Quantitative Palynology of the Paleocene Lower Wilcox Group of Texas: Taxonomy, Biostratigraphy, and Paleoecology

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Edmond Olinick No. 1

Measured depth (ft) | Chronostratigraphy | Onshore Wilcox palynology

Age: Selandian - Thanetian (4949–5515); Selandian (5515–6161)

Zone: B *P. mcgregorii*/T *M. dilatus* (4949–5515); B *C. veripites*/B *P. mcgregorii* (5515–5995); B *Caryapollenites* spp./B *C. veripites* (5995–6161)

Total palynomorph abundance (Sum) | Relative abundance (%)

Samples (ft)	Total count	*Deltoidospora* spp.	*Laevigatosporites* spp.	*Stereisporites* spp.	Other plant spores	*Classopollis classoides*	Class Pinopsida	Ephedroid pollen	*I. hiatipites*	Other gymnosperm pollen	*Alnus* spp.	Betulaceae/Myricaceae type	*Caryapollenites* spp.	*Chenopodipollis* spp.	*Favitricolporites baculoferus*	*Momipites* spp.	*Thomsonipollis magnificus*	Other angiosperm pollen	Dinoflagellate cysts	Fungal remains	Other palynomorphs
		Lower plant spores				Gymnosperm pollen					Angiosperm pollen								Other palynomorphs		
4949 - 4979	1653	1.91	3	2	6	1	1.3	1.12	6			34	3	1.12	3	6	9	20	4	2	1.24
4979 - 5009	1937	1	2	1.9	5		2		2			29	2	1.052	6	10	8	24	2	5	1.1
5039 - 5069	1925 Rw	1.078	2	2	6	1.052	3		6			39	2	1.052	2	6	8	21	2	1.26	1.16
5099 - 5129	1659	1.75	2	1	5	1	2		3	1.06	1.12	35	5		3	5	9	20	5	2	1.12
5158 - 5188	1735	1	2	1	5	1.12	2		2		1.058	27	2	1.17	5	9	4	28	4	7	1.058
5335 - 5365	1227	1.65	3	1	6	1.16	2	1.16	5			34	3	1.081	3	10	8	16	1.9	6	1.16
5395 - 5425	2461	1.91	2	3	7	1.12	2		7	1.041	1.041	30	2	1.081	2	8	10	19	2	5	1.081
5425 - 5455	2026	2	3	2	7	1.099	1.099		4	1.049		29	4	1.049	2	10	11	18	4	4	1.049
5455 - 5485	1302 Rw	1	4	1.31	6		3		5		1.077	32	2	1.15	2	7	11	23	1.84	2	1.077
5515 - 5545	1603	1	2	1.94	6	1.062	1	1.062	4			27	1	1.062	6	11	6	26	5	3	1.062
5545 - 5575	1076	1.19	3	2	6	3	5	1.19	6		1.093	25	2	1.19	1.28	6	9	26	3	4	1.19
5646 - 5676	2758	1.73	3	3	8	1.073	1.11		3	1.036	1.036	32	3	1.036	3	13	7	23	2	1.25	1.036
5676 - 5706	1520	1	3	1	9		3	1.2	4	1.066	1.066	22	1.33	1.2	2	13	10	26	3	2	1.066
5845 - 5874	1002	1	2	2	8	1.1	2	2	2	1.1		15	1.3	1.0	5	15	8	28	5	3	1.1
5935 - 5965	1855 Rw	1.65	2	5	11	2	1	1.11	4	1.054	1.054	24	2	1.11	2	9	10	24	2	2	1.16
5995 - 6025	1015	2	2	1.3	6	1.2	2	1.3	5			20	1.2	1.3	3	13	12	31	2	2	1.099
6161 - 6191	1073 Rw	1.65	2	1	7	3	2	1.28	10	1.093	1.19	17	1	2	2	4	8	32	5	3	1.19

Jerome Olinick No. 16

Measured depth (ft) | Chronostratigraphy: Age | Onshore Wilcox palynology: Zone | Samples (ft) | Total palynomorph abundance: Sum

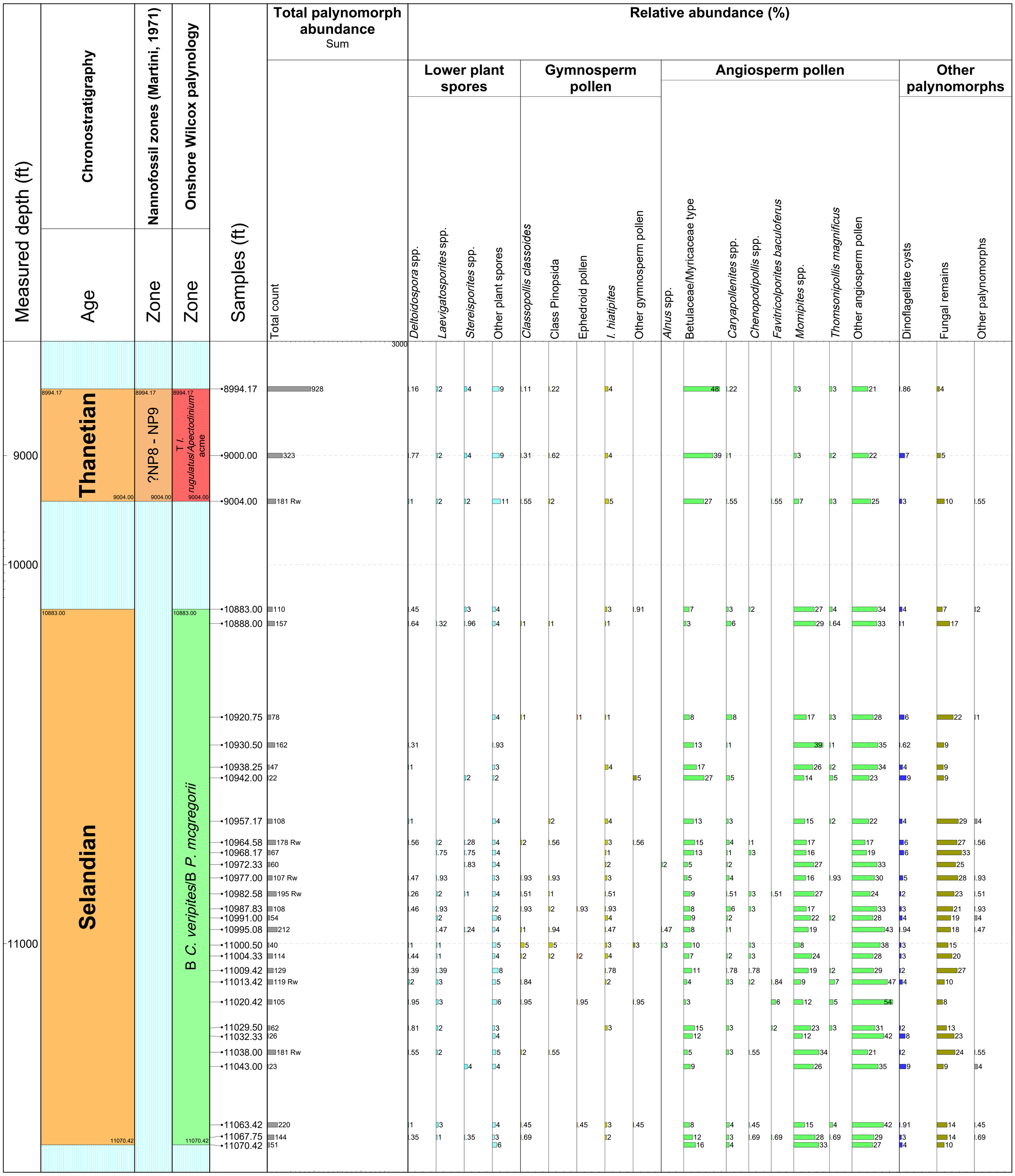
Age: Selandian - Thanetian (5096.17–5221.92); Selandian (5221.92–5966.00); ?Danian - ?Selandian (5966.00–5991.42)

Zone: B *P. mcgregorii*/T *M. dilatus* (5096.17–5221.92); B *P. mcgregorii* (5221.92–5966.00); B *C. veripites*/B *P. mcgregorii* (5966.00–5991.42)

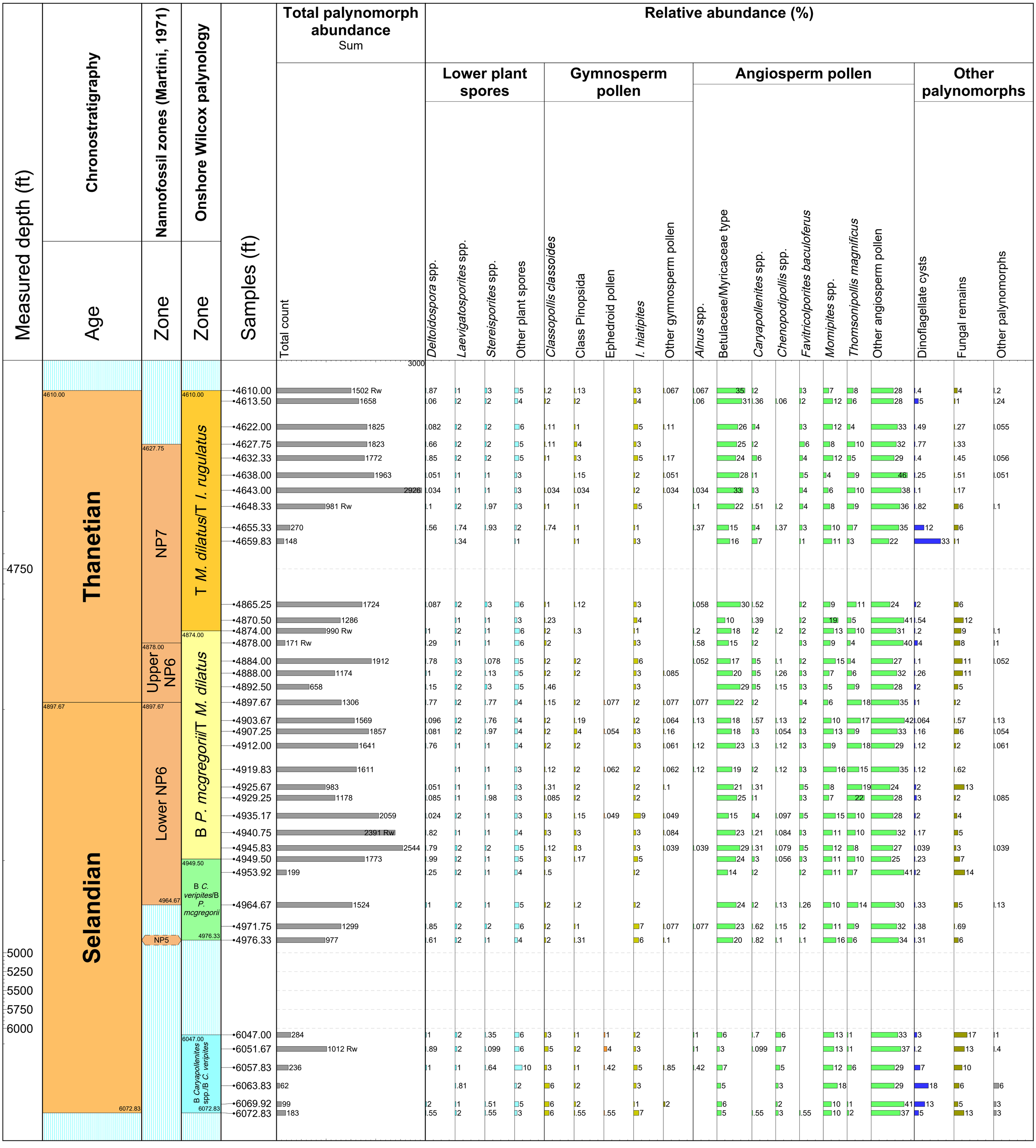
Relative abundance (%)

Samples (ft)	Total count	*Deltoidospora* spp.	*Laevigatosporites* spp.	*Stereisporites* spp.	Other plant spores	*Classopollis classoides*	Class Pinopsida	Ephedroid pollen	*I. hiatipites*	Other gymnosperm pollen	*Alnus* spp.	Betulaceae/Myricaceae type	*Caryapollenites* spp.	*Chenopodipollis* spp.	*Favitricolporites baculoferus*	*Momipites* spp.	*Thomsonipollis magnificus*	Other angiosperm pollen	Dinoflagellate cysts	Fungal remains	Other palynomorphs
5096.17	814 Rw	.92	2	.61	6	2	4	.12	6	.25	.25	9	3	.12	.12	23	2	19	7	14	.37
5100.50	893 Rw	.67	3	1	8	.34	3	.11	3		.11	12	1	.22	.22	30	3	24	4	6	
5102.00	1204	1	2	.62	7	3	2		6		.17	12	2	.17	.25	32	5	24	1	.33	.33
5106.50	1316	1	2	.15	5	3	3		8	.15	.23	14	3	.15	.15	25	5	23	5	3	
5111.67	721	2	1	.69	5	1	2		5			14	4	.55	2	21	7	17	9	7	.97
5119.00	1791	.056	3	.84	5	.056	2	.11	5		.11	25	1	.056	7	14	13	21	.17	2	.11
5124.58	808	1	2	.19	5	.12	5	.12	2		.12	19	3	.37	4	10	19	20	2	8	.12
5129.50	1291	2	4	1	7	.15	.23	.077	3			17	.7		3	27	15	15	2	2	.077
5135.42	856	1	2	.058	6	.35	3	.12	3		.23	11	7	.12	.7	27	7	31	.23	.35	.12
5139.00	145	1	1		8		3		6			14	5		.69	25	4	25	5	3	.69
5151.33	305	1	2	.49	8	1	3	.66	2		.66	12	2		3	24	8	25	2	5	.98
5199.33	275	1	2		8	.73	4	.36	7		.36	5	6	.73	.36	24	3	24	2	12	
5204.75	1046	.81	1	.81	7	.096	2		4		1	8	2	.19		36	2	20	7	8	.29
5221.92	907	1	2	1	5	2	2	.11	3			13	.88	.33	.22	19	7	32	.77	10	.11
5226.00	809 Rw	1	3	.12	7	2	4		6			6	3	.25	1	21	7	23	4	11	.12
5281.33	349 Rw	.72	2	.86	7	.57	3	.29	4		.29	8	2		4	11	19	28	.86	9	.57
5287.58	1248 Rw	1	2	.08	5	.24	1	.08	4			11	4	2	2	18	14	26	8	.64	.08
5292.42	926	.76	4	.11	5		.32	.11	6	.11	.11	16	2	.32	2	16	21	25	.97	.65	
5298.00	758 Rw	1	2	.59	6	2	.66	1	1		.13	5	3	2	2	33	5	25	3	7	.13
5301.00	305 Rw	2	2	.82	9	.98	2		2	.33		14	3	.98	2	18	5	29	3	6	
5308.00	517	2	3		7	1	2		2			5	2	2	.39	17	3	40	1	14	
5951.00	349	2	3	.57	12	3	3	.57	2		.29	3	.29	4		7	7	32	4	15	1
5954.67	606	1	3	.83	7	2	2	2	1		.33	8	.17	4	.17	13	22	24	1	6	.17
5960.33	820 Rw	1	3	.91	6	5	.37	2				2	.12	8	.12	27	1	31	.85	11	.24
5966.00	1394 Rw	1	2	.54	6	7	2	.79	.79		.79	3	.072	3		25	.79	31	1	15	.14
5990.00	284	2	3	2	14	2	2	2	1	.35		5		5	.7	14	5	29	4	10	1
5991.42	632 Rw	2	3	.55	9	5	1	.32	2		.16	3		6		18	5	33	3	9	.47

Lawrence Keseling No. 1

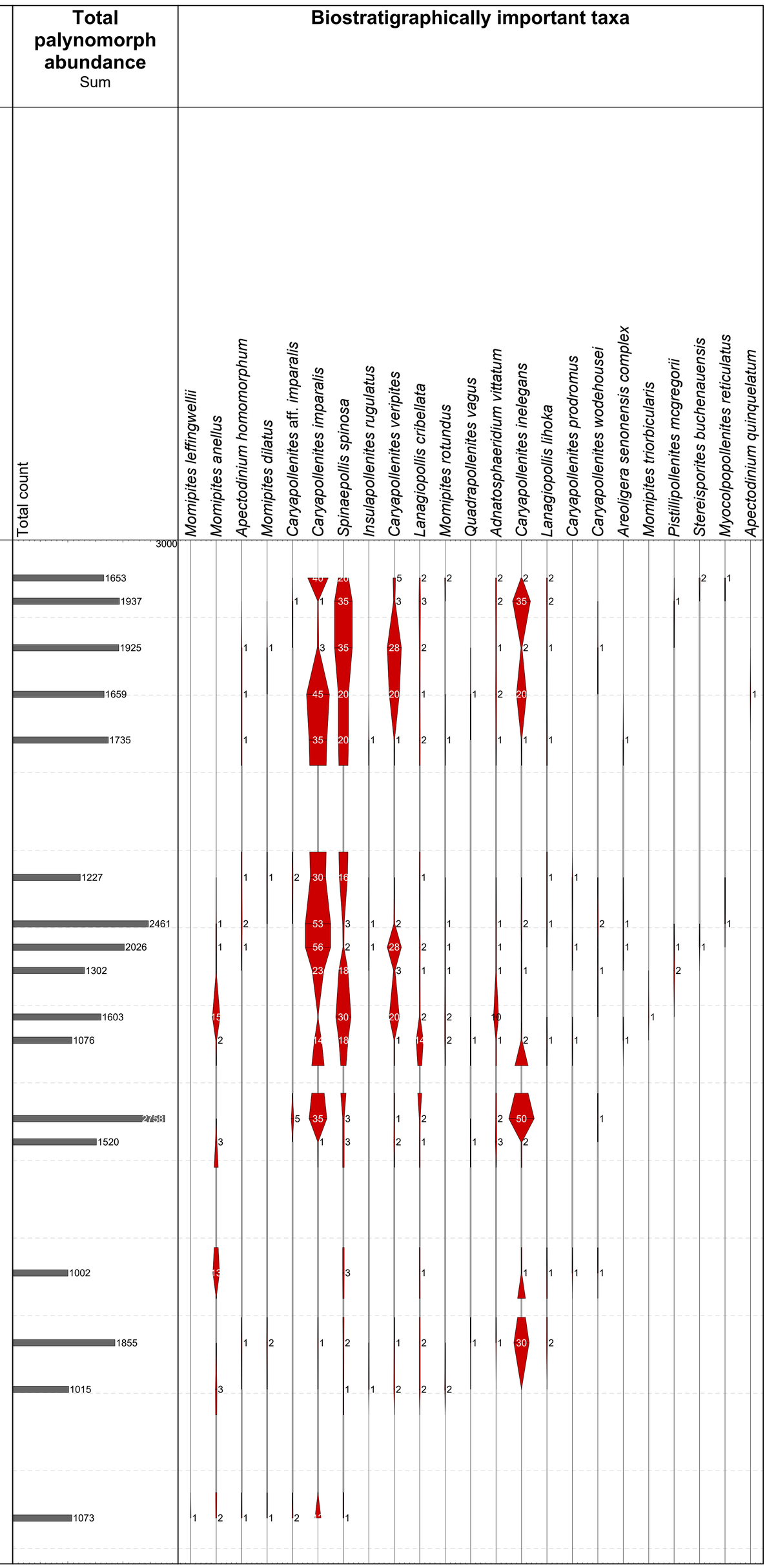


Moczygemba VT No. 11



Edmond Olinick No. 1

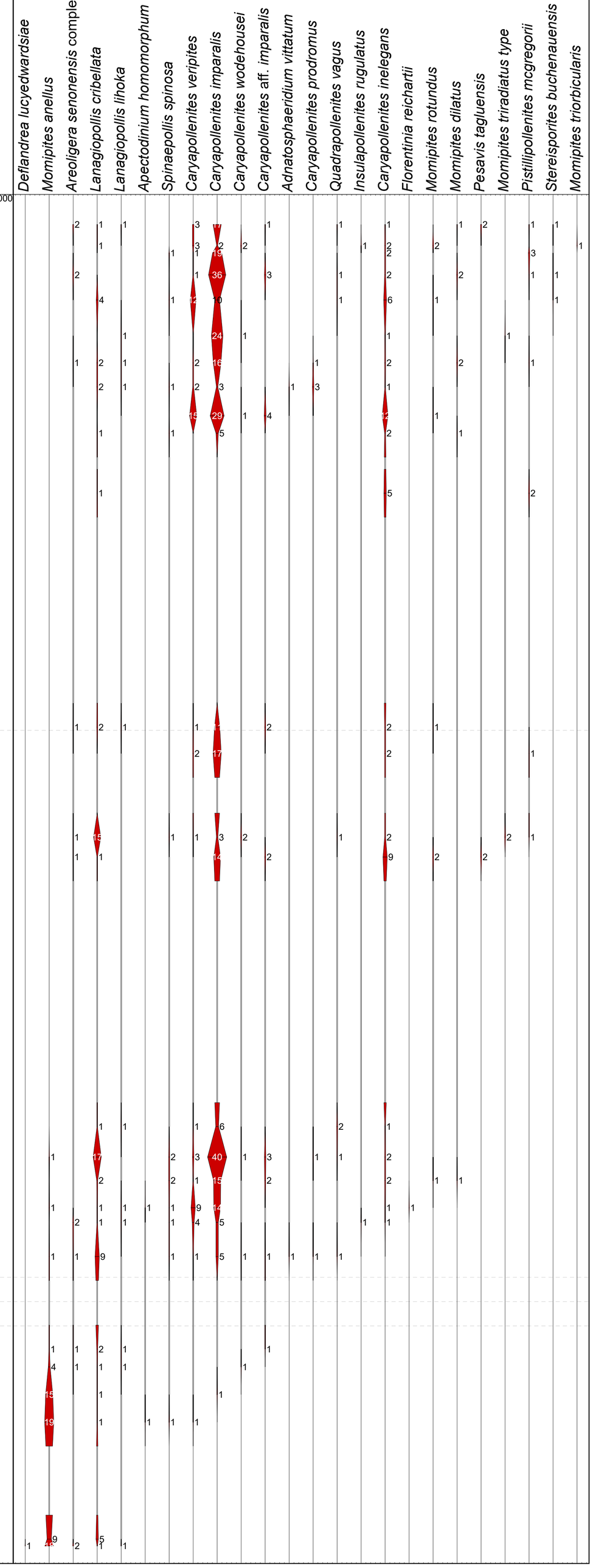
Measured depth (ft)	Chronostratigraphy: Period/Epoch	Chronostratigraphy: Age	Onshore Wilcox palynology: Zone	Samples (ft)	Biostratigraphic comments
4900					
4949	Paleocene	Selandian - Thanetian	B *P. mcgregorii*/T *M. dilatus*	4949 - 4979	Below top of B *P. mcgregorii*/T *M. dilatus* zone: *P. mcgregorii* observed downsection, observed T *M. dilatus* at 5039-5069` considered below true stratigraphic top.
5000				4979 - 5009	
				5039 - 5069	T observed *Momipites dilatus*, considered below true stratigraphic top.
5100				5099 - 5129	
				5158 - 5188	
5200					
5300				5335 - 5365	
5400				5395 - 5425	
				5425 - 5455	
				5455 - 5485	B *Pistillipollenites mcgregrorii* (59.6 Ma).
5500				5515 - 5545	B common *Caryapollenites veripites* (60.0 Ma), T consistent *Momipites anellus*.
				5545 - 5575	
5600					
		Selandian	B *C. veripites*/B *P. mcgregorii*	5646 - 5676	
				5676 - 5706	
5700					
5800					
				5845 - 5874	B *Caryapollenites prodromus*, B *Caryapollenites wodehousei*.
5900					
				5935 - 5965	B *Caryapollenites inelegans*, B *Lanagiopollis lihoka*, B *Quadrapollenites vagus*, B *Adnatosphaeridium vittatum*.
6000				5995 - 6025	B *Caryapollenites veripites* (60.8 Ma), possibly above true stratigraphic bottom due to presence of *Apectodinium homomorphum* downsection. B *Insulapollenites rugulatus*, possibly caved.
6100			B *Caryapollenites* spp./B *C. veripites*		
				6161 - 6191	A*pectodinium homomorphum* and *Spinaepollis spinosa* present, possibly caved. *Caryapollenites* spp. present.
6200					



Jerome Olinick No. 16

Measured depth (ft)	Chronostratigraphy: Period/Epoch	Chronostratigraphy: Age	Onshore Wilcox palynology: Zone	Samples (ft)	Biostratigraphic comments	Total palynomorph abundance (Sum)
				5096.17	In B *P. mcgregorii*/T *M. dilatus* zone based on presence of *P. mcgregorii* and *M. dilatus*.	814
				5100.50		893
				5102.00		1204
				5106.50		1316
				5111.67		721
				5119.00		1791
				5124.58		808
				5129.50		1291
				5135.42		856
				5139.00		145
		Selandian - Thanetian	B *P. mcgregorii*/T *M. dilatus*	5151.33		305
5200				5199.33		275
				5204.75		1046
				5221.92	B *Pistillipollenites mcgregorii* (59.6 Ma).	907
	Paleocene			5226.00		809
		Selandian	B *C. veripites*/B *P. mcgregorii*	5281.33		349
				5287.58		1248
				5292.42	B *Momipites dilatus*, B *Momipites rotundus*.	926
				5298.00		758
				5301.00	B *Caryapollenites inelegans*, B *Insulapollenites rugulatus*.	305
				5308.00	B common *Caryapollenites veripites*? Confidence limited by large sample gap downsection. B *Caryapollenites prodromus*, B *Quadrapollenites vagus*.	517
5400						
5600						
5800						
				5951.00		349
				5954.67	T consistent *Momipites anellus*, B *Caryapollenites wodehousei*.	606
				5960.33	B *Caryapollenites imparalis*.	820
		?Danian - ?Selandian		5966.00	B *Apectodinium homomorphum* (60.4 Ma), B *Caryapollenites veripites* (60.8 Ma), B *Caryapollenites* spp., B *Spinaepollis spinosa*: possible unconformity or condensed section downhole.	1394
				5990.00	T *Deflandrea lucyedwardsiae*, below true stratigraphic top in zone Paly 4c (NP7). *Areoligera senonensis* complex present. Probably lower Selandian or uppermost Danian.	284
				5991.42		632

Biostratigraphically important taxa



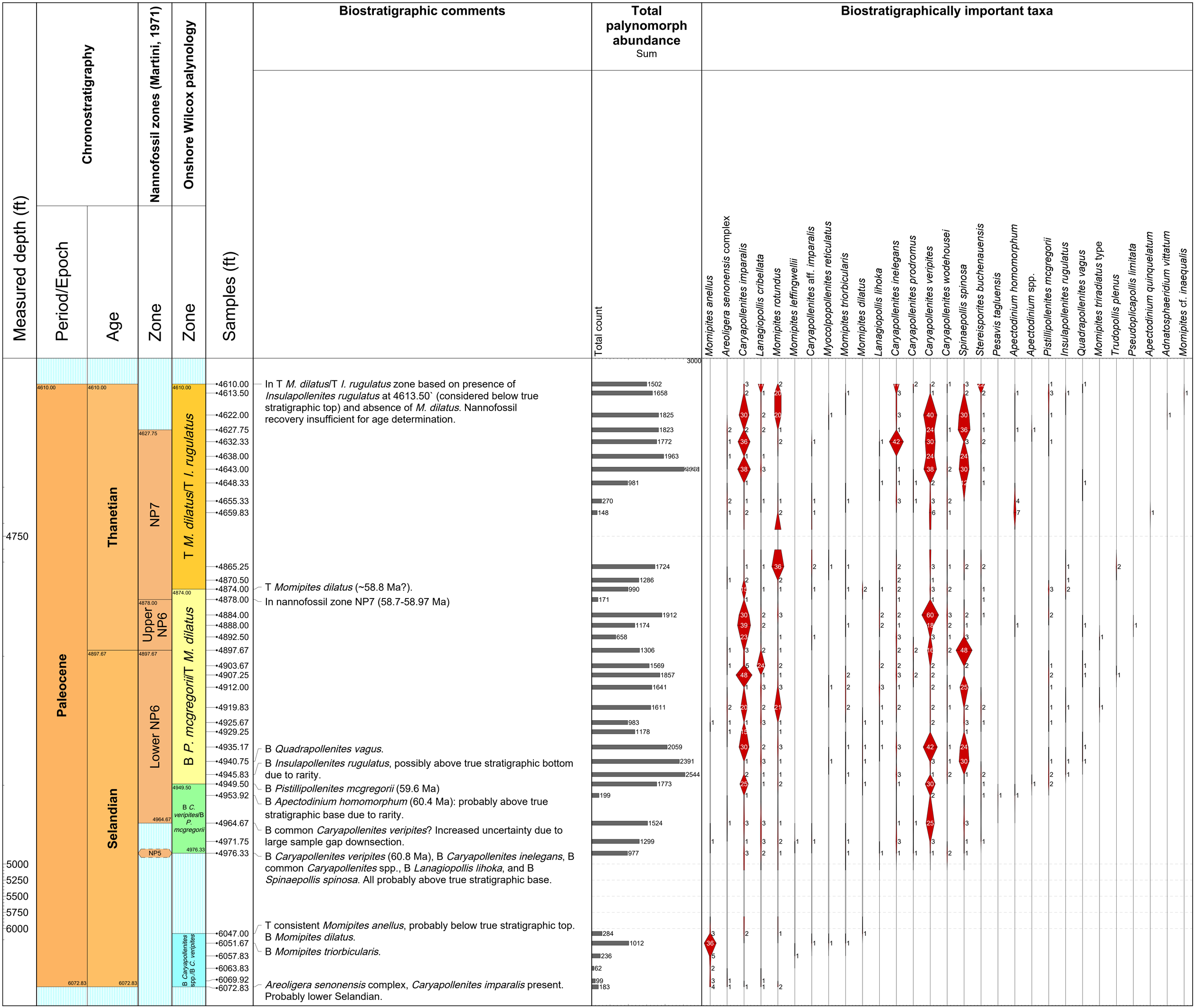
Lawrence Keseling No. 1

Measured depth (ft)	Chronostratigraphy: Age	Nannofossil zones (Martini, 1971): Zone	Onshore Wilcox palynology: Zone	Samples (ft)	Biostratigraphic comments	Total palynomorph abundance (Sum): Total count
9000	Thanetian (8994.17–9004.00)	?NP8 - NP9 (8994.17–9004.00)	T *I. rugulatus*/*Apectodinium* acme (8994.17–9004.00)	8994.17	In T *I. rugulatus*/*Apectodinium* acme zone based on high relative abundance of *Apectodinium homomorphum*, palynomorph assemblage, and nannofossil biostratigraphy.	928
				9000.00		323
				9004.00	B *Pistillipollenites mcgregorii*, B *Apectodinium homomorphum*: both probably above true stratigraphic bottom due to large sample gap downsection.	181
10000	Selandian (10883.00–11070.42)		B *C. veripites*/B *P. mcgregorii* (10883.00–11070.42)	10883.00	Possibly below T common *Caryapollenites veripites*: uncertain due to low abundances in this sample and downsection.	110
				10888.00		157
				10920.75		78
				10930.50		162
				10938.25		47
				10942.00		22
				10957.17		108
				10964.58		178
				10968.17		67
				10972.33		160
				10977.00		107
				10982.58		195
				10987.83		108
				10991.00		54
				10995.08		212
11000				11000.50		40
				11004.33		114
				11009.42		129
				11013.42		119
				11020.42	B *Momipites triradiatus* type.	105
				11029.50	B *Spinaepollis spinosa*: possibly above true stratigraphic bottom due to rarity.	62
				11032.33		26
				11038.00	B *Caryapollentites wodehousei*, B *Momipites rotundus*.	181
				11043.00		23
				11063.42		220
				11067.75	At or above B C*aryapollenites veripites* and possibly below B common *Caryapollenites veripites* (low abundance limits confidence); Selandian age.	144
				11070.42		151

Biostratigraphically important taxa

Samples (ft)	*Momipites dilatus*	*Caryapollenites veripites*	*Momipites anellus*	*Caryapollenites inelegans*	*Momipites leffingwellii*	*Caryapollenites prodromus*	*Momipites triorbicularis*	*Caryapollenites* aff. *imparalis*	*Caryapollenites imparalis*	*Trudopollis plenus*	*Areoligera senonensis* complex	*Caryapollenites wodehousei*	*Momipites rotundus*	*Spinaepollis spinosa*	*Momipites triradiatus type*	*Lanagiopollis cribellata*	*Pesavis tagluensis*	*Apectodinium homomorphum*	*Pistillipollenites mcgregorii*	*Adnatosphaeridium vittatum*	*Lanagiopollis lihoka*	*Stereisporites buchenauensis*
8994.17								1	1	1			1	36		3		2	1		1	2
9000.00				1					3					6				9		1		
9004.00									1					4			1	4	2			
10883.00		1	1					1	1				2									
10888.00	1	1	2	2			1		6			1										
10920.75		1	1	2		1		1	1					1								
10930.50				1					1													
10938.25																						
10942.00								1														
10957.17		1		1					1													
10964.58			3	2					4		1	1	1									
10968.17						1																
10972.33			2			1																
10977.00	1	2	1					2														
10982.58	1		1						1				1									
10987.83	2	1		2				1	2													
10991.00								1														
10995.08	3		3	1		1						1	1									
11000.50																						
11004.33									2				1									
11009.42			1				3	1			1		1									
11013.42			1					1	3		1		1			1						
11020.42													1		1							
11029.50								1	1				1	1								
11032.33											1											
11038.00	2	1	9				1	2	2		1	1	3									
11043.00			1																			
11063.42			2	1	1		1	1	7	2												
11067.75			3		1	2	3	1	2													
11070.42	1	1	2	1																		

Moczygemba VT No. 11



Edmond Olinick No. 1

Measured depth (ft)	Chronostratigraphy: Period/Epoch	Chronostratigraphy: Age	Onshore Wilcox palynology: Zone	Samples (ft)	Biostratigraphic comments
4900				4949 - 4979	Below top of B *P. mcgregorii*/T *M. dilatus* zone: *P. mcgregorii* observed downsection, observed T *M. dilatus* at 5039-5069' considered below true stratigraphic top.
5000	Paleocene	Selandian - Thanetian	B *P. mcgregorii*/T *M. dilatus*	4979 - 5009	
5100				5039 - 5069	T observed *Momipites dilatus*, considered below true stratigraphic top.
5200				5099 - 5129	
5300				5158 - 5188	
5400				5335 - 5365	
5500				5395 - 5425	B *Pistillipollenites mcgregorii* (59.6 Ma).
5600				5425 - 5455	
5700				5455 - 5485	
5800				5515 - 5545	B common *Caryapollenites veripites* (60.0 Ma), T consistent *Momipites anelius*.
5900		Selandian	B *C. veripites*/B *P. mcgregorii*	5545 - 5575	
6000				5646 - 5676	
6100				5676 - 5706	
6200				5845 - 5874	B *Caryapollenites prodromus*, B *Caryapollenites wodehousei*.
				5935 - 5965	B *Caryapollenites inelegans*, B *Lanagiopollis lihoka*, B *Quadrapollenites vagus*, B *Achatosphaeridium vittatum*.
			B *Carpinipollenites* spp. Zone	5995 - 6025	B *Caryapollenites veripites* (60.8 Ma), possibly above true stratigraphic bottom due to presence of *Apectodinium homomorphum* downsection. B *Insulapollenites rugulatus*, possibly caved.
				6161 - 6191	*Apectodinium homomorphum* and *Spinapollis spinosa* present, possibly caved. *Caryapollenites* spp. present.

Wireline Logs: Self Potential (60 (mV) 30)

Total palynomorph abundance Sum (Rw excluded); Pollen and plant spores Sum (Rw excluded); Dinoflagellate cysts Sum (Rw excluded); Fungal spores Sum (Rw excluded); Algae Sum (Rw excluded); Acritarchs Sum (Rw excluded); Relative abundance (%): Terr./freshwater sporomorphs, Freshwater algae, Fungi, Acritarchs, Dinoflagellate cysts

Palynology — Pollen and plant spores: *Alisocolpites circumstriatus*, *Alsophilidites berry*, *Alsophilidites*, *Ahus scotica*, *Ahus*, *Aneplotes partitus*, *Aneplotes*, *Baculatisporites* spp. (monolete), *Baculatisporites* spp. (psilate), *Baculatisporites* type, *Bombacacidites bombacoides*, *Bombacacidites nanacoxiensis*, *Bombacacidites nanacoxiensis*, *Bombacacidites reticulatus*, *Bombacacidites* spp., *Brasipollis* sp. A, *Brasipollis sinuata*, *Caryapollenites gooch*, *Caryapollenites* aff. *impariis*, *Caryapollenites inelegans*, *Caryapollenites lihoka*, *Caryapollenites meiegens*, *Caryapollenites prodromus*, *Caryapollenites simplex*, *Caryapollenites veripites*, *Chenopodipollis* spp., *Chenopodipollis* aff. *asymus* (small), *Coptospermites* aff. *dongensis*, *Coptospermites dongensis*, *Cupanieidites* spp., *Cretacaria* sp. A, *Cretacaria*, *Cretacaria* sp. B, *Cretacaria* sp. C, *Cretacaria* sp. D, *Cretacaria* sp. E, *Cretacaria* sp. F, *Cretacaria* sp. G, *Cretacaria* sp. H, *Cretacaria* sp. I, *Cretacaria* sp. J, *Cretacaria* sp. K, *Cretacaria* sp. L, *Cretacaria* sp. M, *Cretacaria* sp. N, *Cretacaria* sp. O, *Cretacaria* sp. P, *Cretacaria* sp. Q, *Cretacaria* sp. R, *Cretacaria* sp. S, *Cretacaria* sp. T, *Cretacaria* sp. U, *Cretacaria* sp. V, *Cretacaria* sp. W, *Cretacaria* sp. X, *Cretacaria* sp. Y, *Cretacaria* sp. Z, *Cretacaria* sp. AA, *Cretacaria* sp. AB, *Cretacaria* sp. AC, *Cretacaria* sp. AD, *Cretacaria* sp. AE, *Cretacaria* sp. AF, *Cretacaria* sp. AG, *Cretacaria* sp. AH, *Cretacaria* sp. AI, *Cretacaria* sp. AJ, *Cretacaria* sp. AK, *Cretacaria* sp. AL, *Cretacaria* sp. AM, *Cretacaria* sp. AN, *Cretacaria* sp. AO, *Cretacaria* sp. AP, *Cretacaria* sp. AQ, *Cretacaria* sp. AR, *Cretacaria* sp. AS, *Cretacaria* sp. AT, *Cretacaria* sp. AU, *Cretacaria* sp. AV, *Cretacaria* sp. AW, *Cretacaria* sp. AX, *Cretacaria* sp. AY, *Cretacaria* sp. AZ, *Cretacaria* sp. BA, *Cretacaria* sp. BB, *Cretacaria* sp. BC, *Cretacaria* sp. BD, *Cretacaria* sp. BE, *Cretacaria* sp. BF, *Cretacaria* sp. BG, *Cretacaria* sp. BH, *Cretacaria* sp. BI, *Cretacaria* sp. BJ, *Cretacaria* sp. BK, *Cretacaria* sp. BL, *Cretacaria* sp. BM, *Cretacaria* sp. BN, *Cretacaria* sp. BO, *Cretacaria* sp. BP, *Cretacaria* sp. BQ, *Cretacaria* sp. BR, *Cretacaria* sp. BS, *Cretacaria* sp. BT, *Cretacaria* sp. BU, *Cretacaria* sp. BV, *Cretacaria* sp. BW, *Cretacaria* sp. BX, *Cretacaria* sp. BY, *Cretacaria* sp. BZ, *Cretacaria* sp. CA, *Cretacaria* sp. CB, *Cretacaria* sp. CC, *Cretacaria* sp. CD, *Cretacaria* sp. CE, *Cretacaria* sp. CF, *Cretacaria* sp. CG, *Cretacaria* sp. CH, *Cretacaria* sp. CI, *Cretacaria* sp. CJ, *Cretacaria* sp. CK, *Cretacaria* sp. CL, *Cretacaria* sp. CM, *Cretacaria* sp. CN, *Cretacaria* sp. CO, *Cretacaria* sp. CP, *Cretacaria* sp. CQ, *Cretacaria* sp. CR, *Cretacaria* sp. CS, *Cretacaria* sp. CT, *Cretacaria* sp. CU, *Cretacaria* sp. CV, *Cretacaria* sp. CW, *Cretacaria* sp. CX, *Cretacaria* sp. CY, *Cretacaria* sp. CZ, *Cretacaria* sp. DA, *Cretacaria* sp. DB, *Cretacaria* sp. DC, *Cretacaria* sp. DD, *Cretacaria* sp. DE, *Cretacaria* sp. DF, *Cretacaria* sp. DG, *Cretacaria* sp. DH, *Cretacaria* sp. DI, *Cretacaria* sp. DJ, *Cretacaria* sp. DK, *Cretacaria* sp. DL, *Cretacaria* sp. DM, *Cretacaria* sp. DN, *Cretacaria* sp. DO, *Cretacaria* sp. DP, *Cretacaria* sp. DQ, *Cretacaria* sp. DR, *Cretacaria* sp. DS, *Cretacaria* sp. DT, *Cretacaria* sp. DU, *Cretacaria* sp. DV, *Cretacaria* sp. DW, *Cretacaria* sp. DX, *Cretacaria* sp. DY, *Cretacaria* sp. DZ, *Cretacaria* sp. EA, *Cretacaria* sp. EB, *Cretacaria* sp. EC, *Cretacaria* sp. ED, *Cretacaria* sp. EE, *Cretacaria* sp. EF, *Cretacaria* sp. EG, *Cretacaria* sp. EH, *Cretacaria* sp. EI, *Cretacaria* sp. EJ, *Cretacaria* sp. EK, *Cretacaria* sp. EL, *Cretacaria* sp. EM, *Cretacaria* sp. EN, *Cretacaria* sp. EO, *Cretacaria* sp. EP, *Cretacaria* sp. EQ, *Cretacaria* sp. ER, *Cretacaria* sp. ES, *Cretacaria* sp. ET, *Cretacaria* sp. EU, *Cretacaria* sp. EV, *Cretacaria* sp. EW, *Cretacaria* sp. EX, *Cretacaria* sp. EY, *Cretacaria* sp. EZ, *Cretacaria* sp. FA, *Cretacaria* sp. FB, *Cretacaria* sp. FC, *Cretacaria* sp. FD, *Cretacaria* sp. FE, *Cretacaria* sp. FF, *Cretacaria* sp. FG, *Cretacaria* sp. FH, *Cretacaria* sp. FI, *Cretacaria* sp. FJ, *Cretacaria* sp. FK, *Cretacaria* sp. FL, *Cretacaria* sp. FM, *Cretacaria* sp. FN, *Cretacaria* sp. FO, *Cretacaria* sp. FP, *Cretacaria* sp. FQ, *Cretacaria* sp. FR, *Cretacaria* sp. FS, *Cretacaria* sp. FT, *Cretacaria* sp. FU, *Cretacaria* sp. FV, *Cretacaria* sp. FW, *Cretacaria* sp. FX, *Cretacaria* sp. FY, *Cretacaria* sp. FZ, *Cretacaria* sp. GA, *Cretacaria* sp. GB, *Cretacaria* sp. GC, *Cretacaria* sp. GD, *Cretacaria* sp. GE, *Cretacaria* sp. GF, *Cretacaria* sp. GG, *Cretacaria* sp. GH, *Cretacaria* sp. GI, *Cretacaria* sp. GJ, *Cretacaria* sp. GK, *Cretacaria* sp. GL, *Cretacaria* sp. GM, *Cretacaria* sp. GN, *Cretacaria* sp. GO, *Cretacaria* sp. GP, *Cretacaria* sp. GQ, *Cretacaria* sp. GR, *Cretacaria* sp. GS, *Cretacaria* sp. GT, *Cretacaria* sp. GU, *Cretacaria* sp. GV, *Cretacaria* sp. GW, *Cretacaria* sp. GX, *Cretacaria* sp. GY, *Cretacaria* sp. GZ, *Cretacaria* sp. HA, *Cretacaria* sp. HB, *Cretacaria* sp. HC, *Cretacaria* sp. HD, *Cretacaria* sp. HE, *Cretacaria* sp. HF, *Cretacaria* sp. HG, *Cretacaria* sp. HH, *Cretacaria* sp. HI, *Cretacaria* sp. HJ, *Cretacaria* sp. HK, *Cretacaria* sp. HL, *Cretacaria* sp. HM, *Cretacaria* sp. HN, *Cretacaria* sp. HO, *Cretacaria* sp. HP, *Cretacaria* sp. HQ, *Cretacaria* sp. HR, *Cretacaria* sp. HS, *Cretacaria* sp. HT, *Cretacaria* sp. HU, *Cretacaria* sp. HV, *Cretacaria* sp. HW, *Cretacaria* sp. HX, *Cretacaria* sp. HY, *Cretacaria* sp. HZ, *Cretacaria* sp. IA, *Cretacaria* sp. IB, *Cretacaria* sp. IC, *Cretacaria* sp. ID, *Cretacaria* sp. IE, *Cretacaria* sp. IF, *Cretacaria* sp. IG, *Cretacaria* sp. IH, *Cretacaria* sp. II, *Cretacaria* sp. IJ, *Cretacaria* sp. IK, *Cretacaria* sp. IL, *Cretacaria* sp. IM, *Cretacaria* sp. IN, *Cretacaria* sp. IO, *Cretacaria* sp. IP, *Cretacaria* sp. IQ, *Cretacaria* sp. IR, *Cretacaria* sp. IS, *Cretacaria* sp. IT, *Cretacaria* sp. IU, *Cretacaria* sp. IV, *Cretacaria* sp. IW, *Cretacaria* sp. IX, *Cretacaria* sp. IY, *Cretacaria* sp. IZ, *Cretacaria* sp. JA, *Cretacaria* sp. JB, *Cretacaria* sp. JC, *Cretacaria* sp. JD, *Cretacaria* sp. JE, *Cretacaria* sp. JF, *Cretacaria* sp. JG, *Cretacaria* sp. JH, *Cretacaria* sp. JI, *Cretacaria* sp. JJ, *Cretacaria* sp. JK, *Cretacaria* sp. JL, *Cretacaria* sp. JM, *Cretacaria* sp. JN, *Cretacaria* sp. JO, *Cretacaria* sp. JP, *Cretacaria* sp. JQ, *Cretacaria* sp. JR, *Cretacaria* sp. JS, *Cretacaria* sp. JT, *Cretacaria* sp. JU, *Cretacaria* sp. JV, *Cretacaria* sp. JW, *Cretacaria* sp. JX, *Cretacaria* sp. JY, *Cretacaria* sp. JZ, *Cretacaria* sp. KA, *Cretacaria* sp. KB, *Cretacaria* sp. KC, *Cretacaria* sp. 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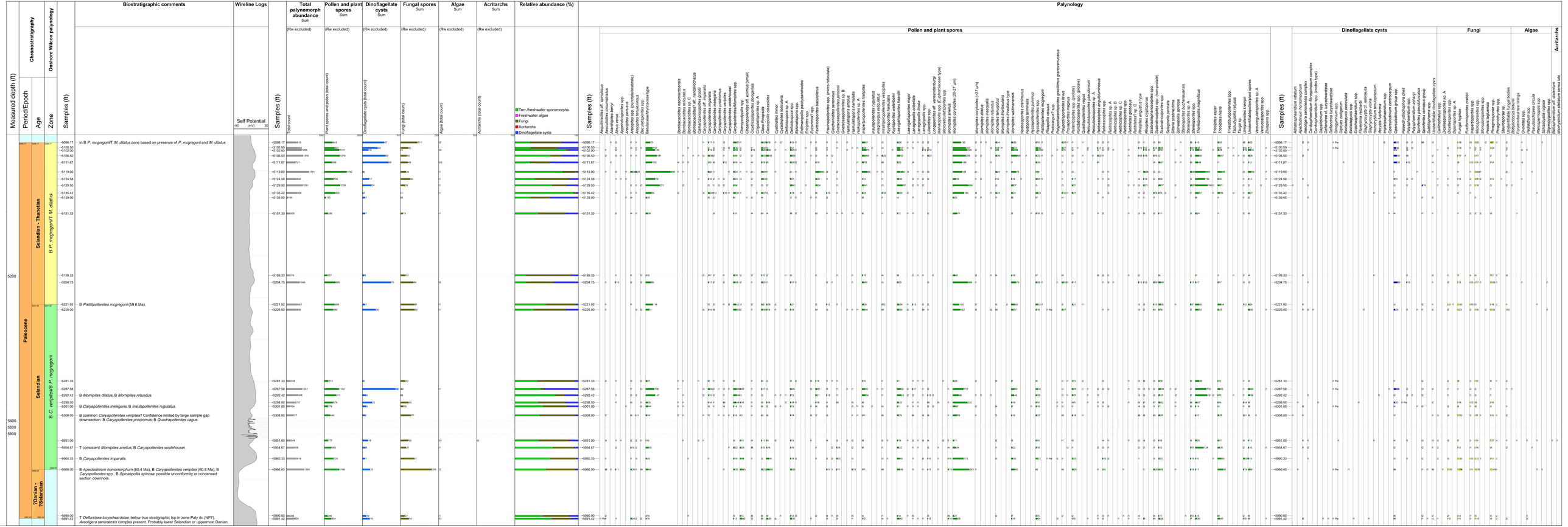
LY, *Cretacaria* sp. LZ, *Cretacaria* sp. MA, *Cretacaria* sp. MB, *Cretacaria* sp. MC, *Cretacaria* sp. MD, *Cretacaria* sp. ME, *Cretacaria* sp. MF, *Cretacaria* sp. MG, *Cretacaria* sp. MH, *Cretacaria* sp. MI, *Cretacaria* sp. MJ, *Cretacaria* sp. MK, *Cretacaria* sp. ML, *Cretacaria* sp. MM, *Cretacaria* sp. MN, *Cretacaria* sp. MO, *Cretacaria* sp. MP, *Cretacaria* sp. MQ, *Cretacaria* sp. MR, *Cretacaria* sp. MS, *Cretacaria* sp. MT, *Cretacaria* sp. MU, *Cretacaria* sp. MV, *Cretacaria* sp. MW, *Cretacaria* sp. MX, *Cretacaria* sp. MY, *Cretacaria* sp. MZ, *Cretacaria* sp. NA, *Cretacaria* sp. NB, *Cretacaria* sp. NC, *Cretacaria* sp. ND, *Cretacaria* sp. NE, *Cretacaria* sp. NF, *Cretacaria* sp. NG, *Cretacaria* sp. NH, *Cretacaria* sp. NI, *Cretacaria* sp. NJ, *Cretacaria* sp. NK, *Cretacaria* sp. NL, *Cretacaria* sp. NM, *Cretacaria* sp. NN, *Cretacaria* sp. NO, *Cretacaria* sp. NP, *Cretacaria* sp. NQ, *Cretacaria* sp. NR, *Cretacaria* sp. NS, *Cretacaria* sp. NT, *Cretacaria* sp. NU, *Cretacaria* sp. NV, *Cretacaria* sp. NW, *Cretacaria* sp. NX, *Cretacaria* sp. NY, *Cretacaria* sp. NZ, *Cretacaria* sp. OA, *Cretacaria* sp. OB, *Cretacaria* sp. OC, *Cretacaria* sp. OD, *Cretacaria* sp. OE, *Cretacaria* sp. OF, *Cretacaria* sp. OG, *Cretacaria* sp. OH, *Cretacaria* sp. OI, *Cretacaria* sp. OJ, *Cretacaria* sp. OK, *Cretacaria* sp. OL, *Cretacaria* sp. OM, *Cretacaria* sp. ON, *Cretacaria* sp. OO, *Cretacaria* sp. OP, *Cretacaria* sp. OQ, *Cretacaria* sp. OR, *Cretacaria* sp. OS, *Cretacaria* sp. OT, *Cretacaria* sp. OU, *Cretacaria* sp. OV, *Cretacaria* sp. OW, *Cretacaria* sp. OX, *Cretacaria* sp. OY, *Cretacaria* sp. OZ, *Cretacaria* sp. PA, *Cretacaria* sp. PB, *Cretacaria* sp. PC, *Cretacaria* sp. PD, *Cretacaria* sp. PE, *Cretacaria* sp. PF, *Cretacaria* sp. PG, *Cretacaria* sp. PH, *Cretacaria* sp. PI, *Cretacaria* sp. PJ, *Cretacaria* sp. PK, *Cretacaria* sp. PL, *Cretacaria* sp. PM, *Cretacaria* sp. PN, *Cretacaria* sp. PO, *Cretacaria* sp. PP, *Cretacaria* sp. PQ, *Cretacaria* sp. PR, *Cretacaria* sp. PS, *Cretacaria* sp. PT, *Cretacaria* sp. PU, *Cretacaria* sp. PV, *Cretacaria* sp. PW, *Cretacaria* sp. PX, *Cretacaria* sp. PY, *Cretacaria* sp. PZ, *Cretacaria* sp. QA, *Cretacaria* sp. QB, *Cretacaria* sp. QC, *Cretacaria* sp. QD, *Cretacaria* sp. QE, *Cretacaria* sp. QF, *Cretacaria* sp. QG, *Cretacaria* sp. QH, *Cretacaria* sp. QI, *Cretacaria* sp. QJ, *Cretacaria* sp. QK, *Cretacaria* sp. QL, *Cretacaria* sp. QM, *Cretacaria* sp. QN, *Cretacaria* sp. QO, *Cretacaria* sp. QP, *Cretacaria* sp. QQ, *Cretacaria* sp. QR, *Cretacaria* sp. QS, *Cretacaria* sp. QT, *Cretacaria* sp. QU, *Cretacaria* sp. QV, *Cretacaria* sp. QW, *Cretacaria* sp. QX, *Cretacaria* sp. QY, *Cretacaria* sp. QZ, *Cretacaria* sp. RA, *Cretacaria* sp. RB, *Cretacaria* sp. RC, *Cretacaria* sp. RD, *Cretacaria* sp. RE, *Cretacaria* sp. RF, *Cretacaria* sp. RG, *Cretacaria* sp. RH, *Cretacaria* sp. RI, *Cretacaria* sp. RJ, *Cretacaria* sp. RK, *Cretacaria* sp. RL, *Cretacaria* sp. RM, *Cretacaria* sp. RN, *Cretacaria* sp. RO, *Cretacaria* sp. RP, *Cretacaria* sp. RQ, *Cretacaria* sp. RR, *Cretacaria* sp. RS, *Cretacaria* sp. RT, *Cretacaria* sp. RU, *Cretacaria* sp. RV, *Cretacaria* sp. RW, *Cretacaria* sp. RX, *Cretacaria* sp. RY, *Cretacaria* sp. RZ, *Cretacaria* sp. SA, *Cretacaria* sp. SB, *Cretacaria* sp. SC, *Cretacaria* sp. SD, *Cretacaria* sp. SE, *Cretacaria* sp. SF, *Cretacaria* sp. SG, *Cretacaria* sp. SH, *Cretacaria* sp. SI, *Cretacaria* sp. SJ, *Cretacaria* sp. SK, *Cretacaria* sp. SL, *Cretacaria* sp. SM, *Cretacaria* sp. SN, *Cretacaria* sp. SO, *Cretacaria* sp. SP, *Cretacaria* sp. SQ, *Cretacaria* sp. SR, *Cretacaria* sp. SS, *Cretacaria* sp. ST, *Cretacaria* sp. SU, *Cretacaria* sp. SV, *Cretacaria* sp. SW, *Cretacaria* sp. SX, *Cretacaria* sp. SY, *Cretacaria* sp. SZ, *Cretacaria* sp. TA, *Cretacaria* sp. TB, *Cretacaria* sp. TC, *Cretacaria* sp. TD, *Cretacaria* sp. TE, *Cretacaria* sp. TF, *Cretacaria* sp. TG, *Cretacaria* sp. TH, *Cretacaria* sp. TI, *Cretacaria* sp. TJ, *Cretacaria* sp. TK, *Cretacaria* sp. TL, *Cretacaria* sp. TM, *Cretacaria* sp. TN, *Cretacaria* sp. TO, *Cretacaria* sp. TP, *Cretacaria* sp. TQ, *Cretacaria* sp. TR, *Cretacaria* sp. TS, *Cretacaria* sp. TT, *Cretacaria* sp. TU, *Cretacaria* sp. TV, *Cretacaria* sp. TW, *Cretacaria* sp. TX, *Cretacaria* sp. TY, *Cretacaria* sp. TZ, *Cretacaria* sp. UA, *Cretacaria* sp. UB, *Cretacaria* sp. UC, *Cretacaria* sp. UD, *Cretacaria* sp. UE, *Cretacaria* sp. UF, *Cretacaria* sp. UG, *Cretacaria* sp. UH, *Cretacaria* sp. UI, *Cretacaria* sp. UJ, *Cretacaria* sp. UK, *Cretacaria* sp. UL, *Cretacaria* sp. UM, *Cretacaria* sp. UN, *Cretacaria* sp. UO, *Cretacaria* sp. UP, *Cretacaria* sp. UQ, *Cretacaria* sp. UR, *Cretacaria* sp. US, *Cretacaria* sp. UT, *Cretacaria* sp. UU, *Cretacaria* sp. UV, *Cretacaria* sp. UW, *Cretacaria* sp. UX, *Cretacaria* sp. UY, *Cretacaria* sp. UZ, *Cretacaria* sp. VA, *Cretacaria* sp. VB, *Cretacaria* sp. VC, *Cretacaria* sp. VD, *Cretacaria* sp. VE, *Cretacaria* sp. VF, *Cretacaria* sp. VG, *Cretacaria* sp. VH, *Cretacaria* sp. VI, *Cretacaria* sp. VJ, *Cretacaria* sp. VK, *Cretacaria* sp. VL, *Cretacaria* sp. VM, *Cretacaria* sp. VN, *Cretacaria* sp. VO, *Cretacaria* sp. VP, *Cretacaria* sp. VQ, *Cretacaria* sp. VR, *Cretacaria* sp. VS, *Cretacaria* sp. VT, *Cretacaria* sp. VU, *Cretacaria* sp. VV, *Cretacaria* sp. VW, *Cretacaria* sp. VX, *Cretacaria* sp. VY, *Cretacaria* sp. VZ, *Cretacaria* sp. WA, *Cretacaria* sp. WB, *Cretacaria* sp. WC, *Cretacaria* sp. WD, *Cretacaria* sp. WE, *Cretacaria* sp. WF, *Cretacaria* sp. WG, *Cretacaria* sp. WH, *Cretacaria* sp. WI, *Cretacaria* sp. WJ, *Cretacaria* sp. WK, *Cretacaria* sp. WL, *Cretacaria* sp. WM, *Cretacaria* sp. WN, *Cretacaria* sp. WO, *Cretacaria* sp. WP, *Cretacaria* sp. WQ, *Cretacaria* sp. WR, *Cretacaria* sp. WS, *Cretacaria* sp. WT, *Cretacaria* sp. WU, *Cretacaria* sp. WV, *Cretacaria* sp. WW, *Cretacaria* sp. WX, *Cretacaria* sp. WY, *Cretacaria* sp. WZ, *Cretacaria* sp. XA, *Cretacaria* sp. XB, *Cretacaria* sp. XC, *Cretacaria* sp. XD, *Cretacaria* sp. XE, *Cretacaria* sp. XF, *Cretacaria* sp. XG, *Cretacaria* sp. XH, *Cretacaria* sp. XI, *Cretacaria* sp. XJ, *Cretacaria* sp. XK, *Cretacaria* sp. XL, *Cretacaria* sp. XM, *Cretacaria* sp. XN, *Cretacaria* sp. XO, *Cretacaria* sp. XP, *Cretacaria* sp. XQ, *Cretacaria* sp. XR, *Cretacaria* sp. XS, *Cretacaria* sp. XT, *Cretacaria* sp. XU, *Cretacaria* sp. XV, *Cretacaria* sp. XW, *Cretacaria* sp. XX, *Cretacaria* sp. XY, *Cretacaria* sp. XZ, *Cretacaria* sp. YA, *Cretacaria* sp. YB, *Cretacaria* sp. YC, *Cretacaria* sp. YD, *Cretacaria* sp. YE, *Cretacaria* sp. YF, *Cretacaria* sp. YG, *Cretacaria* sp. YH, *Cretacaria* sp. YI, *Cretacaria* sp. YJ, *Cretacaria* sp. YK, *Cretacaria* sp. YL, *Cretacaria* sp. YM, *Cretacaria* sp. YN, *Cretacaria* sp. YO, *Cretacaria* sp. YP, *Cretacaria* sp. YQ, *Cretacaria* sp. YR, *Cretacaria* sp. YS, *Cretacaria* sp. YT, *Cretacaria* sp. YU, *Cretacaria* sp. YV, *Cretacaria* sp. YW, *Cretacaria* sp. YX, *Cretacaria* sp. YY, *Cretacaria* sp. YZ, *Cretacaria* sp. ZA, *Cretacaria* sp. ZB, *Cretacaria* sp. ZC, *Cretacaria* sp. ZD, *Cretacaria* sp. ZE, *Cretacaria* sp. ZF, *Cretacaria* sp. ZG, *Cretacaria* sp. ZH, *Cretacaria* sp. ZI, *Cretacaria* sp. ZJ, *Cretacaria* sp. ZK, *Cretacaria* sp. ZL, *Cretacaria* sp. ZM, *Cretacaria* sp. ZN, *Cretacaria* sp. ZO, *Cretacaria* sp. ZP, *Cretacaria* sp. ZQ, *Cretacaria* sp. ZR, *Cretacaria* sp. ZS, *Cretacaria* sp. ZT, *Cretacaria* sp. ZU, *Cretacaria* sp. ZV, *Cretacaria* sp. ZW, *Cretacaria* sp. ZX, *Cretacaria* sp. ZY, *Cretacaria* sp. ZZ, *Cretacaria* sp. AA, *Cretacaria* sp. AB, *Cretacaria* sp. AC, *Cretacaria* sp. AD, *Cretacaria* sp. AE, *Cretacaria* sp. AF, *Cretacaria* sp. AG, *Cretacaria* sp. AH, *Cretacaria* sp. AI, *Cretacaria* sp. AJ, *Cretacaria* sp. AK, *Cretacaria* sp. AL, *Cretacaria* sp. AM, *Cretacaria* sp. AN, *Cretacaria* sp. AO, *Cretacaria* sp. AP, *Cretacaria* sp. AQ, *Cretacaria* sp. AR, *Cretacaria* sp. AS, *Cretacaria* sp. AT, *Cretacaria* sp. AU, *Cretacaria* sp. AV, *Cretacaria* sp. AW, *Cretacaria* sp. AX, *Cretacaria* sp. AY, *Cretacaria* sp. AZ, *Cretacaria* sp. BA, *Cretacaria* sp. BB, *Cretacaria* sp. BC, *Cretacaria* sp. BD, *Cretacaria* sp. BE, *Cretacaria* sp. BF, *Cretacaria* sp. BG, *Cretacaria* sp. BH, *Cretacaria* sp. BI, *Cretacaria* sp. BJ, *Cretacaria* sp. BK, *Cretacaria* sp. BL, *Cretacaria* sp. BM, *Cretacaria* sp. BN, *Cretacaria* sp. BO, *Cretacaria* sp. BP, *Cretacaria* sp. BQ, *Cretacaria* sp. BR, *Cretacaria* sp. BS, *Cretacaria* sp. BT, *Cretacaria* sp. BU, *Cretacaria* sp. BV, *Cretacaria* sp. BW, *Cretacaria* sp. BX, *Cretacaria* sp. BY, *Cretacaria* sp. BZ, *Cretacaria* sp. CA, *Cretacaria* sp. CB, *Cretacaria* sp. CC, *Cretacaria* sp. CD, *Cretacaria* sp. CE, *Cretacaria* sp. CF, *Cretacaria* sp. CG, *Cretacaria* sp. CH, *Cretacaria* sp. CI, *Cretacaria* sp. CJ, *Cretacaria* sp. CK, *Cretacaria* sp. CL, *Cretacaria* sp. CM, *Cretacaria* sp. CN, *Cretacaria* sp. CO, *Cretacaria* sp. CP, *Cretacaria* sp. CQ, *Cretacaria* sp. CR, *Cretacaria* sp. CS, *Cretacaria* sp. CT, *Cretacaria* sp. CU, *Cretacaria* sp. CV, *Cretacaria* sp. CW, *Cretacaria* sp. CX, *Cretacaria* sp. CY, *Cretacaria* sp. CZ, *Cretacaria* sp. DA, *Cretacaria* sp. DB, *Cretacaria* sp. DC, *Cretacaria* sp. DD, *Cretacaria* sp. DE, *Cretacaria* sp. DF, *Cretacaria* sp. DG, *Cretacaria* sp. DH, *Cretacaria* sp. DI, *Cretacaria* sp. DJ, *Cretacaria* sp. DK, *Cretacaria* sp. DL, *Cretacaria* sp. DM, *Cretacaria* sp. DN, *Cretacaria* sp. DO, *Cretacaria* sp. DP, *Cretacaria* sp. DQ, *Cretacaria* sp. DR, *Cretacaria* sp. DS, *Cretacaria* sp. DT, *Cretacaria* sp. DU, *Cretacaria* sp. DV, *Cretacaria* sp. DW, *Cretacaria* sp. DX, *Cretacaria* sp. DY, *Cretacaria* sp. DZ, *Cretacaria* sp. EA, *Cretacaria* sp. EB, *Cretacaria* sp. EC, *Cretacaria* sp. ED, *Cretacaria* sp. EE, *Cretacaria* sp. EF, *Cretacaria* sp. EG, *Cretacaria* sp. EH, *Cretacaria* sp. EI, *Cretacaria* sp. EJ, *Cretacaria* sp. EK, *Cretacaria* sp. EL, *Cretacaria* sp. EM, *Cretacaria* sp. EN, *Cretacaria* sp. EO, *Cretacaria* sp. EP, *Cretacaria* sp. EQ, *Cretacaria* sp. ER, *Cretacaria* sp. ES, *Cretacaria* sp. ET, *Cretacaria* sp. EU, *Cretacaria* sp. EV, *Cretacaria* sp. EW, *Cretacaria* sp. EX, *Cretacaria* sp. EY, *Cretacaria* sp. EZ, *Cretacaria* sp. FA, *Cretacaria* sp. FB, *Cretacaria* sp. FC, *Cretacaria* sp. FD, *Cretacaria* sp. FE, *Cretacaria* sp. FF, *Cretacaria* sp. FG, *Cretacaria* sp. FH, *Cretacaria* sp. FI, *Cretacaria* sp. FJ, *Cretacaria* sp. FK, *Cretacaria* sp. FL, *Cretacaria* sp. FM, *Cretacaria* sp. FN, *Cretacaria* sp. FO, *Cretacaria* sp. FP, *Cretacaria* sp. FQ, *Cretacaria* sp. FR, *Cretacaria* sp. FS, *Cretacaria* sp. FT, *Cretacaria* sp. FU, *Cretacaria* sp. FV, *Cretacaria* sp. FW, *Cretacaria* sp. FX, *Cretacaria* sp. FY, *Cretacaria* sp. FZ, *Cretacaria* sp. GA, *Cretacaria* sp. GB, *Cretacaria* sp. GC, *Cretacaria* sp. GD, *Cretacaria* sp. GE, *Cretacaria* sp. GF, *Cretacaria* sp. GG, *Cretacaria* sp. GH, *Cretacaria* sp. GI, *Cretacaria* sp. GJ, *Cretacaria* sp. GK, *Cretacaria* sp. GL, *Cretacaria* sp. GM, *Cretacaria* sp. GN, *Cretacaria* sp. GO, *Cretacaria* sp. GP, *Cretacaria* sp. GQ, *Cretacaria* sp. GR, *Cretacaria* sp. GS, *Cretacaria* sp. GT, *Cretacaria* sp. GU, *Cretacaria* sp. GV, *Cretacaria* sp. GW, *Cretacaria* sp. GX, *Cretacaria* sp. GY, *Cretacaria* sp. GZ, *Cretacaria* sp. HA, *Cretacaria* sp. HB, *Cretacaria* sp. HC, *Cretacaria* sp. HD, *Cretacaria* sp. HE, *Cretacaria* sp. HF, *Cretacaria* sp. HG, *Cretacaria* sp. HH, *Cretacaria* sp. HI, *Cretacaria* sp. HJ, *Cretacaria* sp. HK, *Cretacaria* sp. HL, *Cretacaria* sp. HM, *Cretacaria* sp. HN, *Cretacaria* sp. HO, *Cretacaria* sp. HP, *Cretacaria* sp. HQ, *Cretacaria* sp. HR, *Cretacaria* sp. HS, *Cretacaria* sp. HT, *Cretacaria* sp. HU, *Cretacaria* sp. HV, *Cretacaria* sp. HW, *Cretacaria* sp. HX, *Cretacaria* sp. HY, *Cretacaria* sp. HZ, *Cretacaria* sp. IA, *Cretacaria* sp. IB, *Cretacaria* sp. IC, *Cretacaria* sp. ID, *Cretacaria* sp. IE, *Cretacaria* sp. IF, *Cretacaria* sp. IG, *Cretacaria* sp. IH, *Cretacaria* sp. II, *Cretacaria* sp. IJ, *Cretacaria* sp. IK, *Cretacaria* sp. IL, *Cretacaria* sp. IM, *Cretacaria* sp. IN, *Cretacaria* sp. IO, *Cretacaria* sp. IP, *Cretacaria* sp. IQ, *Cretacaria* sp. IR, *Cretacaria* sp. IS, *Cretacaria* sp. IT, *Cretacaria* sp. IU, *Cretacaria* sp. IV, *Cretacaria* sp. IW, *Cretacaria* sp. IX, *Cretacaria* sp. IY, *Cretacaria* sp. IZ, *Cretacaria* sp. JA, *Cretacaria* sp. JB, *Cretacaria* sp. JC, *Cretacaria* sp. JD, *Cretacaria* sp. JE, *Cretacaria* sp. JF, *Cretacaria* sp. JG, *Cretacaria* sp. JH, *Cretacaria* sp. JI, *Cretacaria* sp. JJ, *Cretacaria* sp. JK, *Cretacaria* sp. JL, *Cretacaria* sp. JM, *Cretacaria* sp. JN, *Cretacaria* sp. JO, *Cretacaria* sp. JP, *Cretacaria* sp. JQ, *Cretacaria* sp. JR, *Cretacaria* sp. JS, *Cretacaria* sp. JT, *Cretacaria* sp. JU, *Cretacaria* sp. JV, *Cretacaria* sp. JW, *Cretacaria* sp. JX, *Cretacaria* sp. JY, *Cretacaria* sp. JZ, *Cretacaria* sp. KA, *Cretacaria* sp. KB, *Cretacaria* sp. KC, *Cretacaria* sp. KD, *Cretacaria* sp. KE, *Cretacaria* sp. KF, *Cretacaria* sp. KG, *Cretacaria* sp. KH, *Cretacaria* sp. KI, *Cretacaria* sp. KJ, *Cretacaria* sp. KK, *Cretacaria* sp. KL, *Cretacaria* sp. KM, *Cretacaria* sp. KN, *Cretacaria* sp. KO, *Cretacaria* sp. KP, *Cretacaria* sp. KQ, *Cretacaria* sp. KR, *Cretacaria* sp. KS, *Cretacaria* sp. KT, *Cretacaria* sp. KU, *Cretacaria* sp. KV, *Cretacaria* sp. KW, *Cretacaria* sp. KX, *Cretacaria* sp. KY, *Cretacaria* sp. KZ, *Cretacaria* sp. LA, *Cretacaria* sp. LB, *Cretacaria* sp. LC, *Cretacaria* sp. LD, *Cretacaria* sp. LE, *Cretacaria* sp. LF, *Cretacaria* sp. LG, *Cretacaria* sp. LH, *Cretacaria* sp. LI, *Cretacaria* sp. LJ, *Cretacaria* sp. LK, *Cretacaria* sp. LL, *Cretacaria* sp. LM, *Cretacaria* sp. LN, *Cretacaria* sp. LO, *Cretacaria* sp. LP, *Cretacaria* sp. LQ, *Cretacaria* sp. LR, *Cretacaria* sp. LS, *Cretacaria* sp. LT, *Cretacaria* sp. LU, *Cretacaria* sp. LV, *Cretacaria* sp. LW, *Cretacaria* sp. LX, *Cretacaria* sp. LY, *Cretacaria* sp. LZ, *Cretacaria* sp. MA, *Cretacaria* sp. MB, *Cretacaria* sp. MC, *Cretacaria* sp. MD, *Cretacaria* sp. ME, *Cretacaria* sp. MF, *Cretacaria* sp. MG, *Cretacaria*

Jerome Olinick No. 16



Lawrence Keseling No. 1

Measured depth (ft)	Chronostratigraphy: Age	Nannofossil zones (Martini, 1971): Zone	Onshore Wilcox palynology: Zone	Samples (ft)	Biostratigraphic comments
	8994.17	8994.17	8994.17		
9000	Thanetian	?NP8 - NP9	T. / rugulatus/Apectodinium		
	9004.00	9004.00	9004.00		
10000					
	10883.00		10883.00		
	Selandian		B C. veripites/B P. mcgregorii		
11000					
	11070.42		11070.42		

Biostratigraphic comments

- 8994.17: In T *I. rugulatus/Apectodinium* acme zone based on high relative abundance of *Apectodinium homomorphum*, palynomorph assemblage, and nannofossil biostratigraphy.
- 9004.00: B *Pistillipollenites mcgregorii*, B *Apectodinium homomorphum*: both probably above true stratigraphic bottom due to large sample gap downsection.
- 10883.00: Possibly below T common *Caryapollenites veripites*: uncertain due to low abundances in this sample and downsection.
- 10957.17
- 10964.58
- 10968.17
- 10972.33
- 10977.00
- 10982.58
- 10987.83
- 10991.00
- 10995.08
- 11000.50
- 11004.33
- 11009.42
- 11013.42
- 11020.42: B *Momipites triradiatus* type.
- 11029.50: B *Spinaepollis spinosa*: possibly above true stratigraphic bottom due to rarity.
- 11032.33
- 11038.00: B *Caryapollenites wodehousei*, B *Momipites rotundus*.
- 11043.00
- 11063.42
- 11067.75
- 11070.42: At or above B *Caryapollenites veripites* and possibly below B common *Caryapollenites verpites* (low abundance limits confidence); Selandian age.

Wireline Logs: Self Potential (-50 (mV) 30)

Total palynomorph abundance (Rw excluded): Total count (3000)

Pollen and plant spores Sum (Rw excluded): Plant spores and pollen (total count) (3000)

Dinoflagellate cysts Sum (Rw excluded): Dinoflagellate cysts (total count) (100)

Fungal spores Sum (Rw excluded): Fungal (total count) (250)

Algae Sum (Rw excluded): Algae (total count) (100)

Acritarchs Sum (Rw excluded): Acritarchs (total count) (100)

Relative abundance (%): Terr./freshwater sporomorphs; Freshwater algae; Fungi; Acritarchs; Dinoflagellate cysts (100)

Palynology — Pollen and plant spores

Samples (ft) | *Aesculiidites circumstriatus* | *Alnus verus* | *Aquilapollenites spinulosus* | *Aquilapollenites trialatus/subtriatus* | *Arecipites tenuiscricus* | *Baculatisporites* spp. | Betulaceae/Myricaceae type | *Bombacacidites bombaxoides* | *Bombacacidites racimentoensis* | *Bombacacidites reticulatus* | *Bombacacidites* sp. cf. *Ceiba* | *Caryapollenites proximus* | *Caryapollenites simplex* | *Caryapollenites veripites* | *Caryapollenites wodehousei* | *Caryapollenites/Momipites* spp. | *Chenopodipollis* spp. | *Cicatricosisporites dorogensis* | *Cicatricosisporites paradorogensis* | *Cingulatisporites* sp. A | *Class Phragmites* | *Clavatipollenites hesbesiites* | *Cupuliferoidaepollenites* spp. | *Cupuliferoidaepollenites* sp. A | *Cyathidites minor* | *Cyrillaceae/Clethraceae* | *Deltoidospora* spp. | *Deltoidospora* sp. A | *Echinatisporis* spp. | *Equisetosporites* spp. | *Fagacipollenites baculiferus* | *Fraxinopollenites* spp. (micro-reticulate) | *Gleicheniidites senonicus* | *Gnetaceaepollenites jansonii* | *Hamulatisporis hamulatus* | *Holkopollenites* sp. A | *Inaperturopollenites hiatipites* | *Intratriporopollenites instructus* | *Kuylisporites waterbolki* | *Laevigatosporites major* | *Laevigatosporites ovatus* | *Lakesipollis* sp. | *Lanagisporis* sp. | *Lilacidites* spp. | *Magnastriatites howardii* (Euphorbiaceae type) | *Microreticulatisporites* spp. | *Momipites anetilus* | *Momipites coryloides* (20-27 µm) | *Momipites coryloides* (>27 µm) | *Momipites dilatus* | *Momipites effingwellii* | *Momipites rotundus* | *Momipites rotundus* | *Momipites tricolpidites* | *Momipites trinoduatus type* | *Momipites walthamensis* | *Nuphar/Nymphaeaceae* | *Nuxtopollis terminalis* | *Nyssapollenites* spp. | *Platilipolenites megaforaminis* | *Polycolpomonosulcus granoverrucatus* | *Polypodiisporonites* spp. | *Polypodiisporonites fleuxis* | *Palatricolpites* spp. (prolate) | *Retitrescolpites angulosuminosus* | *Retitricolpites* spp. | *Retitricolpites* sp. A | *Retitriletes globosus* | *Rhoipites angulatus* type | *Scabratricolpites* spp. | *Scabratricolpites* spp. (non-prolate) | *Scabratricolpites* sp. | *Scabratriporites* spp. | *Sibiglenella jarritata* | *Sibiglenella* sp. | *Spinaepollis spinosa* | *Spinizonocolpites* spp. | *Stereisporites buchenauensis* | *Stereisporites* sp. A | *Stereisporites* sp. | *Stratapollis* spp. | *Stratapollis gratiani* | *Thomsonipollis magnificus* | *Thymelaeaceae*? sp. A | *Tricolpites* spp. | *Triporoidites* spp. | *Trudopollis* spp. | *Ulmipollenites krempii* | *Unidentifiable pollen/plant spores* | *Vitreisporites* spp. | *Wodehouseia spinata* |
|---|---|---|---|---|---

Moczygemba VT No. 11

Measured depth (ft)	Chronostratigraphy: Period/Epoch	Chronostratigraphy: Age	Nannofossil zones (Martini, 1971)	Orabona Wilcox palynology	Samples (ft)	Biostratigraphic comments	Wireline Logs	Total palynomorph abundance Sum (Raw excluded)	Pollen and plant spores Sum (Raw excluded)	Dinoflagellate cysts Sum (Raw excluded)	Fungal spores Sum (Raw excluded)	Algae Sum (Raw excluded)	Acritarchs Sum (Raw excluded)	Relative abundance (%)
4750	Paleocene	Thanetian	NP7	T. M. dilatus/T. t. rugulatus	4615.00–4659.83	T. M. dilatus/T. t. rugulatus zone based on presence of *Insulapollinites rugulatus* at 4613.50' (considered below true stratigraphic top) and absence of *Momipites dilatus*. Nannofossil recovery insufficient for age determination.	Self Potential (-80 mV) 30	4615.00–4659.83	4615.00–4659.83	4615.00–4659.83	4615.00–4659.83	4615.00–4659.83	4615.00–4659.83	Terr./freshwater sporomorphs; Freshwater algae; Fungi; Acritarchs; Dinoflagellate cysts
		Upper Selandian	Lower NP8	B. P. mcgregorii/T. M. dilatus	4865.25–4912.00	T. Momipites dilatus (~58.8 Ma?). In nannofossil zone NP7 (58.7-58.97 Ma)		4865.25–4912.00	4865.25–4912.00	4865.25–4912.00	4865.25–4912.00	4865.25–4912.00	4865.25–4912.00	
5000					4919.83–4959.83	B. Insulapollenites rugulatus, possibly above true stratigraphic bottom due to rarity. B. Pistillipollenites mcgregorii (59.0 Ma); probably above true stratigraphic base due to rarity. B. Apectodinium homomorphum (60.4 Ma): probably above true stratigraphic base. B common Caryapollenites veripites? Increased uncertainty due to large sample gap downsection. B Caryapollenites veripites (60.8 Ma), B Caryapollenites inelegans, B common Caryapollenites spp., B Lanagiopollis lihoka, and B Spinaepollis spinosa. All probably above true stratigraphic base.		4919.83–4959.83	4919.83–4959.83	4919.83–4959.83	4919.83–4959.83	4919.83–4959.83	4919.83–4959.83	
5250					4959.83–5000.00			4959.83–5000.00	4959.83–5000.00	4959.83–5000.00	4959.83–5000.00	4959.83–5000.00	4959.83–5000.00	
5500					5000.00–5047.00			5000.00–5047.00	5000.00–5047.00	5000.00–5047.00	5000.00–5047.00	5000.00–5047.00	5000.00–5047.00	
5750					5047.00–5057.83	T consistent Momipites anellus, probably below true stratigraphic top. B Momipites dilatus. B Momipites inorbicularia.		5047.00–5057.83	5047.00–5057.83	5047.00–5057.83	5047.00–5057.83	5047.00–5057.83	5047.00–5057.83	
6000					5057.83–6069.92			5057.83–6069.92	5057.83–6069.92	5057.83–6069.92	5057.83–6069.92	5057.83–6069.92	5057.83–6069.92	
					6069.92–6072.83	Arecilgera senonensis complex, Caryapollenites inparalis present. Probably lower Selandian.		6069.92–6072.83	6069.92–6072.83	6069.92–6072.83	6069.92–6072.83	6069.92–6072.83	6069.92–6072.83	

Palynology

Pollen and plant spores

Samples (ft); Aesculiidites circumstriatus; Alapallipollenites; Alnipollenites spp.; Apiculatisporites aff. ellenwardii; Arecipites perfunctus; Arecipites spp. (indistinguishable); Arecipites tenuiverrucus; Arecipites verrucosus; Betulaceoipollenites; Bombacacidites bombacoides; Bombacacidites recrimentaneus; Bombacacidites spp.; Bombacacidites? aff. xenoporiferus; Bombacacidites? aff. spongiosus; Carpolithes spp.; Carpolithes aff. integrus; Carpolithes sp. A; Carpolithes proximus; Carpolithes sp. B; Carpolithes sp. C; Carpolithes wickiboroensis; Carpolithes? sp. A; Carpolithes? sp. B; Carpolithes? fungiform type; Chenopodipollis spp.; Chenopodipollis? sp. animus (small); Cruciferoidites spp.; Cruciferoidites alabamicus; Cruciferoidites? cf. alabamicus; Cruciferoidites? sp. A; Cruciferoidites? sp. B; Cruciferoidites? sp. C; Cruciferoidites? sp. D; Cruciferoidites? sp. E; Cruciferoidites? sp. F; Cruciferoidites? sp. G; Cruciferoidites? sp. H; Cruciferoidites? sp. I; Cruciferoidites? sp. J; Cruciferoidites? sp. K; Cruciferoidites? sp. L; Cruciferoidites? sp. M; Cruciferoidites? sp. N; Cruciferoidites? sp. O; Cruciferoidites? sp. P; Cruciferoidites? sp. Q; Cruciferoidites? sp. R; Cruciferoidites? sp. S; Cruciferoidites? sp. T; Cruciferoidites? sp. U; Cruciferoidites? sp. V