PALYNOLOGY REPORT
KINGFISHER-1
EP-57, BONAPARTE BASIN
ONSHORE

Prepared for:

Teikoku Oil (Bonaparte Gulf) Company Limited

October 1994

GEOTECH GEOTECHNICAL SERVICES PTY LTD
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ACN 050 543 194

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SUMMARY

Two hundred and sixty-four samples from 38 sidewall cores, 1 junk basket sample and 225 ditch cuttings, from the interval 350 to 3256.7 m, were processed for palynological analysis. The assemblages have been assigned to 10 palynological zones, summarised below.

340 - 350	Stage 3a; Early Permian
360 - 390	Stage 3b; Early Permian
410 - ?1110	Stage 2/*Pseudoreticulatispora confluens* zone; ?Late Carboniferous - Early Permian
?1120 - 1151	Stage 2/*Microbaculispora tentula* zone; ?Late Carboniferous - Early Permian
1170 - 1310	Stage 1/*Potonieisporites novicus*; Stephanian (Late Carboniferous)
1325 - ?1470	*Diatomozonotriletes birkheadensis* Assemblage; Westphalian - ?early Stephanian (Late Carboniferous)
1480 - 1550	*Spelaeotriletes ybertii* Assemblage; Namurian (Early - Late Carboniferous)
1563 - ?1660	*Grandispora maculosa* Assemblage; late Visean - Namurian (Early Carboniferous)
?1670 - ?2780	*Anapiculatisporites largus* Assemblage; Visean (Early Carboniferous)
2809 - ?3210	*Retispora lepidophyta* Assemblage; late Famennian (Late Devonian)

PALYNOLOGY REPORT

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INTRODUCTION

Two hundred and sixty-four samples from the Teikoku Oil (Bonaparte Gulf) Company Limited well, Kingfisher-1 were processed for palynological anlaysis. These were derived from 38 sidewall cores, 1 junk basket sample and 225 dirch cuttings, from the interval 350 to 3256.7 m.

The study was conducted to determine a palynostratigraphic sub-division of the section and to provide comments on the environment of deposition, thermal maturity and possible correlation of the section to nearby wells.

PROCESSING

The samples were processed by Laola Pty Ltd in Perth. A summary of the laboratory information is included as Appendix 1.

PALYNOSTRATIGRAPHY

The palynomorphs recorded in each sample are listed on the enclosed species distribution charts in Appendix 2. In the interval 350 to 1563 m, 100 specimens were counted per sample. Palynomorphs not counted but present in the sample are indicated. (Seven samples in this interval were not counted because of very low palynomorph yields.) Samples below 1563 m were not counted for a number of reasons: low yields, common contamination in some ditch cutting samples, and the quantitative composition is less significant in Early Carboniferous palynofloras. Species identified in each sample are listed and the species considered to be contamination are indicated.

The palynostratigraphy is interpreted from these data using the zonation outlined in Figure 1. The individual depths of each sample, with the palynological results, is summarised on Table 1.

Marine influence is noted in samples where spinose acritarchs and/or scolecodonts were identified. The presence of spinose acritarchs is considered an indication of marine and brackish water environments. However, their absence does not always imply non-marine deposition. This and the quantitative composition of the palynofloras is considered in interpreting the environment of deposition.

OFFSHORE BONAPARTE BASIN - DEVONIAN - PERMIAN PALYNOSTRATIGRAPHIC SUMMARY

SYSTEM	AGE	STAGE	PALYNOLOGICAL ZONE	FORMATION	GROUP
EARLY TRIASSIC	SCYTHIAN	Trla	*L. pellucidus*	MT. GOODWIN FM	
LATE PERMIAN	TATARIAN	Trla	*P. microcorpus*	HYLAND BAY FORMATION	
		Upper 5	*D. stellata*		
	KAZANIAN	Upper 5	*D. parvithola*		
	KUNGURIAN	Lower 5	*granulata--dulhuntyi*		
EARLY PERMIAN		Upper 4	*M. villosa - P. sinuosus*	FOSSIL HEAD FORMATION	
	ARTINSKIAN	Lower 4	*P. cicatricosa*		
		3b	*M. trisina*		
	SAKMARIAN	3a	*P. pseudoretic.*	KEYLING FORMATION	KULSHILL GROUP
	ASSELIAN	2	*G. confluens*	TREACHERY SHALE	
LATE CARBONIFEROUS	STEPHANIAN	1	*P. novicus*	KURIYIPPI FORMATION	
	WESTPHALIAN		*D. birkheadensis*		
	NAMURIAN		*S. ybertii*	POINT SPRING FORMATION	WEABER GP
EARLY CARBONIFEROUS	VISEAN		*G. maculosa*		
			A. largus	TANMURRA FM	
				MILLIGANS FM	
	TOURNAISIAN		*G. spiculifera*	BONAPARTE FORMATION	
LATE DEVONIAN	FAMMENIAN		*R. lepidophyta*		
	FRASNIAN				

FIGURE 1

TABLE 1: Summary of samples studied in Kingfisher-1.

Depth (m)	Type	Yield	Preserv	Reliability	Marine	Zone	Age
350	dc	moderate	f	3	+	Stage 3b	Early
370	dc	moderate	f	3	+	Stage 3a	Permian
390	dc	abundant	f-p	2	+	Stage 3a	
410	dc	moderate	f-p	2	+	Stage 2/*P. confluens*	
430	dc	abundant	f-p	3	+	Stage 2/*P. confluens*	
450	dc	low	f-p	3	+	Stage 2/*P. confluens*	
470	dc	abundant	f-p	3	+	Stage 2/*P. confluens*	
490	dc	moderate	g-f	3	+	Stage 2/*P. confluens*	
510	dc	abundant	f	3	+	Stage 2/*P. confluens*	
530	dc	abundant	f-g	3	+	Stage 2/*P. confluens*	
550	dc	moderate	f	3	-	Stage 2/*P. confluens*	
570	dc	moderate	f-g	3	-	Stage 2/*P. confluens*	
590	dc	moderate	f-g	3	+	Stage 2/*P. confluens*	
610	dc	abundant	f-g	3	+	Stage 2/*P. confluens*	
630	dc	moderate	f-g	3	-	Stage 2/*P. confluens*	
650	dc	abundant	f-g	3	+	Stage 2/*P. confluens*	
670	dc	moderate	f-g	3	-	Stage 2/*P. confluens*	
690	dc	moderate	f	3	+	Stage 2/*P. confluens*	
710	dc	moderate	f-p	3	+	Stage 2/*P. confluens*	
730	dc	moderate	f-p	3	+	Stage 2/*P. confluens*	?Late Carboniferous
750	dc	moderate	f-g	3	+	Stage 2/*P. confluens*	
770	dc	moderate	f	3	-	Stage 2/*P. confluens*	
790	dc	moderate	f	3	-	Stage 2/*P. confluens*	
810	dc	abundant	f-g	3	-	Stage 2/*P. confluens*	to
830	dc	abundant	f-g	3	-	Stage 2/*P. confluens*	
850	dc	moderate	f-g	3	-	Stage 2/*P. confluens*	
870	dc	moderate	f-g	3	-	Stage 2/*P. confluens*	
870-80	dc	abundant	f-g	3	+	Stage 2/*P. confluens*	Early Permian
890*	dc	moderate	f-g	3	-	Stage 2/*P. confluens*	
890-900	dc	abundant	f-g	2	+	Stage 2/*P. confluens*	
910	dc	low	f-g	2	-	Stage 2/*P. confluens*	
930	dc	moderate	f-g	2	-	Stage 2/*P. confluens*	
950	dc	moderate	f-g	2	-	Stage 2/*P. confluens*	
970	dc	moderate	f	1	+	Stage 2/*P. confluens*	
990	dc	low	f	1	+	Stage 2/*P. confluens*	
1010	dc	moderate	f-g	1	+	Stage 2/*P. confluens*	
1030	dc	moderate	f-p	2	+	Stage 2/*P. confluens*	
1050*	dc	low	f-g	1	-	Stage 2/*P. confluens*	
1060-70**	dc	moderate	f	1	-	Stage 2/*P. confluens*	
1090	dc	moderate	f	1	-	Stage 2/*P. confluens*	
1100	dc	low	f	2	-	Stage 2/ *P. confluens*	
1110*	dc	abundant	g	2	-	Stage 2/*P. confluens*	
1120	dc	v.low	f	1	-	Stage 2/ *M. tentula*	
1127	dc	v.low	f	1	+	Stage 2/ *M. tentula*	
1130	dc	abundant	f-p	2	-	Stage 2/ *M. tentula*	
1150	dc	low	f-p	2	+	Stage 2/ *M. tentula*	
1151	swc	abundant	f	3	+	Stage 2/*M. tentula*	
1170	dc	moderate	f-g	1	+	Stage 1	
1182	swc	low	f-p	3	-	Stage 1	
1190	dc	low	f-g	1	+	Stage 1	
1210	dc	low	f	2	+	Stage 1	Late Carboniferous
1230	dc	low	f	2	+	Stage 1	
1247	swc	moderate	f-p	2	+	Stage 1	
1250	dc	moderate	f-g	2	+	Stage 1	
1270	dc	low	f	2	+	Stage 1	
1290	dc	v.low	f	1	-	Stage 1	
1310	dc	low	f	2	+	Stage 1	
~~1325~~ 1327	swc	moderate	g	3	+	*D. birkheadensis*	
1330	dc	low	f	1	+	?*D. birkheadensis*	Late Carboniferous
1350	dc	moderate	f-g	2	+	*D. birkheadensis*	
1370	dc	v.low	f	1	-	Indeterminate	
1390	dc	moderate	f-g	2	+	*D. birkheadensis*	

*denotes additional dc samples at theses depths

1392	swc	abundant	f	3	-	*D. birkheadensis*	
1410	dc	low	f-g	2	+	*D. birkheadensis*	
1430	dc	low	f	1	-	*?D. birkheadensis*	Late Carboniferous
1450	dc	low	f-p	1	-	*?D. birkheadensis*	
1470	dc	low	f-g	1	+	*?D. birkheadensis*	
1490	dc	abundant	g	2	-	*S. ybertii*	
1510	dc	moderate	f-g	2	+	*S. ybertii*	Late to
1530	dc	abundant	g	1	-	*S. ybertii*	Early Carboniferous
1550	dc	moderate	g	1	-	*S. ybertii*	
1563	swc	moderate	g	2	+	*G. maculosa*	
1570	dc	low	f	1	+	*?G. maculosa*	Early Carboniferous
1642	swc	low	p	1	+	*?G. maculosa*	
1660	dc	moderate	g	1	-	*?G. maculosa*	
1680	dc	abundant	g	1	-	*?A. largus*	
1700	dc	moderate	p-g	1	-	*?A. largus*	
1720	dc	abundant	p-g	1	+	*?A. largus*	
1740	dc	abundant	p-g	1	-	*?A. largus*	
1745.0	swc	v.low	vp	3	+	*?A. largus*	
1760	dc	abundant	p-g	1	-	*?A. largus*	
1766	swc	abundant	g	3	+	*A. largus*	
1780	dc	abundant	g	1	-	*?A. largus*	
1800	dc	low	f-g	1		*?A. largus*	
1810-20	dc	barren	-	-	-	-	
1820-30	dc	barren	-	-	-	-	
1830-40	dc	?barren	f	1	-	-	
1840-50	dc	low	g	1	-	?	
1841	swc	abundant	g	3	-	*A. largus*	
1850-60	dc	?barren	f	1	-	-	
1860-70	dc	v.low	f	1	-	*?A. largus*	
1870-80	dc	v.low	f	1	-	*?A. largus*	
1878.0	swc	?barren	f-p	2	-	-	
1880-90	dc	moderate	p-g	1	-	*?A. largus*	Early
1884	swc	abundant	f-g	3	-	*A. largus*	
1890-1900	dc	v.low	f	1	-	*?A. largus*	Carboniferous
1900-10	dc	v.low	f	1	-	*A. largus*	
1910-20	dc	low	f-g	1	-	*A. largus*	
1920-30	dc	low	f	1	-	*A. largus*	
1930-40	dc	?barren	-	1	-	-	
1940-50	dc	low	g	1	-	*A. largus*	
1950-60	dc	low	f-g	1	-	*A. largus*	
1960-70	dc	low	f-g	1	-	*?A. largus*	
1964	swc	abundant	p-f	3	+	*A. largus*	
1970-80	dc	low	f-g	1	-	*?A. largus*	
1980-90	dc	v.low	f	1	-	*?A. largus*	
1990-2000	dc	v.low	g	1	-	*?A. largus*	
2000-10	dc	v.low	f-g	1	+	*A. largus*	
2002.0	swc	abundant	f	3	+	*A. largus*	
2010-20	dc	moderate	p-g	1	-	*A. largus*	
2020-30	dc	v.low	p-f	1	+	?	
2030-40	dc	low	f	1	+	*A. largus*	
2040-50	dc	low	p-f	1	-	*?A. largus*	
2050-60	dc	low	p	1	-	*?A. largus*	
2060-70	dc	low	p	1	-	*A. largus*	
2070-80	dc	v.low	p	1	+	?	
2080-90	dc	low	p	1	-	*A. largus*	
2090-2100	dc	low	p-f	1	-	*A. largus*	
2100-10	dc	v.low	p	1	-	*A. largus*	
2101.0	swc	low	p	3	+	*A. largus*	
2110-20	dc	v.low	p	2	-	*A. largus*	
2120-30	dc	v.low	p	1	-	?	
2127.5	swc	abundant	vp	3	+	*A. largus*	
2130-40	dc	v.low	p-f	1	-	?	
2140-50	dc	v.low	p-f	1	-	?	
2150-60	dc	v.low	p-f	1	-	?	
2160-70	dc	low	p-f	1	+	?	
2170-80	dc	low	p	2	-	*?A. largus*	
2180-90	dc	v.low	p	1	-	*?A. largus*	

2190-2200	dc	v.low	p	2	-	*A. largus*	
2200-10	dc	v.low	p-f	1	-	?	
2210-20	dc	v.low	p	1	-	?	
2220-30	dc	v.low	p	2	-	?	
2230-40	dc	v.low	p	1	-	?	
2240-50	dc	?barren	p	1	-	?	
2250-60	dc	moderate	p-f	1	-	?*A. largus*	
2260-70	dc	low	p	1	-	?*A. largus*	
2270-80	dc	moderate	p-f	1	-	?*A. largus*	
2280-90	dc	low	p-f	1	+	*A. largus*	
2289.4	swc	low	p	3	+	?*A. largus*	
2290-2300	dc	low	p-f	1	-	?	
2290.0	swc	low	p	3	+	?*A. largus*	
2298.5	swc	low	p-f	3	-	?*A. largus*	
2300-10	dc	v.low	p-f	1	-	?	
2310-20	dc	v.low	p	1	-	?	
2320-30	dc	low	p-f	1	-	?	
2330-40	dc	v.low	p	2	-	?	
2340-50	dc	v.low	p-f	1	-	?	
2350-60	dc	barren	-	-	-	-	
2360-70	dc	barren	-	-	-	-	
2370-80	dc	?barren	p	1	-	?	
2380-90	dc	barren	-	-	-	-	
2390-2400	dc	barren	-	-	-	-	
2400-10	dc	v.low	p	1	+	?*A. largus*	
2410-20	dc	low	p	2	-	?*A. largus*	
2420-30	dc	low	p-f	1	+	?*A. largus*	
2430-40	dc	v.low	p-f	1	-	?	
2440-50	dc	?barren	p	1	-	-	
2441.5	swc	moderate	p-f	3	-	*A. largus*	Early
2450-60	dc	?barren	p	1	-	?	
2460-70	dc	barren	-	-	-	-	Carboniferous
2470-80	dc	low	p-f	1	+	?	
2480-90	dc	barren	-	-	-	-	
2490-500	dc	barren	-	-	-	-	
2492.1	swc	v.low	p	2	-	?	
2500-10	dc	?barren	p	2	-	-	
2510-20	dc	barren	-	-	-	-	
2520-30	dc	barren	-	-	-	-	
2525.5	swc	moderate	p-f	3	+	*A. largus*	
2530-40	dc	barren	-	-	-	-	
2540-50	dc	barren	-	-	-	-	
2550-60	dc	barren	-	-	-	-	
2560-70	dc	barren	-	-	-	-	
2561.0	swc	moderate	p	3	+	*A. largus*	
2570-80	dc	barren	-	-	-	-	
2580-90	dc	barren	-	-	-	-	
2585.0	swc	low	vp	3	+	?*A. largus*	
2590-600	dc	barren	-	-	-	-	
2600.0	swc	low	vp	2	+	?*A. largus*	
2600-10	dc	barren	-	-	-	-	
2610-20	dc	low	vp	1	+	?	
2612.9	swc	low	vp	3	+	?	
2615.0	swc	low	vp	3	+	?	
2616.5	swc	low	p	3	+	?	
2620-30	dc	barren	-	-	-	-	
2621.0	swc	low	p	3	+	?A. largus	
2630-40	dc	barren	-	-	-	-	
2633.0	swc	low	vp	3	+	?*A. largus*	
2640-50	dc	barren	-	-	-	-	
2650-60	dc	low	p	1	+	?	
2660-70	dc	low	p	1	-	?	
2670-80	dc	barren	-	-	-	-	
2680-90	dc	v.low	p	1	-	?	
2690-700	dc	low	p	1	+	?	
2700-10	dc	?barren	vp	1	-	-	
2710	swc	low	vp	3	+	*A. largus*	

2710-20	dc	barren	-	-	-	-	
2720-30	dc	v.low	vp	1	-	?	
2730-40	dc	v.low	vp	1	-	?	?Early
2740-50	dc	v.low	vp	1	+	?	
2750-60	dc	?barren	p	1	-	-	Carboniferous
2760-70	dc	?barren	vp	1	+	-	
2770-80	dc	v.low	p	1	+	?*A. largus*	
2780-90	dc	v.low	p	1	+	?	
2790-800	dc	?barren	vp	1	-	-	
2809	swc	moderate	f-p	3	+	*R. lepidophyta*	
2810	dc	v.low	p	1	+	?	
2813	jb	moderate	f	1	-	*A. largus*	
2820	dc	low	f-p	1	-	?	
2830	dc	low	p	1	-	?	
2840	dc	barren	-	-	-	-	
2848	swc	moderate	f-p	3	+	*R. lepidophyta*	
2850	dc	?barren	vp	1	-	-	
2860	dc	low	p	1	-	?	
2870	dc	v.low	p	1	+	?*R. lepidophyta*	
2880	dc	?barren	p	1	?	-	
2890	dc	barren	-	-	-	-	
2897.5	swc	?barren	p	1	-	-	
2900	dc	?barren	p	1	-	-	
2910	dc	barren	-	-	-	-	
2920	dc	v.low	f-p	2	-	?	
2930	dc	v.low	vp	2	-	?	Late
2940	dc	barren	-	-	-	-	
2950	dc	barren	-	-	-	-	
2960	dc	barren	-	-	-	-	Devonian
2970	dc	barren	-	-	-	-	
2980	dc	?barren	vp	1	-	-	
2990	dc	?barren	vp	1	-	-	
3000	dc	v.low	p	2	-	-	
3001	swc	low	p	3	+	*R. lepidophyta*	
3010	dc	?barren	vp	1	-	-	
3012.5	swc	moderate	f-p	3	+	*R. lepidophyta*	
3020	dc	barren	-	-	-	-	
3030	dc	barren	-	-	-	-	
3040	dc	barren	-	-	-	-	
3050	dc	barren	-	-	-	-	
3050-60	dc	barren	-	-	-	-	
3060-70	dc	barren	-	-	-	-	
3070	swc	low	vp	3	+	?*R. lepidophyta*	
3077	swc	moderate	vp	3	+	?*R. lepdiophyta*	
3070-80	dc	barren	-	-	-	-	
3080-90	dc	barren	-	-	-	-	
3090-100	dc	barren	-	-	-	-	
3100-10	dc	barren	-	-	-	-	
3110-20	dc	barren	-	-	-	-	
3120-30	dc	barren	-	-	-	-	
3130-40	dc	v.low	vp	2	+	?	
3140-50	dc	v.low	p	1	+	?	
3150-60	dc	?barren	p	1	-	-	?
3160-70	dc	barren	-	-	-	-	
3170-80	dc	barren	-	-	-	-	
3180-90	dc	barren	-	-	-	-	
3190-200	dc	barren	-	-	-	-	
3200-10	dc	moderate	f-p	1	+	?*R. lepidophyta*	
3210-20	dc	barren	-	-	-	-	
3220-30	dc	barren	-	-	-	-	
3230-40	dc	barren	-	-	-	-	
3240-50	dc	barren	-	-	-	-	
3256.7	dc	barren	-	-	-	-	

Legend for Table 1:

Type:	dc	ditch cutting
	swc	sidewall core
	jb	junk basket
Yield:	playnomorph yield	
	barren	barren of palynomorphs
	?barren	very few specimens - possibly contamination
	v. low	very low
	low	
	moderate	
	abundant	
Preservation:		
	p	poor
	f	fair
	g	good
Reliability:		
	1	common, obvious contamination (mainly ditch cuttings)
	2	minor or possible contamination (dc and some swc)
	3	no obvious contamination (mainly swc)
Marine:		
	+	presence of spinose acritarchs and/or scolecodonts
	-	absence of spinose acritarchs and/or scolecodonts

Zonation

The zonation illustrated in Figure 1 follows that outlined in the review by Kemp and others (1977) of the Australian Late Palaeozoic zonal schemes. More recent work on various zones has been incorporated and utilised in recognising zones. Additional work on the *S. ybertii* to Stage 2 zones was provided by Powis (1979); the *D. birkheadensis* Assemblage was described by Powis (1984). Powis (1984) and Foster and Waterhouse (1988) provide additional criteria for recognition of the Stage 2/*P. confluens* zone. Price et al. (1985) provides the latest review of the Permian stages.

Correlation of the palynological zones with the lithologic units on Figure 1 is after Mory (1988).

The palynological zones in Kingfisher-1 were correlated with those identified in Turtle-1, Turtle-2 and the Barnett wells, where data was available. Correlation to Kulshill-1 was not made because of uncertainties in identification of the lithology units in that well. The most recent zonation of the Kulshill-1 section in Kemp et al. (1977) states that the Tanmurra Formation is "considerably younger than in Bonaparte-1 and may have been misidentified".

1. **Stage 3b** (*Microbaculispora trisina* assemblage): 340 - 350 m

Assignment to Stage 3b (*M. trisina* assemblage) is indicated by the presence of *M. trisina* and the absence of younger zone indicators, *Praecolpatites sinuosus* and *Phaeselisporites cicatricosa*. *Indotriradites* spp. were common and *Pseudoreticulatisporita pseudoreticulata* was rare in this assemblage. This zone is dated as Sakmarian by Price et al. (1985). However, Backhouse (1991) in his Collie Basin study indicates an Artinskian (Aktastinian) age for this zone.

The presence of spinose acritarchs (12%) suggests a shallow marine environment of deposition.

Correlation: This zone is present in Turtle-1 between 644.2 - ?910.7 m and Turtle-2 from 912 to 927.6 m in the Keyling and basal Fossil Head formations (Foster, 1984, 1989).

2. **Stage 3a** (*Pseudoreticulatispora pseudoreticulata* assemblage): 360 - 390 m

This zone is distinguished from Stage 3b by the absence of *M. trisina*. *M. trisina* is present in this interval but is rare and possibly contamination. The presence of *Anafoveosporites juvenus* and relatively common *Diatomozonotriletes townrowii* favours a Stage 3a assignment. Other key species present are *P. pseudoreticulata* and *Verrucosisporites naumovae*. This zone is dated as Sakmarian.

Spinose acritarchs are rare (3 and 5%), and with terrestrial material common, suggest a marginal marine environment of deposition.

Correlation: This zone has been identified in the Keyling Formation in Turtle-2 at 932.74 m and 936.5 m (Foster, 1989). In Turtle-1 it was identified in the interval ?935 to 1212 m (Foster, 1984).

3. **Stage 2**: 410 - 1151 m

The top of this zone is identified by the presence of *P. confluens* and the absence of the younger *P. pseudoreticulata*. Assemblages in this interval are characterised by an abundance of *M. tentula* and the persistent occurrence of *A. tereteangulatus*, *A. cornutus*, *P. gretensis*, *H. ramosus*, *Cycadopites cymbatus* and taeniate disaccate pollen. Monosaccate pollen species are represented by *Potonieisporites spp.*, *Plicatipollenites* spp. and *Cannanoropollis* spp.

Foster (in Foster & Waterhouse, 1988) proposed that Stage 2 be renamed the *P. confluens* Oppel-zone and this zone name was used for the section in Turtle-1 (Foster, 1984). However, it was subsequently recognised that in some areas, the species *P. confluens* only occurs in the upper part of the Stage 2 assemblage. Information provided by Teikoku on Barnett-1 shows that the Stage 2 assemblage lacking *P. confluens* in that well has been termed the *M. tentula* assemblage. To avoid confusion, Stage 2 as described by Powis (1984) is used in this report. It has been sub-divided into the *P. confluens* assemblage and the *M. tentula* assemblage.

a) ***P. confluens* assemblage**: 410 - ?1110 m

The species *P. confluens* is a rare component of assemblages in this interval. *D. rotundidentatus* and *Indotriradites* spp. are common. Monosaccate pollen are uncharacteristically rare.

The bottom of this zone may be higher in the section than 1110 m because the zonation is based on assemblages from ditch cutting samples, and there may be downhole contamination.

The *P. confluens* zone has been dated in the Canning Basin as Asselian (Early Permian). Spinose acritarchs are rare (0 to 5%) and accompanied by non-spinose forms and the freshwater algae, *Botryococcus* sp., suggesting brackish water environments of deposition.

b) *Microbaculispora tentula* assemblage: ?1120 - 1151 m

Assignment to this assemblage is based on the absence of *P. confluens*. As mentioned above, the top of this zone is possibly higher. Assemblages in this zone have less common *D. rotundidentatus* and *Indotriradites* spp. *Calamospora* spp. and monosaccate pollen are common through this interval. Species from the older *S. ybertii* and *D. birkheadensis* assemblages were identified in samples in the interval 1050 to 1150 m. However, these are considered to be reworked because of the good Stage 2 assemblage recovered from the sidewall core at 1151 m.

The *M. tentula* assemblage, as discussed above, is the older subzone of Stage 2. Balme (1980) suggested that the Permian/Carboniferous boundary be placed at or near the base of Stage 3 making Stage 2 mainly Carboniferous. In the Canning Basin Foster (1988) considered Stage 2, equivalent to his original *P. confluens* zone, to be entirely Early Permian. However, in the Perth Basin, the introduction of the Stage 2 assemblage appears to occur in the uppermost Carboniferous (Backhouse, 1991).

Spinose acritarchs were rarely present in this interval. The presence of the freshwater algae, *Botryococcus* sp, and common terrestrial material suggest a fresh to brackish water environment of deposition.

Correlation: This Stage 2 interval would be equivalent to the *P. confluens* zone in: Turtle-1 from 1333.6 to ?1602 m (Foster, 1984); Turtle-2 from 1255 to 1652 m (Foster, 1989); and Barnett-2 from 1103 - 1332 m (Foster, 1989). In Turtle-2 it occcurred in the top Kuriyippi Formation, Treachery Shale and basal Keyling Formation. In Barnett-1, the boundary between the *P. confluens* and *M. tentula* zones was interpreted at around 1550 m; in Barnett-3 it was placed between 1460 and 1510 m (information provided by Teikoku). In both wells it corresponded closely with the top of the Kuriyippi Formation. This sub-divison in Kingfisher-1 is not considered reliable enough to make a similar correlation.

4. Stage 1/*Potonieisporites novicus* Assemblage: 1170 - 1310 m.

This zone is characterised by lean, impoverished assemblages containing common *Calamospora* spp., *Cristatisporites* spp., *Punctatisporites* spp. and monosaccate pollen, *P. novicus* and *Cannanoropollis* spp. Rare components include *Verrucosisporites aspratilis* *Dentatisporites inaequalia* and *Wilsonites australiensis*.

Stage 2 species are rare and intermittent although *Brevitriletes levis* is relatively common in some assemblages. This could be interpreted as a poorly developed Stage 2 assemblage with components of the *D. birkheadensis* Assemblage considered reworking. However, these assemblages do not conform to the criteria defined for Stage 2 by Powis (1984) and the few Stage 2 species identified are considered caving contamination.

Stage 1, also called the *P. novicus* Assemblage, is dated as Stephanian. Because this assemblage contains species that also occur in the *D. birkheadensis* Assemblage, Foster (1988) contends that it is probably an impoverished or non-diverse facies-controlled palynoflora equivalent in part to the *D. birkheadensis* Assemblage.

Spinose acritarchs are rare and the freshwater algae, *Botryococcus* sp. common. This, coupled with common terrestrial material, suggests marginal marine, brackish water environments.

Correlation: This zone would correspond to the upper part of the *D. birkheadensis* Assemblage in Turtle-1 and Turtle-2.

5. *Diatomozontriletes birkheadensis* Assemblage: 1325 - 1470 m

Assignment to this assemblage is indicated by the presence of *D. birkheadensis* and *Ahrenisporites cristatus* with common *Kraeuselisporites kuttungensis*, *Apiculatisporites concinnus* and *Cristatisporites* spp. Monosaccate pollen, *Cannanoropollis* spp., is also present This assemblage is distinguished from the underlying *S. ybertii* zone by the rare occurrence of *S. ybertii.*

This zone is dated as Westphalian.

Spinose acritarchs are very rare or absent in the lower part of this zone ranging to 6% at the top indicating brackish water to marginal marine environments of deposition.

Correlation: This zone has been identified in the Kuriyippi Formation in Turtle-1 in the interval ?1608 to 1892 m and in Turtle-2 from 1719 to ?2227 m (Foster 1984, 1989). Foster (1988) considers that it is conformably overlain by the *P. confluens* zone and would include the Stage 1 microfloras in this zone.

6. *Spelaeotriletes ybertii* Assemblage: 1480 - 1550 m

This zone is characterised by an abundance of *Spelaeotriletes ybertii* and the presence of monosaccate pollen. The associated microflora is non-diverse and includes *Verrucosisporites italiensis, V. aspratilis, Punctatisporites lucidulus* and *Kraeuselisporites kuttungensis*. It is dated as Namuarian.

The bottom of this zone is placed at 1550 m. However, it should be noted that the ditch cutting samples at 1530 and 1550 m are contaminated with mud additive material and probable caved palynomorphs.

Spinose acritarchs are rare or absent suggesting brackish water environments.

Correlation: In Turtle-1, it was identified in the interval 2230.5 m to 2250.5 m and in Turtle-2 it occurred in the Point Spring Formation in samples from ?2287 to 2312 m (Foster 1984, 1989).

7. *Grandispora maculosa* **Assemblage**: 1563 - ?1660 m

Assignment to this zone is based on the presence of *S. ybertii* and absence of monosaccate pollen. Monosaccate pollen were identified in the sidewall core and ditch cuttings in this interval but are considered mud and/or caving contamination. The presence of *Reticulatisporites magnidictyus*, a key zone species, supports the *G. maculosa* assignment. Other significant species identified include *G. maculosa* and *Dibolisporites lictor*. *Kraeuselisporites* spp., *Cristatisporites* spp. and *Calamospora* spp. are common. This zone is dated as late Visean to Namurian.

Spinose acritarchs were rare, suggesting a marginal marine environment of deposition.

The ditch cutting samples at 1570 and 1660 m are contaminated with mud additive material and yielded an abundance of *S. ybertii*, considered contamination.

Correlation: In Turtle-1, the interval 2342 to 2387 m was assigned to this zone (Foster, 1984). In Turtle-2, it occurred in the interval 2381.5 to 2433 m, encompassing the Tanmurra to basal Point Spring formations ((Foster, 1989).

8. ?*Anapiculatisporites largus* **Assemblage**: 1670 -1760 m

The assemblages in this interval are dominated by *S. ybertii*, and associated species from the *S. ybertii* and *G. maculosa* assemblages are rare. *A. largus* Assemblage species, *Crassispora scrupulosa*, *Anapiculatisporites largus*, *Aurorospora macra*, *Hymenospora. caperata* and *Knoxisporites* sp. cf. *K. ruhlandi* are also present. The ditch cutting samples are contaminated with mud additive and caved material; the sidewall core sample at 1745 m yielded a poor assemblage and no definitive species were identified. When relying on contaminated ditch cuttings, as in this case, the older assignment is preferred and the interval is tentatively assigned to the *A. largus* Assemblage. However, it is recognised that these palynomorphs could be reworked into the younger zone.

9. *Anapiculatisporites largus* **Assemblage**: 1766 - 2710 m

The absence of *S. ybertii* and the common occurrence of *Granulatisporites frustulentus* characterises assemblages in this zone. Significant species identified include *A. largus*, *A. semisentus*, *Camptotriletes robertsii*, *Hymenospora caperata*, *Gorgonispora convoluta*, *Knoxisporites* sp. cf. *K. ruhlandi*, *Crassispora scrupulosa* and *Punctatisporites subvaricosus*. This zone is dated as Visean.

In general, more definitive assemblages were recovered from the sidewall cores. The ditch cutting samples in the interval 1770 to 2000 m yielded very lean assemblages with mud additive material common. Below 2000 m, the preservation deteriorated rapidly with miospores being deformed by pyrite crystals and becoming dark, making identification difficult. Even though the asssemblages appear impoverished, forms such as *H. caperata*, *G. convoluta*, *Punctatisporites subvaricosus* and *A. largus* persist down to the bottom of the zone.

The deepest reliable identification of this zone is in the sidewall core at 2710 where *Knoxisporites* sp. cf. *K. ruhlandi*, *R. bonapartensis*, *A. semisentus* and ?*C. invicta* were identified.

Devonian miospores of the *Retispora lepidopyta* Assemblage were noted in the sidewall core samples at 2561 and 2710 m and are considered reworking.

Marine influence was more evident below 2000 m where spinose acritarchs and scolecodonts were rare but intermittent in their occurrence. Their presence suggests a shallow marine environment of deposition.

Evidence of an unconformity at 2612.5 m, interpreted from log data, was not supported by the palynology results. Palynofloras recovered from above and below this depth are assigned to the *A. largus* Assemblage. This is similar to Turtle-1 where an unconformity was interpreted from log data at 2486 m but there was no attendant change in palynoflora.

Correlation: In Turtle-1, this zone was identified in the interval 2479.24 to 2672 m (Foster, 1984). From data supplied by Teikoku, it appears that this has been revised and the interval from approximately 2530 m to 2672 m assigned to the *Grandispora* sp. cf. *G. praecipua* zone. This new zone was defined in Barnett-2 by Foster (1989) in the interval 2400 to 2816 m and is overlain by the *A. largus* Assemblage, which occurs from 2192 to 2396 m.

The *Grandispora* sp. cf. *G. praecipua* zone, as defined by Foster in Barnett-2 (1989), does not appear to be developed in the Kingfisher-1 section. The relationship of this assemblage to the *G. spiculifera* (Tournaisian) and *A. largus* (Visean) assemblages is not established. It contains species common to both these assemblages as well as species peculiar to it (Foster, 1989).

The species *G.* sp. cf. *G. praecipua* and SPM 68 from this assemblage were identified in the sidewall core sample at 2002 m and the ditch cutting sample at 2010-20 m in Kingfisher-1, but other characteristics of the assemblage were not evident. It is possible that this is the top of the *G.* sp. cf. *G. praecipua* zone-equivalent in Kingfisher-1 and that its full extent is not evident because of the poorly preserved, lean assemblages obtained from ditch cuttings below this depth.

If this is the case, the *G.* sp. cf. *G. praecipua* zone would appear to be equivalent to part of the *A. largus* Assemblage of Visean age, and may be a provincially developed microflora. The fact that the *G.* sp. cf. *G. praecipua* zone in Turtle-1 was originally assigned to the *A. largus* Assemblage would support this.

10. Indeterminate: 2720 - 2800 m

Assemblages in this interval were poor and no diagnostic forms were identified.

11. *Retispora lepidophyta* Assemblage: 2809 - ?3077 m

This assemblage is identifed on the presence of the key species, *R. lepidophyta*. Significant associated species identified here included *Grandispora clandestina*, *Hymenozonotriletes scorpius*, *Apiculatisporis morbosus*, *Planisporites furfuris* and *Hystrichosporites porrectus*. The assemblages are very lean and best defined in recoveries from the sidewall cores but miospores are dark and poorly preserved. The *R. lepidophyta* Assemblage is dated as late Famennian.

Impoverishement of the assemblages is possibly due to sandy lithologies and probable destruction of organic matter by high temperatures. This latter process would explain the virtual absence of the thin-walled *R. lepidophyta*, usually a common component in this assemblage.

It is possible that this assemblage has been reworked into the *G. spiculifera* or *A. largus* assemblages. However, this interpretation would require all evidence of the host assemblage to be destroyed because no evidence of a younger assemblage was observed. An alternate interpretation is the existence of an unconformity in the interval 2710 to 2809 m.

The junk basket sample at 2813 yielded an *A. largus* Assemblage microflora. The colour and preservation of the miospores indicate that this sample has been caved from around 2600 m.

The zone is extended down to include the sidewall core at 3077 m. A very poor assemblage was recovered from this sample. *R. lepidophyta* was not identified but *H. porrectus* and ?*H. scorpius* were present. The inclusion of this sample in this zone assumes that any *R. lepidophyta* in the assemblage have been destroyed. However, it is possible that this sample is slightly older.

Spinose acritarchs and scolecodonts were rare and observed mainly in the sidewall core samples, and indicate a shallow marine environment of deposition.

Correlation: This assemblage has been recorded from the Bonaparte Beds (Kemp et al., 1977), but was not penetrated in the Turtle or Barnett wells. Onshore, Playford (1982) recorded its presence in the Button Beds, regarded as equivalent to part of the Nimbing Limestone.

12. Indeterminate: 3080 - 3256.7 m

Most of the samples in this interval appeared barren of palynomorphs. *R. lepidophyta* was identified in the ditch cutting sample at 3200-10 m. The accompanying assemblage was mixed, with some miospores being dark and poorly preserved and some obviously caved from higher in the section. Because of this, *R. lepidophyta* is considered caving contamination also.

THERMAL MATURITY

Spore colour indicates the folowing thermal maturities for liqiud hydrocarbon generation:

350 - 890 m	Immature	TAI 1+
900 - 1960 m	Marginally mature	2
1964 - 2410	Mature	2+ to 3
2420 - 3077	Post mature	3+ to 4

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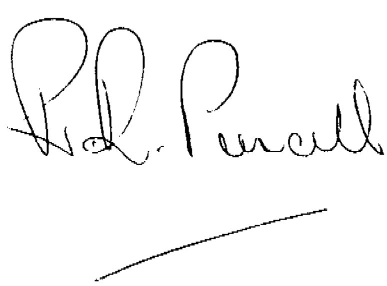

APPENDIX 1

LAOLA PTY LTD
10 Lefroy Avenue
Bellevue 6056 Ph : (09)250 2500

KINGFISHER # 1 TEIKOKU

Samp Depth(m)	Samp Type		Sample#	WT(g)	VOM(cc)	O/Yield	O/T	Time	Cont
350	CUT			15.7	0.5	0.031	HS	1:	
370	CUT			15.9	0.4	0.025	HS	1:	
390	CUT			15.2	0.7	0.046	HS	1:	
410	CUT			14.7	0.4	0.027	HS	1:	
430	CUT			12.9	0.4	0.031	HS	1:	
450	CUT			16.5	0.1	0.006	HS	1:	
470	CUT			14.8	0.3	0.020	HS	1:	
490	CUT			15.8	0.3	0.018	HS	1:	
510	CUT			13.7	0.3	0.021	HS	1:	
530	CUT			17.0	0.3	0.017	HS	1:	
550	CUT			13.0	0.2	0.015	HS	1:	
570	CUT			14.1	0.2	0.014	HS	1:	
590	CUT			15.0	0.1	0.006	HS	1:	
610	CUT			18.0	0.3	0.016	HS	1:	
630	CUT			16.8	0.1	0.005	HS	1:	
650	CUT			12.9	0.2	0.015	HS	1:	
670	CUT			15.7	0.5	0.031	SS	:30	
690	CUT			14.6	0.8	0.054	SS	:30	
710	CUT			13.4	0.2	0.014	SS	:30	
730	CUT			13.9	0.1	0.007	SS	:30	
750	CUT			13.5	0.1	0.007	SS	:30	
770	CUT			12.3	0.2	0.016	SS	:30	
790	CUT			12.6	0.3	0.023	SS	:30	
810	CUT			14.0	0.2	0.014	SS	:30	
830	CUT			14.1	1.2	0.085	SS	:30	
850	CUT			13.4	2.0	0.149	SS	:30	
870	CUT			13.2	1.5	0.113	SS	:30	
880	CUT	URG		15.0				:	
890	CUT	URG		15.0				:	
890	CUT			16.9	1.4	0.082	SS	:30	
900	CUT	URG		15.0				:	
910	CUT			13.5	0.3	0.022	SS	:30	
930	CUT			13.1	0.7	0.053	SS	:30	
950	CUT			12.4	0.3	0.024	SS	:30	
970	CUT			12.3	0.1	0.008		:	
990	CUT			13.6	0.05	0.003		:	
1010	CUT			17.8	0.05	0.002		:	
1030	CUT			14.8	0.05	0.003		:	
1050	CUT			15.8	0.1	0.006	SS	:30	
1050	CUT	URG		15.0				:	
1060	CUT	URG		15.0				:	
1070	CUT			16.7	0.3	0.017	SS	:30	
1070	CUT	URG		15.0				:	
1090	CUT			11.2	0.2	0.017	SS	:30	
1100	CUT	URG		15.0			NIT	1:	
1110	CUT	URG		15.0			NIT	1:	
1110	CUT			22.8	0.2	0.008	NIT	1:	
1120	CUT	URG		15.0			NIT	1:	
1127	CUT	URG		15.0			NIT	1:	
1130	CUT			21.0	1.5	0.071	NIT	1:	
1150	CUT			21.3	0.3	0.014	NIT	1:	

LAOLA PTY LTD
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KINGFISHER # 1 TEIKOKU

Samp Depth(m)	Samp Type	Sample#	WT(g)	VOM(cc)	O/Yield	O/T	Time	Cont
1151.0	SWC		5.7	0.3	0.052	NIT	1:	
1170	CUT		18.6	0.4	0.021	NIT	1:	
1182.0	SWC		5.8	2.2	0.379	NIT	1:	
1190	CUT		21.8	0.4	0.018	NIT	1:	
1210	CUT		20.3	0.5	0.024	NIT	1:	
1230	CUT		22.0	0.6	0.027	NIT	1:	
1247.0	SWC		5.8	0.3	0.051	NIT	1:	
1250	CUT		20.0	0.4	0.020	NIT	1:	
1270	CUT		22.2	0.3	0.013	NIT	1:	
1290	CUT		21.1	0.1	0.004		:	
1310	CUT		20.8	0.1	0.004	NIT	1:	
1325.0	SWC		4.5	0.7	0.155	NIT	1:	
1330	CUT		23.0	0.05	0.002		:	
1350	CUT		19.4	1.3	0.067	NIT	1:	
1370	CUT		22.6	0.1	0.004		:	
1390	CUT		20.3	0.1	0.004		:	
1392.0	SWC		4.4	0.2	0.045	NIT	1:	
1410	CUT		21.0	0.1	0.004	NIT	1:	
1430	CUT		23.1	0.1	0.004		:	
1450	CUT		23.2	0.05	0.002		:	
1470	CUT		26.1	0.05	0.001		:	
1490	CUT		25.9	0.3	0.011	NIT	1:	
1510	CUT		25.8	0.05	0.001		:	
1530	CUT		25.9	0.1	0.003	NIT	1:	
1550	CUT		26.5	0.1	0.003	NIT	1:	
1563.0	SWC		6.3	0.1	0.015	NIT	1:	
1570	CUT		20.7	0.05	0.002		:	
1642.0	SWC		3.1	0.1	0.032	NIT	1:	
1660	CUT		21.9	3.1	0.141	NIT	1:	
1680	CUT		25.2	1.2	0.047	NIT	1:	
1700	CUT		21.7	0.4	0.018	NIT	1:	
1720	CUT		22.7	0.4	0.017	NIT	1:	
1740	CUT		22.9	0.2	0.008	NIT	1:	
1745.0	SWC		4.3	0.05	0.011		:	
1760	CUT		26.2	0.4	0.015	NIT	1:	
1766.0	SWC		4.6	0.1	0.021	NIT	1:	
1780	CUT		26.9	0.4	0.014	NIT	1:	
1800	CUT		23.0	0.4	0.017	NIT	1:	

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Samp Depth(m.)	Samp Type	Sample#	WT(g)	VOM(cc)	O/Yield	O/T	Time	Cont
1810-1820	CUT		13.2	0.2	0.015	SS	1:	
1820-1830	CUT		14.7	0.3	0.020	SS	1:	
1830-1840	CUT		17.6	0.4	0.022	SS	1:	
1840-1850	CUT		13.4	0.4	0.029	SS	1:	
1841.0	SWC	60	6.7	0.3	0.044	HS	:30	
1850-1860	CUT		13.8	0.5	0.036	SS	1:	
1860-1870	CUT		13.1	0.3	0.022	SS	1:	
1870-1880	CUT		13.7	0.2	0.014	SS	1:	
1878.0	SWC	56	7.4	0.1	0.013		:	
1880-1890	CUT		18.8	0.1	0.005	SS	1:	

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Samp Depth(m.)	Samp Type	Sample#	WT(g)	VOM(cc)	O/Yield	O/T	Time	Cont
1884.0	SWC	57	6.9	0.2	0.028	HS	:30	
1890-1900	CUT		14.2	0.3	0.021	SS	1:	
1900-1910	CUT		15.9	0.2	0.012		:	
1910-1920	CUT		13.5	0.1	0.007	SS	1:	
1920-1930	CUT		13.2	0.1	0.007	SS	1:	
1930-1940	CUT		14.8	0.1	0.006		:	
1940-1950	CUT		12.9	0.1	0.007		:	
1950-1960	CUT		12.3	0.1	0.008		:	
1960-1970	CUT		19.1	0.1	0.005	SS	1:	
1964.0	SWC	50	7.1	0.5	0.070	HS	:30	
1970-1980	CUT		13.3	0.1	0.007	SS	1:	
1980-1990	CUT		14.5	0.01			:	
1990-2000	CUT		18.0	0.1	0.005		:	
2000-2010	CUT		14.6	0.1	0.006	SS	1:	
2002.0	SWC	49	10.4	0.1	0.009	HS	:30	
2010-2020	CUT		13.0	0.2	0.015	SS	1:	
2020-2030	CUT		13.6	0.1	0.007	SS	1:	
2030-2040	CUT		15.7	0.3	0.019	SS	1:	
2040-2050	CUT		13.1	0.2	0.015	SS	1:	
2050-2060	CUT		14.8	0.2	0.013	N	1:	
2060-2070	CUT		16.8	0.3	0.017	N	1:	
2070-2080	CUT		19.0	0.1	0.005	N	1:	
2080-2090	CUT		14.0	0.2	0.014	N	1:	
2090-2100	CUT		13.2	0.2	0.015	N	1:	
2101.0	SWC	43	9.3	0.05	0.005		:	
2100-2110	CUT		13.1	0.1	0.007		:	
2110-2120	CUT		13.2	0.1	0.007		:	
2120-2130	CUT		12.5	0.05	0.004		:	
2127.5	SWC	47	6.8	0.1	0.014	HS	:30	
2130-2140	CUT		13.2	0.05	0.003		:	
2140-2150	CUT		12.6	0.1	0.007		:	
2150-2160	CUT		15.7	0.1	0.006	N	1:	
2160-2170	CUT		13.0	0.1	0.007		:	
2170-2180	CUT		14.2	0.1	0.007		:	
2180-2190	CUT		13.4	0.1	0.007		:	
2190-2200	CUT		11.6	0.05	0.004		:	
2200-2210	CUT		13.2	0.1	0.007		:	
2210-2220	CUT		15.6	0.1	0.006	HS	2:	
2220-2230	CUT		13.2	0.1	0.007		:	
2230-2240	CUT		14.4	0.1	0.006		:	
2240-2250	CUT		14.9	0.5	0.033		:	
2250-2260	CUT		13.8	0.1	0.007	HS	2:	
2260-2270	CUT		15.2	0.1	0.006		:	
2270-2280	CUT		13.1	0.1	0.007	HS	2:	
2280-2290	CUT		14.6	0.1	0.006		:	
2289.4	SWC	40	6.2	0.1	0.016		:	
2290.0	SWC	39	8.9	0.1	0.011	HS	:30	
2290-2300	CUT		13.7	0.1	0.007		:	
2298.5	SWC	36	7.3	0.01	0.001		:	
2300-2310	CUT		19.4	0.1	0.005	HS	2:	
2310-2320	CUT		14.0	0.05	0.003		:	
2320-2330	CUT		16.7	0.05	0.002		:	

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Samp Depth(m.)	Samp Type		Sample#	WT(g)	VOM(cc)	O/Yield	O/T	Time	Cont
2330-2340	CUT			18.9	0.05	0.002		:	
2340-2350	CUT			14.5	0.05	0.003		:	
2350-2360	CUT			14.5	0.01			:	
2360-2370	CUT			14.4	0.01			:	
2370-2380	CUT			15.4	0.05	0.003		:	
2380-2390	CUT			14.3	0.01			:	
2390-2400	CUT			14.9	0.01			:	
2400-2410	CUT			13.4	0.1	0.007		:	
2410-2420	CUT			15.6	0.1	0.006		:	
2420-2430	CUT			14.4	0.1	0.006		:	
2430-2440	CUT			14.1	0.05	0.003		:	
2440-2450	CUT			14.3	0.1	0.006	HS	1:	
2441.5	SWC		40	7.0	0.3	0.042	HS	:30	
2450-2460	CUT			14.6	0.05	0.003		:	
2460-2470	CUT			14.2	0.05	0.003		:	
2470-2480	CUT			14.8	0.1	0.006	HS	1:	
2480-2490	CUT			14.3	0.01			:	
2490-2500	CUT			15.1	0.05	0.003		:	
2492.1	SWC		35	10.4	0.01			:	
2500-2510	CUT			15.6	0.01			:	
2510-2520	CUT			15.7	0.01			:	
2520-2530	CUT			15.1	0.01			:	
2525.5	SWC		34	12.3	0.3	0.024	HS	:30	
2530-2540	CUT			15.2	0.0			:	
2540-2550	CUT			15.8	0.01			:	
2550-2560	CUT			15.0	0.0			:	
2560-2570	CUT			14.7	0.01			:	
2561.0	SWC		32	5.7	0.3	0.052	HS	:30	
2570-2580	CUT			15.3	0.05	0.003		:	
2580-2590	CUT			15.0	0.0			:	
2585.0	SWC		31	5.6	0.3	0.053	HS	:30	
2590-2600	CUT			21.4	0.01			:	
2600.0	SWC		29	6.7	0.4	0.059	HS	:30	
2600-2610	CUT			15.8	0.0			:	
2610-2620	CUT			17.1	0.1	0.005	N	1:	
2612.9	SWC		28	7.9	1.2	0.151	HS	:30	
2615.0	SWC		27	6.5	0.2	0.030	HS	:30	
2616.5	SWC		26	6.0	0.5	0.083	HS	:30	
2620-2630	CUT			23.1	0.01			:	
2621.0	SWC		25	11.8	0.3	0.025	HS	:30	
2630-2640	CUT			23.2	0.01			:	
2633.0	SWC		23	8.2	0.2	0.024	HS	:30	
2640-2650	CUT			17.5	0.0			:	
2650-2660	CUT			17.5	0.01			:	
2660-2670	CUT			17.9	0.05	0.002		:	
2670-2680	CUT			21.0	0.01			:	
2680-2690	CUT			19.9	0.2	0.010	N	1:	
2690-2700	CUT			22.1	0.1	0.004	N	1:	
2700-2710	CUT			19.5	0.1	0.005		:	
2710.0	SWC	URG	16	6.3				:	
2710-2720	CUT			22.5	0.1	0.004		:	
2720-2730	CUT			14.3	0.1	0.006		:	

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2730-2740	CUT			19.9	0.1	0.005	N	1:	
2740-2750	CUT			16.1	0.1	0.006		:	
2750-2760	CUT			23.1	0.2	0.008		:	
2760-2770	CUT			25.3	0.2	0.007		:	
2770-2780	CUT			13.8	0.2	0.014		:	
2780-2790	CUT			20.6	0.1	0.004	N	1:	
2790-2800	CUT			17.6	0.2	0.011	N	1:	
2809.0	SWC	URG	13	4.0				:	
2800-2810	CUT			21.4	0.2	0.009	HS	2:	
2813	JUNK			22.0	0.7	0.031	HS	2:	
2810-2820	CUT			19.7	0.2	0.010	HS	2:	
2820-2830	CUT			18.8	0.2	0.010	HS	2:	
2830-2840	CUT			18.2	0.01			:	
2840-2850	CUT			18.6	0.01			:	
2848.0	SWC		12	7.7	0.05	0.006		:	
2850-2860	CUT			14.3	0.1	0.006	HS	2:	
2860-2870	CUT			13.5	0.01			:	
2870-2880	CUT			18.6	0.01			:	
2880-2890	CUT			20.1	0.01			:	
2890-2900	CUT			14.4	0.1	0.006		:	
2897.5	SWC		9	5.2	0.05	0.009		:	
2900-2910	CUT			14.3	0.01			:	
2910-2920	CUT			15.3	0.01			:	
2920-2930	CUT			13.6	0.01			:	
2930-2940	CUT			21.1	0.1	0.004		:	
2940-2950	CUT			18.5	0.2	0.010	HS	2:	
2950-2960	CUT			21.8	0.1	0.004		:	
2960-2970	CUT	URG		15.0				:	
2970-2980	CUT	URG		15.0				:	
2980-2990	CUT	URG		15.0				:	
2990-3000	CUT	URG		15.0				:	
3000-3010	CUT	URG		15.0				:	
3001.0	SWC	URG	6	3.3				:	
3010-3020	CUT	URG		15.0				:	
3012.5	SWC		8	7.9	0.4	0.050	HS	:30	
3020-3030	CUT	URG		15.0				:	
3030-3040	CUT	URG		15.0				:	
3040-3050	CUT	URG		15.0				:	
3050-3060	CUT			12.4	0.1	0.008		:	
3060-3070	CUT			19.7	0.1	0.005		:	
3070.0	SWC	URG	2	5.9				:	
3070-3080	CUT			13.3	0.1	0.007		:	
3077.0	SWC	URG	1	3.3				:	
3080-3090	CUT			14.0	0.05	0.003		:	
3090-3100	CUT			13.3	0.01			:	
3100-3110	CUT			15.8	0.01			:	
3110-3120	CUT			13.7	0.01			:	
3120-3130	CUT			19.7	0.05	0.002		:	
3130-3140	CUT			24.1				:	
3140-3150	CUT			21.1				:	
3150-3160	CUT			20.9				:	
3160-3170	CUT			17.7				:	

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Samp Depth(m.)	Samp Type	Sample#	WT(g)	VOM(cc)	O/Yield	O/T	Time	Cont
3170-3180	CUT		21.9				:	
3180-3190	CUT		19.8				:	
3190-3200	CUT		19.7				:	
3200-3210	CUT		20.6				:	
3210-3220	CUT		18.9				:	
3220-3230	CUT		21.2				:	
3230-3240	CUT		20.9				:	
3240-3250	CUT		23.3				:	
3256.7	TD		27.1				:	