indeterminate			Quick scan only
Cuttings	2735-40	P. mawsonii		3	Significant contamination
SWC 7	2756.5	Indeterminate			
SWC 6	2773.0	Indeterminate			
SWC 64	2794.0	P. mawsonii		2	Common algae cysts
SWC 63	2805.0	Indeterminate			
SWC 62	2824.0	Indeterminate			
SWC 3	2839.0	P. mawsonii		1	
SWC 1	2862.0	P. mawsonii		1	

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: +21m GL: -94m(MSL)

WELL NAME: KIPPER-1 TOTAL DEPTH: 2875.0m

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA					LOWEST DATA				
		Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
	P. tuberculatus						1412.5	1			
PALEOGENE	Upper *N. asperus*										
	Mid *N. asperus*										
	Lower *N. asperus*	1427.6	0				1433.4	0			
	P. asperopolus	1436.2	1				1454.4	1			
	Upper *M. diversus*										
	Mid *M. diversus*										
	Lower *M. diversus*	1478.0	2				1493.0	0			
	Upper *L. balmei*	1506.0	1				1562.5	2			
	Lower *L. balmei*	1603.0	2				1727.0	0			
LATE CRETACEOUS	Upper *T. longus*	1733.5	0				1855.0	3	1832.5	1	
	Lower *T. longus*										
	T. lilliei	1895.0	4				1895.0	4			
	N. senectus	1998.0	2				2080.0	4			
	T. apoxyexinus	2135.0	3	2155.0	2		2196.5	2			
	P. mawsonii	2296.5	2	2320.0	1		2862.0	1			
	A. distocarinatus										
EARLY CRET.	*P. pannosus*										
	C. paradoxa										
	C. striatus										
	C. hughesi										
	F. wonthaggiensis										
	C. australiensis										

COMMENTS: All depths in metres. Volcanics interval: 1893-1989m

Dinoflagellate Zones: A. diktyoplokus 1427.6-1433.4m,

K. thompsonae 1440.4m, A. hyperacanthum 1493.0m,

A. homomorphum 1562.0m, T. evittii 1727.0m, M. druggii 1733.5m

CONFIDENCE RATING:

0: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.

1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.

2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.

4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: N. MARSHALL DATE: JUNE 30, 1986

DATA REVISED BY: A.D. PARTRIDGE DATE: JULY 29, 1986

BASIC DATA SECTION

TABLE-2: SUMMARY OF BASIC DATA
THREE PALYNOMORPHY DISTRIBUTION CHARTS

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA FOR KIPPER-1

SAMPLE TYPE	DEPTH (m)	LITHOLOGY	RESIDUE YIELD	PRESERVATION	SPORE POLLEN DIVERSITY	MICROPLANKTON YIELD	MICROPLANKTON NO. SPECIES	SAMPLE CODE
SWC 111	1412.5	Calc. clayst.	Very low	Good	Low	Moderate	7+	77921N
Core-1	1427.6	Glauc. sandst.	Moderate	Fair	High	Low	4+	77934S
Core-1	1430.7	Glauc. sandst.	Moderate	Fair-good	Moderate	Moderate	7+	77934T
Core-1	1433.4	Glauc. sandst.	High	Good	High	Moderate	7+	77934U
Core-2	1436.2	Silty sandst.	Moderate	Poor	Low	Low	3	77934A
Core-2	1436.6	Silty sandst.	Low	Poor	Low	Low	3	77934B
Core-2	1437.0	Silty sandst.	Moderate	Poor-fair	Moderate	Low	5	77934C
Core-2	1437.5	Silty sandst.	Very low	Poor	Very low			77934D
Core-2	1437.72	Silty sandst.	Moderate	Poor-good	Moderate	Moderate	7	77934E
Core-2	1438.0	Silty sandst.	Moderate	Good	Moderate	Low	1	77934F
Core-2	1438.6	Silty sandst.	Barren					77934G
Core-2	1439.0	Silty sandst.	Very low	Poor	Very low			77934H
Core-2	1440.44	Sandstone	Moderate	Fair	Low	Low	2	77934I
Core-2	1442.8	Sandstone	Moderate	Fair	Moderate	Low	1	77934J
Core-2	1444.5	Silty sandst.	Moderate	Fair-good	High	Moderate	4+	77934K
Core-2	1445.4	Silty sandst.	High	Fair-good	High	Moderate	5+	77934L
Core-3	1449.8	Siltstone	High	Fair-good	High	Low	2	77934V
Core-3	1453.8	Siltstone	High	Fair-good	High	Low	4	77934W
Core-3	1454.4	Siltstone	High	Good	High	Low	4	77934X
SWC 108	1457.5	Sandstone	Barren					77934X
SWC 107	1464.0	Carb. sandst.	Low	Good	Low			77921J

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA FOR KIPPER-1

SAMPLE TYPE	DEPTH (m)	LITHOLOGY	RESIDUE YIELD	PRESERVATION	SPORE POLLEN DIVERSITY	MICROPLANKTON YIELD	MICROPLANKTON NO. SPECIES	SAMPLE CODE
SWC 106	1478.0	Coal	High	Very good	Moderate			779211
SWC 105	1486.5	Silty. glauc. sandst.	High	Fair	Low	Low	1+	77921H
SWC 104	1493.0	Glauc. sandst.	Low	Fair	High	Low	4	77921G
SWC 103	1506.0	Siltstone	Low	Good	Moderate			77921F
SWC 100	1562.5	Siltstone	Moderate	Good	Moderate	Low	3	77921C
SWC 99	1579.6	Sandstone	Very low	Poor	Very low			77921B
SWC 98	1603.0	Coaly shale	Low	Good	Moderate			77921A
SWC 96	1646.0	Shale	High	Good	Moderate			77920Y
SWC 92	1727.0	Sandy siltst.	Low	Good	Moderate	Low	3	77920V
SWC 91	1733.5	Sandy siltst.	Low	Good	Moderate	Low	2	77920V
SWC 90	1743.0	Pyritic sandst.	Barren					77920T
SWC 89	1760.0	Siltstone	Moderate	Good	Moderate			77920S
Cuttings	1765-70		High	Good	High			779301
SWC 87	1797.0	Sandstone	Very low	Poor	Very low			77920R
SWC 86	1805.0	Silty sandst.	High	Fair-good	High	Low	2	77920Q
Cuttings	1825-30		Moderate	Fair	Moderate			77930J
Core-5	1832.5		Moderate	Good	Moderate			77934M
Core-5	1835.0		Moderate	Good	Moderate			77934N
Core-5	1840.6		Moderate	Good	Moderate			77934R
Cuttings	1850-55		Moderate	Good	Moderate			77930K
Cuttings	1875-80		Moderate	Fair	Moderate			77930L

SAMPLE TYPE	DEPTH (m)	LITHOLOGY	RESIDUE YIELD	PRESERVATION	SPORE POLLEN DIVERSITY	MICROPLANKTON YIELD	MICROPLANKTON NO. SPECIES	SAMPLE CODE
SWC 84	1872.0	White sandstone	Low	Poor-fair	Low			77920P
Cuttings	1885.90		Low	Fair-good	Moderate			77930M
Cuttings	1895-1900		Moderate	Fair-good	Moderate			77930N
SWC 60	1990.0	Sandstone	Barren					77919U
Cuttings	1995-2000		Moderate	Fair	Moderate			77930A
SWC 58	1998.0	Sandstone	Low	Fair-good	Moderate			77919S
Cuttings	2000-2005		Moderate	Fair-good	Low			77930B
SWC 57	2008.0	Sandstone	Low	Fair	Low			77919R
Cuttings	2015-20		Moderate	Fair	Low			77930C
SWC 56	2025.0	Sandstone	Barren					77930Q
Cuttings	2045-50		Low	Fair-good	Moderate			77919D
Cuttings	2050-55		Moderate	Fair	Low			77930E
SWC 54	2052.0	Silty Sandst.	Low	Poor	Very low			77919O
Cuttings	2075-80		Moderate	Poor	Low			77930F
Cuttings	2085-90		Low	Fair	Low			77930G
SWC 53	2088.0	Siltstone	Low	Fair	Low			77919N
SWC 79	2095.0	Pyritic sandst.	Barren					77920N
Cuttings	2135-40		High	Fair	Moderate			77930H
SWC 49	2143.0	Shale	Low	Poor	Low			77919J
SWC 47	2155.0	Carb. siltstone	Moderate	Fair-good	Moderate			77919H
SWC 43	2187.5	Carb. siltstone	High	Fair-good	High	Moderate	6+	77919O
SWC 42	2192.0	Carb. siltstone	Moderate	Poor-fair	Low	Low	2+	77919C

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA FOR KIPPER-1

SAMPLE TYPE	DEPTH (m)	LITHOLOGY	RESIDUE YIELD	PRESERVATION	SPORE POLLEN DIVERSITY	MICROPLANKTON YIELD	MICROPLANKTON NO. SPECIES	SAMPLE CODE
SWC 41	2196.5	Carb. siltstone.	Moderate	Fair-good	Moderate			77919B
SWC 40	2209.5	Shale	Barren					77919A
SWC 37	2234.0	Silty shale	Low	Fair	Low	Very low	1	77918X
SWC 36	2245.5	Sandstone	Moderate	Fair-good	Moderate	Very low	2	77918W
SWC 32	2296.5	Siltstone	Moderate	Fair	Low	Low	1	77918S
SWC 78	2307.0	Sandy siltstone	Moderate	Fair	Very low			77920M
SWC 31	2320.0	Siltstone	Moderate	Poor-fair	Low	Low	1	77918R
SWC 30	2342.5	Carb. Siltstone	Moderate	Fair-good	Low			77918Q
SWC 77	2357.0	Sandstone	Moderate	Poor	Low			77920L
SWC 76	2381.0	Carb. sandstone	Moderate	Fair	Low			77920K
SWC 27	2396.0	Carb. siltstone	Moderate	Fair	Moderate			77918P
SWC 75	2408.0	Carb. siltstone	Moderate	Fair	Low			77920J
SWC 74	2420.0	Carb. shale	Moderate	Fair-good	Low	Low	2+	77920I
SWC 25	2442.0	Carb. siltstone	Low	Fair	Low			77918O
SWC 24	2451.0	Shale	Moderate	Fair-good	Moderate	Low	1	77918N
SWC 73	2460.0	Carb. siltst.	Moderate	Poor-fair	Low			77920H
SWC 72	2483.0	Siltstone	Moderate	Fair	Low			77920G
SWC 71	2493.0	Siltstone	Moderate	Fair	Low	Low	2+	77920F
SWC 21	2500.0	Shale	Low	Fair	Low			77918M
SWC 70	2519.5	Siltstone	Moderate	Poor-fair	Low	Low	1	77920E

SAMPLE TYPE	DEPTH (m)	LITHOLOGY	RESIDUE YIELD	PRESERVATION	SPORE POLLEN DIVERSITY	MICROPLANKTON YIELD	MICROPLANKTON NO SPECIES	SAMPLE CODE
SWC 19	2538.0	Carb. shale	Low	Poor-fair	Low	Low	2	77918L
SWC 18	2559.0	Carb. shale	Moderate	Fair	Moderate	Low	1	77918K
SWC 69	2581.5	Siltstone	Low	Poor	Low			77920D
SWC 16	2601.0	Carb. siltstone	Low	Fair	Low			77918J
Cuttings	2605-10		Moderate	Fair	Low	Low	2	77919P
SWC 15	2617.0	Carb. siltstone	Moderate	Fair	Low			77918I
SWC 68	2635.5	White sandstone	Low	Fair	Low			77920C
SWC 12	2661.0	Calc. siltstone	Moderate	Poor-Fair	Moderate	Low	2	77918G
Cuttings	2685-90		Moderate	Fair	Low	Low	2	77917R
SWC 66	2686.0	Carb. shale	Moderate	Good	Low	Moderate	3	77920A
SWC 10	2697.0	Shale	Moderate	Fair	Low	Low	3	77918F
SWC 9	2709.0	Carb. siltstone	Moderate	Fair	Moderate	Low	1	77918E
SWC 65	2730.0	Carb. siltstone	Low	Fair	Low			77919Z
Cuttings	2730-35		Moderate	Poor-Fair	Low			77917S
Cuttings	2735-40		Low	Poor-Fair	Low			77917T
SWC 7	2756.5	Limestone	Moderate	Poor	Low			77918D
SWC 6	2773.0	Siltstone	Moderate	Poor	Low			77918C
SWC 64	2794.0	Carb. shale	Moderate	Fair-good	Moderate	Moderate	2	77919Y
SWC 63	2805.0	Carb. shale	Moderate	Poor	Low	Low	1	77919X
SWC 62	2824.0	Siltstone	Moderate	Fair	Low			77919W
SWC 3	2839.0	Sandy siltstone	Moderate	Fair	Moderate	Low	2	77918B
SWC 1	2862.0	Sandy siltstone	Moderate	Poor-fair	Moderate	Low	1	77918A