



# **Occurrences of Calcareous Nannofossil, Dinoflagellate Cyst, and Pollen Taxa in Paleocene Strata in South Carolina**

By Norman O. Frederiksen, Lucy E. Edwards, Laurel M. Bybel, and Jean M. Self-Trail

Report Series 2006–1353

**U.S. Department of the Interior**  
**U.S. Geological Survey**

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Suggested citation:  
Frederiksen, Norman O., Edwards, Lucy E., Bybell, Laurel M., Self-Trail, Jean M., 2006,  
Occurrences of Calcareous Nannofossil, Dinoflagellate Cyst, and Pollen Taxa in Paleocene  
Strata in South Carolina: Reston, Virginia, Open-File Report 2006-1353, p. ##; information  
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## **Abstract**

This report presents 26 diagrams showing the occurrences of fossil dinocyst, calcareous nannofossil, and pollen assemblages in Paleocene samples from 15 boreholes in South Carolina.

## **Introduction**

### **Previous Work**

Paleocene stratigraphic units of South Carolina are not known in detail because most research on these units was based on discontinuous outcrop sections. Except for the many coreholes drilled at the Savannah River Site (SRS, fig. 1), few Paleocene cores were taken in South Carolina until the 1980's. Therefore, except at the SRS (Fallaw and Price, 1995, and references therein; Hargrove and Engelhardt, 1997), relatively little is known about the nature of the Paleocene stratigraphic units in the subsurface of South Carolina, and the Paleocene section is divided into only a few formations (fig. 2). Furthermore, until relatively recently, few paleontological studies of Paleocene strata in South Carolina based on dinoflagellate cysts (dinocysts), calcareous nannofossils, and pollen had been completed. This made it difficult to subdivide and correlate the Paleocene section in a detailed way. The object of the present report is to provide data on occurrences of Paleocene dinocysts, calcareous nannofossils, and pollen in samples from 15 boreholes in the coastal plain of South Carolina (table 1).

### **Acknowledgments**

The authors acknowledge the efforts of Donald G. Queen, Eugene F. Cobbs II, Eugene F. Cobbs III, Gerald E. Idler, and especially David C. Prowell, all of whom work or did work for the U.S. Geological Survey, and Karen Waters and Joe Gellici of the South Carolina Department of Natural Resources, during coring and logging of the cores whose paleontology is reported here. We also thank Colleen Durand, Nancy Durika, Ellen Seefelt, Thomas Sheehan, and Karlyn Westover for diligent processing of the fossil-bearing samples. The U.S. Department of Energy supported this investigation.

**Table 1.** South Carolina boreholes for which Paleocene dinoflagellate cyst, calcareous nannofossil, and pollen occurrence data are presented in this report and (or) have been presented in previous U. S. Geological Survey open-file reports.

USGS Drillhole Designation	Drillhole Name	County	Year	Degrees North Latitude	Degrees West Longitude	Measured Elevation, Feet	Total Depth, Feet	Samples	Occurrence Data Presented In This Report			Occurrence Data Previously Provided in USGS Open-File Reports		
									Dino-flagellate Cysts	Calcareous Nanno-fossils	Pollen	Dino-flagellate Cysts	Calcareous Nanno-fossils	Pollen
ALL-348	DNR/DOE C10A	Allendale	1990	33.013	81.2303	281.6	1,734	cores	X	X				
BFT-2055	Hilton Head Water test	Beaufort	1992	32.1129	80.4214	10.0	3,833	cuttings	X					
BRK-644	USGS/DNR St. Stephen	Berkeley	1998	33.2415	79.5604	75.0	1,826	cores	X	X	X			
BRN-335	SRS P21TA	Barnwell	1985	33.0846	81.3628	207.0	1,152	cores	X		X			
CHN-800	USGS Cannon Park	Charleston	1994	32.4655	79.5641	10.0	1,012	cores		X		X	X	X
CHN-802	USGS Moores Landing	Charleston	1996	32.5627	79.3927	7.8	369	cores		X				
CHN-803	USGS Santee Coastal Reserve	Charleston	1996	33.0910	79.2130	9.9	545	cores		X		X	X	X
COL-364	USGS/DNR Edisto Island	Colleton	1999	32.3013	80.1746	9.9	977	cores	X	X	X			
DOR-37	USGS Clubhouse Crossroads No. 1	Dorchester	1975	32.5317	80.2133	18.0	2,599	cores	X	X	X	X	X	X
DOR-208	USGS Pregnall	Dorchester	1982	33.0908	80.2814	85.0	346	cores		X		X	X	
DOR-211	USGS St. George	Dorchester	1982	33.0925	80.3118	78.0	2,067	cores	X	X				
JAS-426	DNR/DOE C15	Jasper	1996	32.3704	80.5945	63.5	2,900	sidewall cores					X	
LEX-844	USGS/DNR Swansea	Lexington	1997	33.4444	81.0628	367.0	548	cores	X		X			
ORG-393	USGS/DNR Clark School No. 1	Orangeburg	1997	33.3029	80.5154	253.0	1,138	cores	X		X			
ORG-430	USGS/DNR Clark School No. 2	Orangeburg	1999	33.3029	80.5154	253.0	330	cores	X		X			

## Fossil Assemblages

The fossil dinocyst, calcareous nannofossil, and pollen assemblages are presented in figures 3 through 28. These data are from 13 coreholes, one borehole from which sidewall cores were obtained, and one borehole from which cuttings were recovered (table 1). The table shows that some fossil data from some of these holes previously have been presented in U. S. Geological Survey open-file reports by Edwards and others (1997, 1999, 2000), Self-Trail and Bybell (1997), and Bybell and others (1998), but a subset of these data is updated in the present report along with data not previously made public. The diagrams for calcareous nannofossil assemblages do not display sample numbers (other than the depths from which the samples were obtained) because no such numbers were assigned. The coreholes and boreholes are presented in alphabetical order according to the county in which they were drilled. Hence, charts presenting data from each borehole are adjacent in the report, thereby permitting easy comparison of age interpretations based on different fossil groups from each borehole.

## Summary

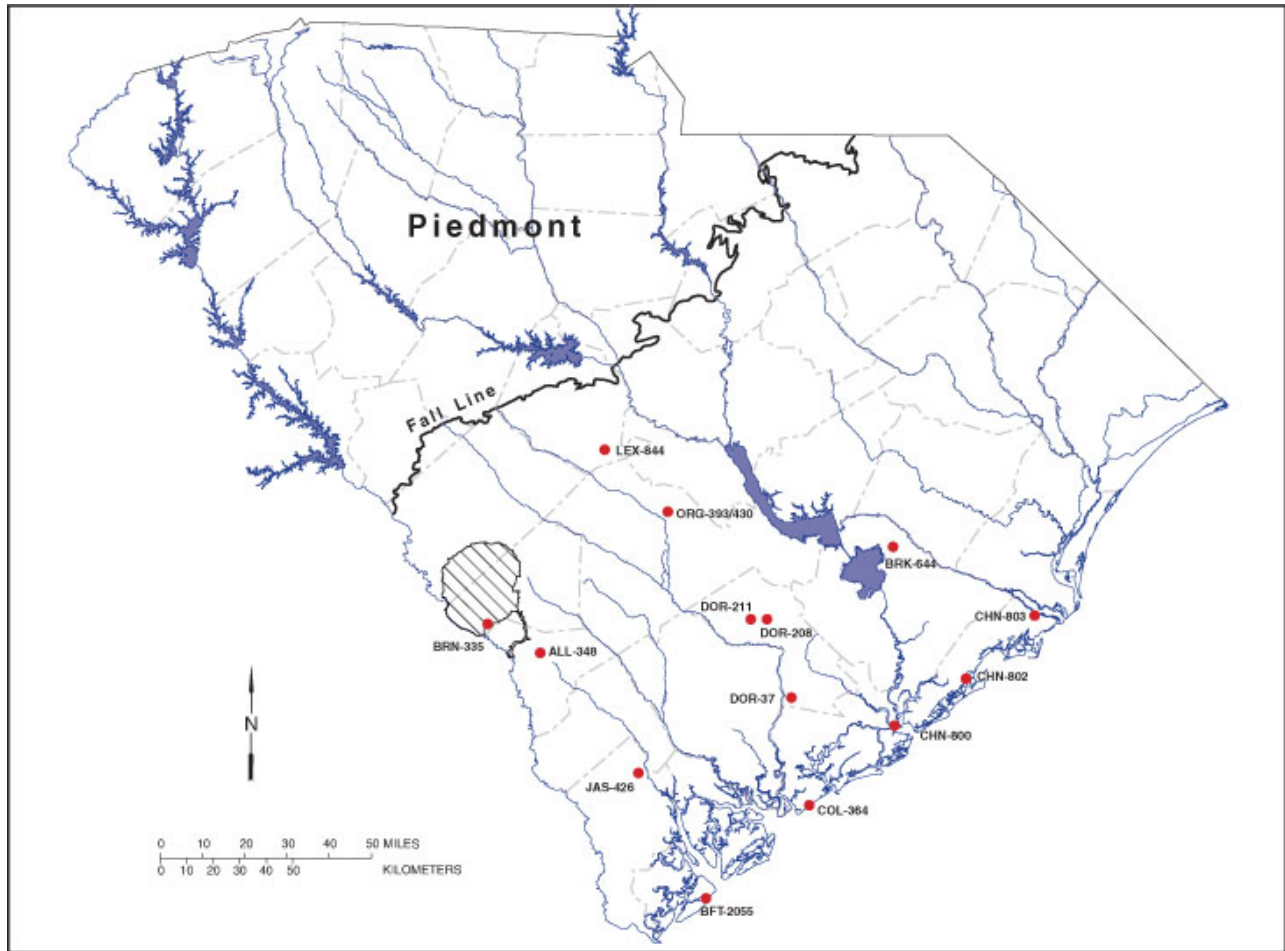
Twenty-six diagrams in this report display the occurrences of fossil dinocyst, calcareous nannofossil, and pollen assemblages in Paleocene samples from 13 coreholes, one borehole from which sidewall cores were obtained, and one borehole from which cuttings were recovered, all in South Carolina.

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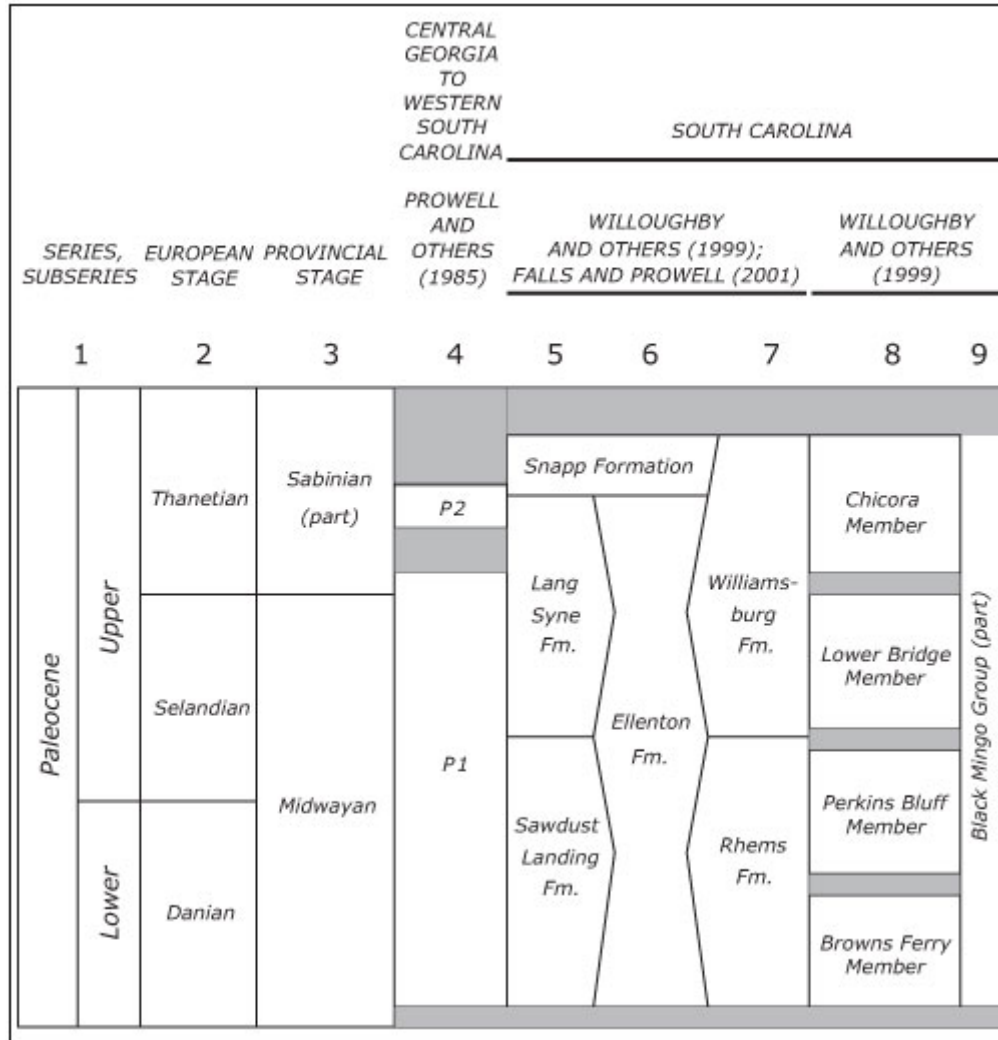
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**Figure 1.** Index map of South Carolina showing the locations (black circles) and names of boreholes from which conventional cores, sidewall cores, or cuttings were recovered that were studied for this report, and the location of the Savannah River Site (hatched area). [file Norm Map-2.ai]



**Figure 2.** Generalized comparison of nomenclature used by several authors for Paleocene geologic units in South Carolina. Shaded areas indicate missing stratigraphic sections. Fm., formation. Columns 4-7 are slightly modified from Falls and Prowell (2001); in column 5, formations are updip units; in column 7, formations are downdip units. [file SE Paleocene fms-o file.ai]

Depth (feet)	639.5	617	609	583.5
Sample	R4787 A	R4787 B	R4787 C	R4787 D
Series	Paleocene	Barren	Barren	Eocene
Part of Series	Upper			Lowest
Taxa				
<i>Adnatosphaeridium multispinosum</i> Williams & Downie 1966	.			X
<i>Adnatosphaeridium</i> Williams & Downie 1966 n. sp.	X			.
<i>Amphorosphaeridium multispinosum</i> (Davey & Williams 1966) Sarjeant 1966	X			X
<i>Apectodinium augustum</i> / <i>A. hyperacanthum</i>	.			X
<i>Apectodinium homomorphum</i> (Defl. & Cook. 1955) Lentin & Williams 1977	.			X
<i>Apectodinium paniculatum</i> (Costa & Downie 1976) Lentin & Williams 1977	.			X
<i>Cerodinium medcalfi</i> (Stover 1974) Lentin & Williams 1987	.			?
<i>Cerodinium speciosum</i> (Alberti 1959) Lentin & Williams 1987	X			.
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	X			X
<i>Cordosphaeridium gracile</i> (Eisenack 1954) Davey & Williams 1966	.			X
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	X			.
<i>Dinopterygium cladoides</i> sensu Morgenroth (1966)	.			X
<i>Eocladopyxis peniculata</i> Morgenroth 1966	.			X
<i>Fibrocysta bipolaris</i> (Cookson & Eisenack 1965) Stover & Evitt 1978	.			X
<i>Hafniasphaera septata</i> (Cookson & Eisenack 1967) Hansen 1977	.			X
<i>Hystrichokolpoma unispinum</i> Williams & Downie 1966	.			X
<i>Hystrichosphaeridium tubiferum</i> (Erhenberg 1838) Deflandre 1937	X			.
<i>Kallosphaeridium brevibarbatum</i> de Coninck 1969	.			X
<i>Nematosphaeropsis</i> Deflandre & Cookson 1955 n. sp.	X			.
<i>Operculodinium</i> Wall 1967 sp.	X			X
<i>Palaeocystodinium golzowense</i> Alberti 1961	X			.
<i>Phelodinium</i> sp. of Edwards (1989)	X			.
<i>Polysphaeridium zoharyi</i> (Rossignol 1962) Bujak et al. 1980	.			?
<i>Senegalinium microgranulatum</i> (Stanley 1965) Stover & Evitt 1978	X			.
<i>Spiniferites</i> Mantell 1850 spp.	X			X
miscellaneous areoligeracean forms	.			X
small peridiniacean forms	.			X

**Figure 3.** Distribution of dinocyst taxa in Paleocene samples from DNE/DOE corehole C10-A (ALL-348), Allendale County, South Carolina. X = present; ? = questionable occurrence.

	1569-1594 ft	1345-1357 ft	1316-1325 ft (quick)
Depth			
Sample	R4965G	R4965H	R4965I
Inferred Age	mid-Paleocene	early Eocene or older	early Eocene or older
Taxa			
<i>Homotryblium plectilum</i> Drugg & Loeblich 1967	X	X	.
<i>Wetzeliiella</i> group	X	X	X
<i>Thalassiphora pelagica</i> (Eisenack 1954) Eisenack & Gocht 1960	X	X	X
<i>Diphyes colligerum</i> (Deflandre & Cookson 1955) Cookson 1965	.	X	.
<i>Pentadinium goniferum</i> Edwards 1982	?	X	X
<i>Areosphaeridium diktyoplokus</i> (Klumpp 1953) Eaton 1971	.	X	.
<i>Rhombodinium draco</i> Gocht 1955	.	X	X
<i>Fibrocysta radiata</i> (Morgenroth 1966) Stover & Evitt 1978	.	.	X
<i>Phelodinium</i> sp. of Edwards (1989)	X	.	.
<i>Amphorosphaeridium multispinosum</i> (Davey & Williams 1966) Sarjeant 1967	X	.	.
<i>Palaeoperidinium pyrophorum</i> (Ehrenberg 1838) Sarjeant 1967	X	.	.
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	X	.	.
<i>Deflandrea delineata</i>	X	.	.
<i>Senegalinium micrograulatum</i> (Stanley 1965) Stover & Evitt 1978	X	.	.

**Figure 4.** Distribution of dinocyst taxa in Paleocene cuttings samples from the Hilton Head water test borehole (BFT-2055), Beaufort County, South Carolina.

Taxa	Depth (Ft)													Sample		
	274.4-274.8	253.0-253.4	243.1-243.4	236.0-236.5	233.4-233.8	226.5-226.8	207.6-208.0	182.6-182.9	164.2-164.7	111.6-112.0	90.0-90.2	81.7-82.0	72.1-72.5	60.9-60.1	47.7-47.8	ca. 29
	R5606 E	R5606 F	R5606 G	R5606 H	R5606 I	R5606 J	R5606 K	R5606 L	R5606 M	R5606 O	R5606 P	R5606 Q	R5606 R	R5606 S	R5606 T	R5606 U
Series	Paleocene													Pal-Eoc.?		
Subseries	Lower									Upper						
<i>Achilleodinium biformoides</i> (Eisenack 1954) Eaton 1976	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
chorate, cf. <i>Achilleodinium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	.
<i>Achomosphaera alvicornu</i> (Eisenack 1954) Davey & Williams 1966	X	.	.	.	.	.	.	.	.	X	X	.	.	.	.	.
<i>Adnatosphaeridium multispinosum</i> Williams & Downie 1966	.	.	.	.	.	.	.	.	.	.	X	X	X	X	X	X
<i>Amphrosphaeridium multispinosum</i> (Davey & Williams 1966) Sarjeant 1981	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.
<i>Andalusiella polymorpha</i> (Malloy 1972) Lentin & Williams 1977	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	.
<i>Andalusiella</i> sp. aff. <i>A. polymorpha</i> of Edwards (1980)	.	X	?	.	.	.	.	.	.	.	.	.	.	.	.	.
? <i>Andalusiella rhombohedra</i> of Edwards and others (1984)	.	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.
<i>Apectodinium homomorphum</i> (Deflandre & Cookson 1955) Lentin & Williams 1977	.	.	.	.	.	.	.	.	.	.	X	X	X	X	.	.
<i>Apectodinium hyperacanthum</i> (Deflandre & Cookson 1955) Lentin & Williams 1977	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.
<i>Carpatella cornuta</i> Grigorovich 1969	?	.	?	.	X	.	.	.	X	.	.	.	.	.	.	.
<i>Catillopsis</i> Drugg 1970 ? sp.	.	X	.	.	X	.	.	.	.	.	.	.	.	.	.	.
<i>Cerodinium diebelii</i> (Alberti 1959) Lentin & Williams 1987	.	.	X	.	.	X	.	.	.	.	.	.	.	.	.	.
<i>Cerodinium striatum</i> (Drugg 1967) Lentin & Williams 1987	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cerodinium</i> Vozzhennikova 1963 sp.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	X	X	.	.	.	.	X	X	.	.	.	.	.	.	.	X
<i>Cordosphaeridium gracile</i> (Eisenack 1954) Davey & Williams 1966	.	.	.	.	.	.	.	.	.	.	.	X	X	X	X	X
<i>Cordosphaeridium inodes</i> (Klumpp 1953) Eisenack 1963	.	.	X	.	.	X	.	X	.	.	.	.	.	.	.	.
<i>Cordosphaeridium</i> Eisenack 1963 sp.	.	.	.	.	X	.	X	.	.	X	X	X	.	.	.	.
<i>Cribroperidinium</i> Neale & Sarjeant 1962 spp.	X	X	X	.	X	X	.	.	.	.	.	.	.	.	.	.
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	X	X	X	X	X	X	X	.	X	X	X	X	X	X	?	?f
<i>Deflandrea</i> cf. <i>D. diebelii</i> Alberti of Drugg (1967)	.	X	.	.	.	.	X	.	X	.	.	.	.	.	.	.
<i>Deflandrea</i> n. sp. aff. <i>D. truncata</i> Eisenack 1938	.	X	X	X	.	.	X	.	X	.	.	.	.	.	.	.
<i>Deflandrea phosphoritica</i> Eisenack 1938	.	.	.	.	.	.	.	.	.	.	X	?	?	.	X	.
<i>Diphyes colligerum</i> (Deflandre & Cookson 1955) Cookson 1965	X	X	X	.	P	P	.	X	.	X	.	.	.	.	.	.
<i>Disphaerogena carposphaeropsis</i> Wetzel 1933	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Eocladopyxis peniculata</i> Morgenroth 1966	.	.	.	.	.	.	.	.	.	.	X	X	X	X	X	X
<i>Exochosphaeridium</i> Davey et al. 1966 spp.	.	X	X	X	X	X	X	X	X	X	.	.	.	.	.	.
<i>Fibradinium annetorpense</i> Morgenroth 1968	X	X	.	.	?	.	.	.	.	.	.	.	.	.	.	.
<i>Fibrocysta radiata</i> (Morgenroth 1966) Stover & Evitt 1978	.	.	.	.	.	.	.	.	.	.	X	X	X	.	.	.
<i>Fibrocysta</i> Stover & Evitt 1978 sp.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.

Taxa	Paleocene													Pal-Eoc.?			
	Lower						Upper										
Taxa																	
<i>Fromea fragilis</i> (Cookson & Eisenack 1962) Stover & Evitt 1978	X	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Hafniasphaera fluens</i> Hansen 1977	X	X	X	.	X	.	X	.	.	.	.	.	.	.	.	.	.
<i>Hafniasphaera septata</i> (Cookson & Eisenack 1967) Hansen 1977	.	.	.	.	X	.	.	.	.	.	X	.	.	.	.	.	.
<i>Hafniasphaera</i> Hansen 1977 sp.	.	.	.	.	.	.	.	X	.	.	.	X	.	.	.	.	.
<i>Hystrichokolpoma</i> Deflandre 1935 sp.	X	X	X	.	X	X	.	.	.	.	X	X	X	X	X	.	.
<i>Ifecysta</i> Jan du Chêne & Adediran 1985 sp.	X	X	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.
<i>Isabelidinium/Chatangiella/Manumiella</i> sp. (reworked?)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.
<i>Kallosphaeridium brevibarbatum</i> de Coninck 1969	.	.	.	.	.	.	.	.	.	.	X	X	?	?	.	.	.
<i>Lejeunecysta</i> Artzner & Dörhöfer 1978 sp.	.	X	.	.	.	.	.	.	.	.	X	.	.	X	.	.	.
<i>Lingulodinium machaerophorum</i> (Deflandre & Cookson 1955) Wall 1967	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.
<i>Melitasphaeridium pseudorecurvatum</i> (Morgenroth 1966) Bujak et al. 1980	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.
<i>Membranosphaera maastrichtica</i> Samoilovitch 1961	.	?	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Oligosphaeridium complex</i> (White 1842) Davey & Williams 1966	?	.	.	.	.	?	.	.	.	.	.	.	.	.	.	.	.
<i>Operculodinium</i> Wall 1967 sp. or spp.	X	.	.	X	X	X	.	X	X	X	.	.	X	X	X	.	.
<i>Palaeocystodinium golzowense</i> Alberti 1961	.	.	.	.	.	.	.	.	?	X	.	.	.	.	.	.	.
<i>Palaeocystodinium</i> Alberti 1961 sp.	X	X	.	.	.	.	X	.	X	X	.	.	.	.	.	.	.
<i>Palaeocystodinium</i> Alberti 1961 sp. (fat)	.	.	.	.	X	X	X	X	.	.	.	.	.	.	.	.	.
<i>Palaeoperidinium pyrophorum</i> (Ehrenberg 1838) Sarjeant 1967	.	X	X	.	.	.	X	.	.	X	.	.	.	.	.	.	.
<i>Phelodinium magnificum</i> (Stanley 1965) Stover & Evitt 1978	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phelodinium</i> sp. of Edwards (1989)	.	.	.	.	.	.	.	.	.	X	.	.	poor	.	.	.	.
<i>Phelodinium</i> Stover & Evitt 1978 spp.	.	X	X	X	X	X	.	X	X	.	.	.	.	.	.	.	.
<i>Pulchrasphaera minuscula</i> Schiøler et al. 1997	X	.	.	?	.	?	.	.	.	.	.	.	.	.	.	.	.
<i>Rottnestia</i> Cookson & Eisenack 1961 sp.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.
<i>Senoniasphaera</i> Clarke & Verdier 1967 sp.	.	.	.	.	.	.	.	?	?	.	.	.	.	.	.	.	.
<i>Spinidinium pulchrum</i> (Benson 1976) Lentin & Williams 1977	?	.	?	.	.	.	.	?	?	.	.	.	.	.	.	.	.
<i>Spinidinium</i> Cookson & Eisenack 1962 spp.	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	.	.
<i>Spiniferites pseudofurcatus</i> (Klumpp 1953) Sarjeant 1970	.	.	.	.	.	.	.	.	?	.	.	.	.	.	.	.	.
<i>Spiniferites</i> Mantell 1850 spp.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Tectatodinium rugulatum</i> (Hansen 1977) McMinn 1988 ( <i>sensu amplo</i> )	.	.	.	.	.	.	X	X	X	.	.	.	.	.	.	.	.
<i>Turbiosphaera</i> sp. aff <i>T. magnifica</i> Eaton of Edwards (1989) (frag.)	.	.	.	.	.	.	.	.	.	.	.	?	.	.	.	.	.
<i>Xenicodinium-Tectatodinium</i> plexus	X	.	.	.	.	.	?	.	.	.	.	.	.	.	.	.	.

Depth (Ft)	ca. 29	47.7-47.8	60.9-60.1	72.1-72.5	81.7-82.0	90.0-90.2	111.6-112.0	164.2-164.7	182.6-182.9	207.6-208.0	226.5-226.8	233.4-233.8	236.0-236.5	243.1-243.4	253.0-253.4	274.4-274.8	
Sample	R5606 U	R5606 T	R5606 S	R5606 R	R5606 Q	R5606 P	R5606 O	R5606 M	R5606 L	R5606 K	R5606 J	R5606 I	R5606 H	R5606 G	R5606 F	R5606 E	
Series	Paleocene													Pal-Eoc.?			
Subseries	Lower							Upper									
Taxa																	
miscellaneous areoligeracean forms	X	X	X	.	X	X	X	X	X	X	X	X	X	X	.	X	X
miscellaneous cladopyxiacean forms	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
small peridiniacean forms	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	v!	.
X=present, .=not present, ?=questionably present																	
P=variety of <i>D. colligerum</i> with precingular archeopyle																	
v!=near <i>Isabelidinium? viborgense</i> Heilman-Clausen 1985																	
?f=questionably identified, fragment only																	

**Figure 5.** Distribution of dinocyst taxa in Paleocene samples from the USGS/DNR St. Stephen corehole (BRK-644), Berkeley County, South Carolina.

Depth (ft)	274.4	265.6	250.6	244.8	237.8	232.3	226.3	221.4	209.2	204.7	197.8	183.8	180.4	174.4	162.6	150.2	143.2	134.9	131.2	112.7	78.2	68.3
Calcareous Nannofossil Zone	NP 1	NP 1	NP 1	NP 1	NP 1	NP 2	NP 2	NP 2	NP 2	NP 2	NP 2	NP 2	NP 2	NP 2	NP 2	Barren	Barren	Barren	Barren	Barren	Barren	Barren
Taxa	Biostratigraphic Ranges																					
<i>Biscutum</i> spp. NP 1-12?	X																					
<i>Braarudosphaera bigelowii</i> Cret-Recent		X	X		X	X		X	X		X		X									
<i>Chiasmolithus consuetus</i> s.l. NP 3-											??											
<i>Coccolithus cribellum</i>	X									X												
<i>Coccolithus pelagicus</i>										?1	?2											
<i>Cruciplacolithus asymmetricus</i> NP 1-5		X	X	X	X	X	X	X	X	1	X		X		X							
<i>Cruciplacolithus edwardsii</i> NP 2?-5?									X		1											
<i>Cruciplacolithus intermedius</i> NP 1-	X	X	X	X	X	X	X	X	X	X	X	X	X									
<i>Cruciplacolithus primus</i> NP 1-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
<i>Cruciplacolithus tenuis</i> NP 2-9								1	X		2	1										
<i>Cruciplacolithus</i> spp.					X																	
<i>Cyclagelosphaera prima</i> NP 1-10						X	X				X											
<i>Cyclagelosphaera reinhardtii</i> NP 1-5					X																	
<i>Cyclagelosphaera</i> spp.	X																					X
<i>Ericsonia subpertusa</i> NP 1-12?	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
<i>Goniolithus fluckigeri</i> Cret-NP 25?												X										
<i>Hornibrookina</i> spp.	X	X		X	X						X		X									
<i>Lanternithus duocavus</i> NP 1-5?											X											
<i>Markalius inversus</i> NP 1-21	X	X		X	X	X	X		X	X		X	X									
<i>Micrantholithus crenulatus</i>						?																
<i>Neococcolithes</i> sp. aff. <i>N. protenus</i>					X	X							X									
<i>Neococcolithes</i> spp.	X	X		X								X										
<i>Neocrepidolithus</i> spp.		X							X													
<i>Placozygus sigmoides</i> NP 1-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1	X					
<i>Praeprinsius</i> spp.						X		X	X	X	X	X	X	X								
<i>Thoracosphaera</i> spp.	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
placoliths															1							X
Cretaceous forms		R	R	R						R												
Abundance	C	F+	F+	F+	F+	F-	F+	F-	F+	F-	F+	R	F+	R	F-	B	B	B	B	R	B	B
Preservation	M	G	M+	M	M	M+	M	M	M	M	M	M	M	M	M	M-					T	
Legend																						
Species range with known FAD's & LAD's	[Grey shaded box]																					
Interval where species is absent but should occur	[Light green shaded box]																					
Species range with unknown FAD's & LAD's	[Light green shaded box]																					
Reworked, contaminated, aberrant occurrences	[Blue shaded box with R C]																					
Barren sample	[Grey shaded box]																					
FAD's and LAD's for Martini (1971) zones	[Vertical pink line]																					
FAD's and LAD's used to define age of unit	[Vertical red line]																					
FAD's and LAD's consistent with known ranges	[Vertical blue line]																					
Questionable & very questionable occurrences	[Vertical blue line with ? ??]																					
1, 2, 3 specimens in sample	[Vertical blue line with 1 2 3]																					
Martini (1971) zonal markers ( <b>bold</b> )	[Vertical blue line with bold text]																					
Abundance: C, Common; F, Frequent; R, Rare; B, Barren																						
Preservation: G, Good; M, Moderate; P, Poor; T, Terrible																						

Figure 6. Distribution of calcareous nannofossil taxa in Paleocene samples from the USGS/DNR St. Stephen corehole (BRK-644), Berkeley County, South Carolina.



Depth (ft)	Sample	Age or NP zone equivalent	Taxa
CA. 29	R5606 U	Paleocene, NP7 or younger	.
47.7-47.8	R5606 T	Upper NP9	. X . . . . .
60.9-61.0	R5606 S	No age determination	. . . . . X . . . . .
72.1-72.5	R5606 R	NP9	. . . . . X X . . . . .
81.7-82.0	R5606 Q	NP9	. . . . . X X X . . . . .
90.0-90.2	R5606 P	Paleocene, mid-NP5 or younger	. . . . . X X X . . . . .
111.6-112.0	R5606 O	Paleocene, NP4 or younger	. . . . . X . . . . .
134.9-135.4	R5606 N	Barren of fossil pollen	. . . . .
164.2-164.7	R5606 M	Paleocene	. . . . . X X . . . . .
182.6-182.9	R5606 L	Paleocene	. . . . . X . . . . .
207.6-208.0	R5606 K	Presumably Paleocene	. . . . . X X X . . . . .
226.5-226.8	R5606 J	Presumably Paleocene	. . . . . X . . . . .
233.4-233.8	R5606 I	Pollen is rare	. . . . .
236.0-236.5	R5606 H	Pollen is rare	. . . . .
243.1-243.4	R5606 G	Pollen is rare	. . . . .
253.0-253.4	R5606 F	Paleocene	. . . . . X . . . . .
274.4-274.8	R5606 E	Pollen is rare	. . . . .
<b>Taxa</b>			
			<i>Aesculiidites circumstriatus</i>
			<i>Bombacacides reticulatus</i>
			<i>Carya</i> <29µm
			<i>Caryapollenites prodromus</i> group
			<i>Favitricolporites baculiferus</i>
			<i>Holkopollenites chemardensis</i>
			<i>Intratropollenites pseudinstructus</i>
			<i>Momipites actinus</i>
			<i>Momipites coryloides/microfoveolatus</i>
			<i>Momipites strictus</i>
			<i>Momipites tenuipolus</i> group
			<i>Nudopollis terminalis</i>
			<i>Pistillipollenites mcgregorii</i> Range base is in NP9
			<i>Platycarya</i> sp. A
			<i>Plicatopollis triorbicularis</i> type
			<i>Pseudoplicapollis limitatus</i>
			<i>Psilodiporites iszkaszentgyorgyi</i> Range base is up. NP8
			<i>Sparganiaceapollenites</i> sp.
			<i>Thomsonipollis magnificus</i>
			<i>Tricolpites asper</i>
			<i>Tricolpites crassus</i>
			<i>Tripopollenites microgranulatus</i>
			<i>Trudopollis</i> spp., including <i>T. plenus</i>
			<i>Ulmipollenites krempii</i>
			<i>Ulmipollenites tricostatus</i>
			<i>Ulmipollenites undulosus</i>
			prob. = probably belongs to this taxon.

**Figure 7.** Distribution of pollen taxa in Paleocene samples from the USGS/DNR St. Stephen corehole (BRK-644), Berkeley County, South Carolina.

Depth (Ft)	444	426	414	400	390	366	363
Sample	R3574 AB	R3574 AD	R3574 AE	R3574 AG	R3574 AH	R3574 AK	R3574 AL
Series	Paleocene						?
Subseries	Lower Paleocene						
Taxa							
<i>?Andalusiella rhombohedra</i> of Edwards and others (1984)	.	X	X	X	X	X	X
<i>Achomospaera alcornu</i> (Eisenack 1954) Davey & Williams 1966	.	.	.	.	X	X	.
<i>Amphorosphaeridium multispinosum</i> (Davey & Williams 1966) Sarjeant 1981	.	.	.	.	X	X	.
<i>Andalusiella polymorpha</i> (Malloy 1972) Lentin & Williams 1977	.	X	.	.	.	.	.
<i>Apteodinium</i> Eisenack 1958 sp.	?	.	.	.	.	.	.
<i>Areoligera volata</i> Drugg 1967	.	.	.	?	.	.	.
<i>Carpatella cornuta</i> Grigorovich 1969	.	X	X	.	.	.	.
<i>Cordosphaeridium</i> Eisenack 1963 spp.	X	X	.	X	X	X	.
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	.	.	.	X	X	X	.
<i>Deflandrea</i> cf. <i>D. diebelii</i> Alberti of Drugg (1967)	?	.	.	.	.	.	.
<i>Deflandrea</i> n. sp. aff. <i>D. truncata</i> Eisenack 1938	X	X	?	.	.	.	.
<i>Diphyes colligerum</i> (Deflandre & Cookson 1955) Cookson 1965	.	.	.	.	X	X	.
<i>Exochosphaeridium</i> Davey et al. 1966 sp.	X	.	.	.	.	.	.
<i>Fibradinium annetorpense</i> Morgenroth 1968	.	.	.	X	X	X	.
<i>Hafniasphaera</i> Hansen 1977 sp.	.	.	.	X	.	X	.
<i>Hafniasphaera septata</i> (Cookson & Eisenack 1967) Hansen 1977	.	.	.	.	X	.	.
<i>Hystriochosphaeridium tubiferum</i> (Ehrenberg 1838) Deflandre 1937	.	.	.	.	X	X	.
<i>Ifecysta</i> Jan du Chêne & Adediran sp.	X	.	.	.	.	.	.
<i>Impagidinium</i> / <i>Pterodinium</i> sp.	.	X	.	.	.	.	.
<i>Kenleyia</i> group	.	.	.	.	X	X	.
<i>Operculodinium</i> Wall 1967 sp.	X	.	.	X	X	X	.
<i>Palaeocystodinium</i> Alberti 1961 (fat)	.	.	.	X	.	X	.
<i>Palaeocystodinium</i> Alberti 1961 sp.	X	.	.	.	.	.	.
<i>Palaeocystodinium golzowense</i> Alberti 1961	.	.	.	.	X	X	.
<i>Palaeoperidinium pyrophorum</i> (Ehrenberg 1838) Sarjeant 1967	.	.	.	X	.	.	.
<i>Phelodinium magnificum</i> (Stanley 1965) Stover & Evitt 1978 (various forms)	X	X	.	X	X	.	.
<i>Phelodinium</i> sp. of Edwards (1989)	.	.	.	?	X	X	.
<i>Spinidinium densispinatum</i> Stanley 1965	X	X	.	.	X	.	.
<i>Spinidinium pulchrum</i> (Benson 1976) Lentin & Williams 1977	X	X	?	.	.	.	.
<i>Spinidinium</i> Cookson & Eisenack 1962 spp.	X	X	X	.	.	X	X
<i>Spiniferites</i> Mantell 1850 spp.	.	X	X	X	X	X	.
<i>Tectatodinium rugulatum</i> (Hansen 1977) McMinn 1988 s.l.	.	X	.	.	.	.	.
<i>Tenua</i> sp. cf. <i>T. formosa</i> of Kurita and McIntyre (1995)	.	X	.	.	.	.	.
miscellaneous areoligeracean forms	X	X	.	X	X	.	.
small peridiniacean forms	X	X	X	X	X	X	.
acritarch: <i>Catillopsis</i> sp.	X	.	X	.	X	X	.
(reworked) <i>Chatangiella</i> sp.	X	.	.	.	.	.	.

X=present, .=not present, ?=questionably present

**Figure 8.** Distribution of dinocyst taxa in Paleocene samples from the SRS P21TA corehole (BRN-335), Barnwell County, South Carolina.

Depth (Ft)	444	440	426.0	414.0	380	370
Sample	R3574A B	R3574A C	R3574A D	R3574A E	R3574A I	R3574A J
Age	Probably early Danian	Probably early Danian	Late? Danian	Late Danian	Selandian	Selandian
Pollen Taxa						
<i>Aesculiidites circumstriatus</i>	.	.	.	.	X	X
<i>Alnus</i> sp.	.	.	.	.	.	X
<i>Bombacacidites nanobrochatus</i>	.	.	.	.	.	X
<i>Bombacacidites paulus</i>	.	X	.	.	.	.
<i>Bombacacides reticulatus</i>	X	X	X	X	.	X
<i>Caryapollenites prodromus</i> group	.	.	.	X	.	.
<i>Choanopollenites conspicuus</i>	.	.	.	.	X	X
<i>Favitricolporites baculoferus</i>	.	X	X	X	.	.
<i>Lanagiopollis cribellatus</i>	.	.	.	.	.	X
<i>Milfordia minima</i>	X	.	.	.	.	.
<i>Momipites coryloides/microfoveolatus</i>	X	.	X	X	.	X
<i>Momipites dilatus</i>	.	.	.	prob.	.	X
<i>Momipites tenuipolus</i> group	X	X	X	X	.	.
<i>Nudopollis terminalis</i>	X	X	X	.	.	X
<i>Nyssapollenites paleocenicus</i>	X	X	.	.	X	X
<i>Osculapollis? colporatus</i>	X	X	X	X	.	X
<i>Plicatopollis triradiatus</i>	.	.	X	.	.	.
<i>Pseudoplicapollis limitatus</i>	.	.	.	X	.	X
<i>Pseudoplicapollis serenus</i>	X	.	X	X	.	.
<i>Tricolpites asper</i>	.	X	.	.	.	.
<i>Tricolpites microreticulatus</i>	X?	.	.	.	.	.
<i>Trudopollis</i> spp., including <i>T. plenus</i>	.	.	.	.	.	X

**Figure 9.** Distribution of pollen taxa in Paleocene samples from the SRS P21TA corehole (BRN-335), Barnwell County, South Carolina.





Depth (Ft)	368.3'	365.4'	360.6'	353.2'	348.5'	343.5'	331.4'	322.3'	315.4'	307.6'	302.5'	295.0'	286.0'	276.2'	270.7'	266.5'	253.2'	237.6'	229.3'	222.6'	214.6'	205.9'	200.5'	195.0'
Inferred Nannofossil Zone	NP 4	NP 4	Contam	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5 U	??	NP 5 U	NP 5 U	NP 8	NP 8	NP 8	NP 8	NP 8
Taxa; Biostratigraphic Ranges																								
<i>Biscutum</i> spp. NP 1-12?										X														
<i>Braarudosphaera bigelowii</i> Cret-Recent						X	X	X																
<i>Chiasmolithus bidens</i> NP 5-16				sm	sm	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Chiasmolithus consuetus</i> s.l. NP 3-								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Chiasmolithus</i> spp.																	X							
<i>Coccolithus cribellum</i>	X																							
<i>Coccolithus pelagicus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Cruciplacolithus asymmetricus</i> NP 1-5								1?																
<i>Cruciplacolithus edwardsii</i> NP 2?-5?														X	?									
<i>Cruciplacolithus intermedius</i> NP 1-	X														?									
<i>Cruciplacolithus primus</i> NP 1-5	X	X						X																
<i>Cruciplacolithus tenuis</i> NP 2-9	X	X																						
<i>Cruciplacolithus</i> spp.							X								X									X
<i>Cyclagelosphaera alta</i> NP 3-5		?																						
<i>Cyclagelosphaera reinhardtii</i> NP 1-5								X																
<i>Cyclococcolithus</i> spp.	X													X										
<i>Dictyococcites bisectus</i> NP 16-NN 1			C																					
<i>Dictyococcites scrippsae</i> NP 16-24?																C								
<i>Discoaster distinctus/deflandrei</i> NP 12-NN 7																C								
<i>Discoaster woodringii</i> NP 19/20-21,24-25																					C	?	C	
<i>Discoaster</i> spp.																							5C	
<i>Ellipsolithus bollii</i> NP 4-5	X	X												X										
<i>Ericsonia subpertusa</i> NP 1-12?	X	X				X		X						X						X				X
<i>Fasciculithus involutus</i> NP 5-10																					X			
<i>Fasciculithus tympaniformis</i> NP 5-10																					X			
<i>Fasciculithus ulii</i> NP 5									X					X										
<i>Fasciculithus</i> spp.							X																	X
<i>Goniolithus fluckigeri</i> Cret-NP 25?															X									
<i>Helicosphaera bramlettei</i> NP -25																								C
<i>Helicosphaera intermedia</i>								C																
<i>Helicosphaera lophota</i> NP 12-																		?	C					C
<i>Helicosphaera</i> spp.			C																					
<i>Heliolithus cantabriae</i> NP 5-8																X			X	?				
<i>Heliolithus riedelii</i> NP 8-9																					X			X
<i>Hornibrookina arca</i> NP 3-10																X				X				X
<i>Markalius apertus</i> NP 3-10?	X	?																						
<i>Markalius inversus</i> NP 1-21										X														
<i>Micrantholithus vesper</i>	??																							
<i>Neochiastozygus concinnus</i> NP 2?-11										X				X						X				
<i>Neochiastozygus junctus</i>																					X			X
<i>Neococcolithes</i> sp. aff. <i>N. protenus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Placozygus sigmoides</i> NP 1-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Pontosphaera multipora</i>																								?
<i>Reticulofenestra abisecta</i> NP 24?-NN1			C				C	1C																
<i>Reticulofenestra daviesii</i> NP 13-			C																					
<i>Reticulofenestra floridana</i> NP 13?-NN 6?	1C		C																					
<i>Reticulofenestra</i> spp.																C								
<i>Sphenolithus anarrhopus</i>																								X
<i>Sphenolithus ciperiensis</i> NP 24-25																								
<i>Sphenolithus primus</i>	?																							
<i>Sphenolithus</i> spp.																								
<i>Thoracosphaera</i> spp.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Toweius eminens eminens</i> NP 5?-10																								X

Depth (Ft)	368.3'	365.4'	360.6'	353.2'	348.5'	343.5'	331.4'	322.3'	315.4'	307.6'	302.5'	295.0'	286.0'	276.2'	270.7'	266.5'	253.2'	237.6'	229.3'	222.6'	214.6'	205.9'	200.5'	195.0'
Inferred Nannofossil Zone	NP 4	NP 4	Contam	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5	NP 5 U	??		NP 5 U	NP 5 U	NP 8			NP 8
Taxa; Biostratigraphic Ranges																								
<i>Toweius eminens tovae</i> NP 5-9																X				X	X			X
<i>Toweius pertusus</i> NP 4-12	X	X		X		X		X		X					X sm	X				X				
<i>Toweius serotinus</i> NP 9-10																					X			X
<i>Zygodiscus herlyni</i> NP 7-11																				2				X
Cretaceous forms	R	R																						
Abundance	C+	C-	A	C+	C-	C-	C								A	F+	C-	R			C-	C-		F+
Preservation	M	G	P		M+		P	P							G	P	P	T			G	M		G
Legend:																								
species range w/ known FAD's & LAD's																								
interval where species is absent but should occur																								
species range w/ unknown FAD's & LAD's																								
reworked, contaminated, aberrant occurrences				R	C																			
barren sample																								
FAD's and LAD's for Martini (1971) zones																								
FAD's and LAD's used to define age of unit																								
FAD's and LAD's consistent with known ranges																								
questionable & really questionable occurrences				?	??																			
1, 2, 3 specimens in sample					1																			
aff.					@																			
pacolith with a narrow rim					nr																			
small specimen					sm																			
small central area					sc																			
number of rays for discoasters & bifurcated rays					6r	6b																		
Martini (1971) zonal markers ( <b>bold</b> )																								
Abundance: A, Abundant; C, Common; F, Frequent; R, Rare; B, Barren																								
Preservation: G, Good; M, Moderate; P, Poor																								

**Figure 11.** Distribution of calcareous nannofossil taxa in Paleocene samples from the USGS Moores Landing corehole (CHN-802), Charleston County, South Carolina.

Depth (Ft)																									
	Calcareous Nannofossil Zone																								
Taxa	Biostratigraphic Ranges																								
<i>Biantholithus sparsus</i> NP 1–9									X																
<i>Biscutum</i> spp. NP 1–12?	X						X																		
<i>Braarudosphaera bigelowii</i> Cret–Recent	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X								
<i>Braarudosphaera discula</i>										X															
<i>Braarudosphaera</i> spp.																									
<i>Chiasmolithus bidens</i> NP 5–16																									
<i>Chiasmolithus</i> sp. aff. <i>C. bidens</i> NP 4																									
<i>Chiasmolithus consuetus</i> s.l. NP 3–																									
<i>Chiasmolithus</i> spp.																									
<i>Coccolithus cribellum</i>																									
<i>Coccolithus pelagicus</i>																									
<i>Cruciplacolithus asymmetricus</i> NP 1–5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Cruciplacolithus edwardsii</i> NP 2?–5?																									
<i>Cruciplacolithus intermedius</i> NP 1–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Cruciplacolithus primus</i> NP 1–5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Cruciplacolithus tenuis</i> NP 2–9	1	X	X																						
<i>Cruciplacolithus</i> spp.																									
<i>Cyclagelosphaera alta</i> NP 3–5																									
<i>Cyclagelosphaera prima</i> NP 1–10	X	X																							
<i>Cyclagelosphaera reinhardtii</i> NP 1–5																									
<i>Cyclagelosphaera</i> spp.																									
<i>Cyclococcolithus robustus</i>																									
<i>Cyclococcolithus</i> spp.																									
<i>Ellipsolithus bollii</i> NP 4–5																									
<i>Ellipsolithus distichus</i> NP 4–12																									
<i>Ellipsolithus macellus</i> NP 4–12																									
<i>Ericsonia subpertusa</i> NP 1–12?	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Fasciculithus involutus</i> NP 5–10																									
<i>Fasciculithus</i> spp.																									
<i>Goniolithus fluckigeri</i> Cret–NP 25?	X																								
<i>Heliolithus cantabriae</i> NP 5–8																									
<i>Heliolithus kleinpellii</i> NP 6–8																									
<i>Heliolithus</i> spp.																									
<i>Hornibrookina</i> spp.																									
<i>Lanternithus duocavus</i> NP 1–5?																									
<i>Lanternithus</i> sp.																									
<i>Markalius apertus</i> NP 3–10?																									
<i>Markalius inversus</i> NP 1–21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Micrantholithus aequalis</i>																									
<i>Micrantholithus fornicatus</i>																									
<i>Micrantholithus pinguis</i>																									
<i>Micrantholithus vesper</i>																									
<i>Micrantholithus</i> spp.																									
<i>Neochiastozygus concinnus</i> NP 2?–11?																									
<i>Neococcolithes</i> sp. aff. <i>N. protenus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Neococcolithes</i> spp.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X





Depth (Ft)	972.1-972.4	901.0-901.3	823.0-823.3	729.0-729.4	719.1-719.4
	Sample	R6122 AL	R6122 AK	R6122 AJ	R6122 AI
Series	Paleocene				
Subseries	upper				
Taxa					
? <i>Andalusiella rhombohedra</i> of Edwards and others (1984)	X	X	.	.	.
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	X	.	.	.	X
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	?	X	X	X	X
<i>Deflandrea delineata</i> Cookson & Eisenack 1965	?	X	X	X	.
<i>Exochosphaeridium</i> Davey et al. 1966 sp.	X	.	.	.	.
<i>Fibradinium annetorpense</i> Morgenroth 1968	X	.	.	.	.
<i>Fibrocysta</i> Stover & Evitt 1978 sp.	X	.	.	.	.
<i>Fromea fragilis</i> (Cookson & Eisenack 1962) Stover & Evitt 1978	.	.	.	.	X
<i>Hystrichokolpoma unispinum</i> Williams & Downie 1966	.	.	.	.	X
<i>Impagidinium</i> Stover & Evitt 1978 spp.	X	.	.	.	.
<i>Kallosphaeridium brevibarbatum</i> de Coninck 1969	.	.	.	.	X
<i>Kallosphaeridium</i> De Coninck 1969 spp.	X	.	.	.	.
<i>Nematosphaeropsis</i> Deflandre & Cookson 1955 sp.	.	?	.	.	X
<i>Operculodinium</i> Wall 1967 spp.	X	.	.	.	X
<i>Palaeocystodinium golzowense</i> Alberti 1961	X	X	.	X	.
<i>Phelodinium</i> Stover & Evitt 1978 sp.	X	.	.	.	.
<i>Phelodinium</i> sp. of Edwards (1989)	X	X	.	X	.
<i>Spinidinium</i> Cookson & Eisenack 1962 spp.	X	.	.	.	.
<i>Spiniferites mirabilis</i> (Rossignol 1964) Sarjeant 1970	.	.	.	.	.
<i>Spiniferites pseudofurcatus</i> (Klumpp 1953) Sarjeant 1970	X	.	.	.	.
<i>Spiniferites</i> Mantell 1850 spp.	X	X	.	X	X
<i>Turbiosphaera filosa</i> (Wilson 1967) Archangelsky 1969	.	.	.	X	.
miscellaneous areoligeracean forms	X	X	.	.	X
miscellaneous cladopyxidiacean forms	.	.	.	X	.
small peridiniacean forms	X	.	.	X	X
X=present, .=not present, ?=questionably present					

**Figure 13.** Distribution of dinocyst taxa in Paleocene samples from the USGS/DNR Edisto Island corehole (COL-364), Colleton County, South Carolina.

Depth (Ft)	972.4	962.3	952.3	923.5	906.9	894.0	874.0	866.0	856.6	847.6	838.2	815.0	805.5	794.3	791.5	769.6	757.6	742.1	729.0	723.8	716.0	706.0
Calcareous Nannofossil Zone	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	NP 5	NP 5	upper NP 5	upper NP 5	NP 8	NP 8	NP 8	NP 8	NP 8
Taxa	Biostratigraphic Ranges																					
<i>Biscutum</i> spp. NP 1-12?	X																					
<i>Blackites</i> spp.																						C
<i>Braarudosphaera bigelowii</i> Cret-Recent	X		X	X	X	X	X	X	X	X	X	X	X						X			X
<i>Campylosphaera dela</i> NP 9-17																						C
<i>Cepekiella lumina</i> NP 11-24?																						1C
<i>Chiasmolithus bidens</i> NP 5-16	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X		X
<i>Chiasmolithus consuetus</i> s.l. NP 3-			X	X			X		X		X								X		X	X
<i>Coccolithus pelagicus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Cruciplacolithus asymmetricus</i> NP 1-5	X	X		X	X																	
<i>Cruciplacolithus primus</i> NP 1-5			X	X						X												
<i>Cruciplacolithus tenuis</i> NP 2-9	X		X	X				X		X												
<i>Cruciplacolithus</i> spp.			X		X	X		X		X								X			X	X
<i>Cyclagelosphaera</i> spp.	X		X									X	X									
<i>Cyclococcolithus</i> spp.	X		X	X	X	X	X			X	X		X									X
<i>Discoaster mohleri</i> NP 7-8?																			X		X	
<i>Discoaster</i> spp.				1C																		
<i>Ellipsolithus bollii</i> NP 4-5			X	X	X		X		X	X	X	X	X									
<i>Ellipsolithus distichus</i> NP 4-12						X	X												X			X
<i>Ellipsolithus macellus</i> NP 4-12						X	X	X	X	X												
<i>Ericsonia subpertusa</i> NP 1-12?	X	X	X	X	X	X	X	X	X	X	X	X	X			X			X		X	X
<i>Fasciculithus involutus</i> NP 5-10									X										X			
<i>Fasciculithus ulii</i> NP 5			X	X	X	X		X				X	X									
<i>Fasciculithus</i> spp.										X									X			
<i>Goniolithus fluckigeri</i> Cret-NP 25?	X	X																				
<i>Heliolithus cantabriae</i> NP 5-8																X			X			X
<i>Heliolithus riedelii</i> NP 8-9																			X	X		X
<i>Hornibrookina arca</i> NP 3-10																			X	X		
<i>Isthmolithus recurvus</i> NP 19/20-21																						1C
<i>Lophodolichus</i> spp.																						?
<i>Markalius apertus</i> NP 3-10?	X			X					X			X							X			X
<i>Markalius inversus</i> NP 1-21				X	X		X	X														X
<i>Micrantholithus inaequalis</i>																				?		
<i>Micrantholithus pinguis</i>																				?		
<i>Micrantholithus</i> spp.	X		X			X																X
<i>Neochiastozygus concinnus</i> NP 2?-11		X	X		X		X	X	X	X	X	X	X					X	X			X
<i>Neochiastozygus junctus</i>																				X		
<i>Neococcolithes</i> sp. aff. <i>N. protenus</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Neocrepidolithus</i> spp.				X			X															
<i>Pemma</i> spp.																						?
<i>Placozygus sigmoides</i> NP 1-10	X	X	X	X	X	X	X	X	X	X	X	X	X						X	X		
<i>Pontosphaera</i> spp.				X																		
<i>Praeprinsius</i> spp.			X																			
<i>Reticulofenestra umblicus</i> NP 16-22																						1C
<i>Reticulofenestra</i> spp.												C										
<i>Scapholithus apertus</i> NP 5-10																			X		X	
<i>Sphenolithus anarrhopus</i>																			X			
<i>Sphenolithus primus/moriformis</i>				X			X		X	X									X		X	
<i>Sphenolithus</i> spp.						X							?									
<i>Thoracosphaera</i> spp.	X	X	X	X	X	X	X	X	X	X	X	X							X			
<i>Toweius eminens eminens</i> NP 5?-10																			X			X
<i>Toweius eminens tovae</i> NP 5-9								X	X										X	X	X	X
<i>Toweius pertusus</i> NP 4-12	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Toweius serotinus</i> NP 9-10				1C																		
<i>Transversopontis pulcher</i> NP 9-17?												C										2C
<i>Zygodiscus herlyni</i> NP 7-11																			X	X		X
placoliths														X								

Depth (Ft)	972.4	962.3	952.3	923.5	906.9	894.0	874.0	866.0	856.6	847.6	838.2	815.0	805.5	794.3	791.5	769.6	757.6	742.1	729.0	723.8	716.0	706.0	
Calcareous Nannofossil Zone	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	NP 5	NP 5	upper NP 5	upper NP 5	NP 8	NP 8	NP 8	NP 8	NP 8	
Taxa	Biostratigraphic Ranges																						
Cretaceous forms	R		R																	R			
Abundance	F+	F+	C-	A	C-	C	C-	C-	C-	C-	C+	C-	F+	R	F-	F-	C+	A	F-	A	C+		
Preservation	M	M+	M	M	M	M	M	M	M	M	M	M	M	P	P	P		M	G	P	M-	P	
<b>Legend</b>																							
Species range with known FAD's & LAD's																							
Interval where species is absent but should occur																							
Species range with unknown FAD's & LAD's																							
Reworked, contaminated, aberrant occurrences																							
FAD's and LAD's for Martini (1971) zones																							
FAD's and LAD's used to define age of unit																							
FAD's and LAD's consistent with known ranges																							
Questionable occurrences																							
1, 2, 3 specimens in sample																							
Martini (1971) zonal markers ( <b>bold</b> )																							
Abundance: A, Abundant; C, Common; F, Frequent; R, Rare																							
Preservation: G, Good; M, Moderate; P, Poor																							

**Figure 14.** Distribution of calcareous nannofossil taxa in Paleocene samples from the USGS/DNR Edisto Island corehole (COL-364), Colleton County, South Carolina.

Depth in ft	972.1-972.4	901.0-901.3	823.0-823.3	729.0-729.4	719.1-719.4
Sample	R6122AL	R6122AK	R6122AJ	R6122AI	R6122AH
Age or NP zone equivalent	Very sparse pollen	Apparently NP5	Paleocene, older than mid-NP5?	Paleocene, NP5 or younger	Paleocene, NP8 or younger
Taxa					
<i>Aesculiidites circumstriatus</i>	.	.	.	X	.
<i>Carya</i> <29µm range base = mid-NP5	.	.	.	X	X
<i>Choanopollenites</i> sp. cf. <i>C. consanguineus</i>	.	X	X	.	.
<i>Choanopollenites conspicuus</i> Range top = NP5	.	X	.	.	.
<i>Favitricolporites baculoferus</i>	.	.	X	X	X
<i>Momipites actinus</i>	.	.	.	.	X
<i>Momipites dilatus</i> Range top = NP8	.	X	.	.	.
<i>Momipites strictus</i>	.	.	.	.	X
<i>Nudopollis terminalis</i>	.	.	X	.	X
<i>Nudopollis thiergartii</i>	.	.	.	X	.
<i>Platycarya</i> sp. A NP8 to lower Eocene	.	.	.	.	X
<i>Plicatopollis triorbicularis</i> type	.	.	.	X	X
<i>Plicatopollis triradiatus</i>	.	.	.	X	X
<i>Pseudoplicapollis limitatus</i>	.	.	X	X	.
<i>Sparganiaceapollenites</i> sp.	.	.	.	X	.
<i>Spinaepollis spinosus</i> Range base = approx. NP 4-5 bound.	.	X	.	X	.
<i>Thomsonipollis magnificus</i>	.	.	X	X	X
<i>Trudopollis</i> spp., including <i>T. plenus</i>	.	X	X	.	X

**Figure 15.** Distribution of pollen taxa in Paleocene samples from the USGS/DNR Edisto Island corehole (COL-364), Colleton County, South Carolina.

	Depth (Ft)*	797	780	768	758	741	739	729	700	652	643	633	629	600	587	543	531	525	500	450
	Sample	R4209 AB	R4209 AC	R4209 AD	R4209 AE	DC-19	R4209 AF	R4209 AG	DC-18	R4209 AJ	DC-17	R4209 AK	R4209 AL	DC-16	R4209 H	DC-15	DC-14	DC-13	DC-12	DC-11
Taxa																				
<i>Achomosphaera alcicornu</i> (Eisenack 1954) Davey & Williams 1966	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.
<i>Amphorosphaeridium ? multispinosum</i> (Davey & Williams 1966) Sarjeant 1981	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.
<i>Andalusiella</i> sp. aff. <i>A. polymorpha</i> of Edwards (1980)	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Andalusiella</i> Riegel 1974 spp.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
? <i>Andalusiella rhombohedra</i> of Edwards and others (1984)	.	X	X	.	.	.	.	.	X	X	.	.	.	.	X	X	X	.	.	.
<i>Apectodinium homomorphum</i> (Defl. & Cook. 1955) Lentin & Williams 1977	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
<i>Areoligera volata</i> Drugg 1967	X	.	X	X	.	X	X	.	X	.	.	.	cf	.	.	.	.	.	.	.
? <i>Canningia</i> Cookson & Eisenack 1960 sp.	.	.	X	X	.	X	X	.	.	.	.	.	X	.	.	.	.	.	.	.
cf. <i>Catillopsis</i> Drugg 1970	.	X	X	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	.	.	X	X	.	.	.	.	X	.	.	.	X	.	.	.	.	.	.	.
<i>Cordosphaeridium gracile</i> (Eisenack 1954) Davey & Williams 1966	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	X
<i>Cordosphaeridium inodes</i> (Klumpp 1953) Eisenack 1963	X	X	X	.	.	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cordosphaeridium</i> Eisenack 1963 spp.	.	.	.	.	.	.	.	.	X	.	.	.	X	.	X	.	.	.	.	.
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	X	?	.	.	.	X	X	.	X	.	.	.	X	.	X	.	.	?	X	.
<i>Deflandrea delineata</i> Cookson & Eisenack 1965	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	X	.	X	X
<i>Deflandrea</i> cf. <i>D. diebelii</i> Alberti of Drugg (1967)	X	X	X	X	.	X	.	.	X	X	.	.	.	.	.	.	.	.	.	.
<i>Deflandrea</i> n. sp. aff. <i>D. truncata</i> Eisenack 1938	X	X	X	cf	.	X	X	.	X	.	.	.	.	.	.	.	.	.	.	.
<i>Diphyes colligerum</i> (Deflandre & Cookson 1955) Cookson 1965	X	X	X	.	.	X	X	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Disphaerogena carposphaeropsis</i> Wetzel 1933	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Exochosphaeridium</i> Davey et al. 1966 spp.	X	X	X	X	X	X	X	.	X	X	.	cf	X	.	.	.	.	.	.	.
<i>Fibradinium annetorpense</i> Morgenroth 1968	.	X	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Fibrocysta lappacea</i> (Drugg 1970) Stover & Evitt 1978	.	.	.	?	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Gonyaulacacysta</i> group	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hafniasphaera septata</i> (Cookson & Eisenack 1967) Hansen 1977	.	?	X	X	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Hafniasphaera</i> Hansen 1977 sp.	X	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hystrichokolpoma</i> Deflandre 1935 spp.	.	X	X	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hystrichosphaeridium tubiferum</i> (Ehrenberg 1838) Deflandre 1937	.	X	X	.	.	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Impagidinium</i> Stover & Evitt 1978 spp. (and transitional forms)	.	X	X	.	.	X	X	.	X	.	.	.	X	.	.	.	.	.	.	.
<i>Ifecysta</i> Jan du Chêne & Adediran 1985 sp.	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Depth (Ft)*	797	780	768	758	741	739	729	700	652	643	633	629	600	587	543	531	525	500	450
Sample	R4209 AB	R4209 AC	R4209 AD	R4209 AE	DC-19	R4209 AF	R4209 AG	DC-18	R4209 AJ	DC-17	R4209 AK	R4209 AL	DC-16	R4209 H	DC-15	DC-14	DC-13	DC-12	DC-11
Taxa																			
<i>Kallosphaeridium</i> de Coninck 1969 ? sp.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Operculodinium centrocarpum</i> (Deflandre & Cookson 1955) Wall 1967	.	X	X	X	.	.	X	.	X	.	.	.	.	X	.	.	.	.	.
<i>Palaeocystodinium golzowense</i> Alberti 1961	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	.	.
<i>Palaeocystodinium</i> Alberti 1961 sp. (fat)	X	X	X	X	X	X	X	X	X	X	.	X	.	.	.	.	.	.	.
<i>Palaeoperidinium pyrophorum</i> (Ehrenberg 1838) Sarjeant 1967	.	X	X	X	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.
<i>Phelodinium magnificum</i> (Stanley 1965) Stover & Evitt 1978	.	X	X	.	.	.	.	X	X	X	.	.	.	.	.	.	.	.	.
<i>Phelodinium</i> sp. of Edwards (1989)	.	.	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	X	.
<i>Phelodinium</i> Stover & Evitt 1978 sp.	X	.	.	.	X	X	X	.	.	.	.	.	.	.	.	.	.	.	.
<i>Senoniasphaera inornata</i> (Drugg 1970) Stover & Evitt 1978	.	X	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.
<i>Spinidinium pulchrum</i> (Benson 1976) Lentin & Williams 1977	X	X	X	X	X	X	X	X	X	.	.	cf	.	.	.	.	.	.	.
<i>Spinidinium</i> Cookson & Eisenack 1962 spp.	X	X	X	X	X	X	X	X	X	X	.	.	.	.	X	.	X	.	.
<i>Spiniferites</i> Mantell 1850 spp.	X	X	X	X	.	X	X	X	X	.	.	X	.	X	.	.	.	.	.
<i>Tanyosphaeridium xanthiopyxides</i> (Wetzel 1933) Stover & Evitt 1978	X	X	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Tectatodinium rugulatum</i> (Hansen 1977) McMinn 1988 ( <i>sensu amplo</i> )	.	.	X	X	.	X	X	.	X	X	.	.	.	.	.	.	.	.	.
<i>Tenua</i> sp. cf. <i>T. formosa</i> of Kurita and McIntyre (1995)	.	.	X	cf	.	cf	.	.	X	.	X	.	.	.	.	.	.	.	.
<i>Trithyrodinium</i> Drugg 1967 sp.	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tubiosphaera filosa</i> (Wilson 1967) Archangelsky 1969	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
<i>Turbiosphaera</i> sp. aff. <i>T. magnifica</i> Eaton of Edwards (1989)	.	.	.	.	.	.	!	.	.	.	.	.	.	.	.	.	.	X	.
<i>Veryhachium</i> -group acritarch	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
miscellaneous areoligeracean forms	X	X	X	X	.	.	X	.	.	.	.	X	.	X	.	.	.	.	.
miscellaneous cladopyxiacean forms	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
small peridiniacean forms	.	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	X	.
*Depths recorded at the time of sampling. To convert to log depths, add 5 ft.																			
cf = similar to this taxon.																			

**Figure 16.** Distribution of dinocyst taxa in Paleocene samples from the USGS Clubhouse Crossroads No. 1 corehole (DOR-37), Dorchester County, South Carolina.

Depth (Ft)	Biostratigraphic Ranges	
	Calcareous Nannofossil Zone	Taxa
435.0	NP 9	
443.0	Barren	
445.0	Barren	
448.0	Barren	
449.0	NP 9	
450.0	NP 9	
451.0	NP 9	
454.0	NP 9	
501.0	upper NP 57	
502.0	upper NP 57	
511.0	upper NP 57	
521.0	upper NP 57	
522.0	upper NP 57	
531.0	upper NP 5	
535.0	NP 5	
539.0	Barren	
551.0	NP 5	
557.0	NP 5	
561.0	NP 5	
562.0	NP 5	
571.0	NP 5	
575.0	NP 5	
581.0	NP 5	
587.0	NP 5	
591.0	NP 5	
597.0	NP 5	
601.0	NP 5	
607.0	NP 5	
611.0	NP 5	
617.0	NP 5	
621.0	NP 5	
627.0	Barren	
631.0	Barren	
635.0	Barren	
643.0	NP 3	
647.0	NP 3	
651.0	NP 3	
653.0	NP 3	
681.0	NP 3	
685.0	NP 3	
699.0	NP 3	
707.0	NP 3	
711.0	NP 3	
715.0	NP 2	
720.0	NP 2	
721.0	NP 2	
726.0	NP 2	
730.0	NP 2	
735.0	NP 2	
741.0	NP 2	
759.0	NP 1	
761.0	NP 1	
767.0	NP 1	
771.0	NP 1	
776.5	NP 1	
781.0	NP 1	
788.0	NP 1	
792.0	NP 1	
792.5	NP 1	
793.5	NP 1	
794.0	NP 1	
794.5	NP 1	
794.7	NP 1	
795.0	NP 1	
796.0	NP 1	





Core depth (Ft)*	797	792	780	768	758.3	741	700	643	629	626	613	600	587	573	564	553	543	531	527	525	524	
Sample	R4209AB	DC-792	R4209AC	R4209AD	R4209AE	DC-19	DC-18	DC-17	R4209AL	R4209J	R4209I	DC-16	R4209H	R4209G	R4209F	R4209E	DC-15	4209D	R4209C	DC-13	DC-524	
Age or NP zone equivalent	Type Rhems age**	Type Rhems age**	Type Rhems age**	Type Rhems age**	Possible type Rhems age**	Prob. NP 3-5	Apparently early NP4 (latest Danian)	Late Danian	Paleocene	Paleocene, not younger than NP8	Paleocene, not younger than NP8	Late NP4 to NP5	Paleocene, not younger than NP8	Late NP4 to NP5	Late NP4 to NP5	Late NP4 to NP5	Late NP4 to NP5	Late NP4 to NP5	Late NP5	Late NP4 to NP5	Paleocene, not older than mid-NP5	
Taxa; known biostratigraphic ranges																						
<i>Aesculioidites circumstriatus</i> NP 4-10	-	-	-	-	-	-	-	-	-	-	-	X	X	X	Q	-	X	-	-	-	X	-
<i>Bombacacidites nacimientensis</i>	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-
<i>Bombacacidites reticulatus</i>	-	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	-	-	X
<i>Carya</i> <29µm Mid-NP5-NP16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
<i>Caryapollenites prodromus</i> group	-	-	-	X	X	-	-	-	-	-	-	-	-	X	-	-	-	X	X	-	-	-
<i>Choanopollenites alabamicus</i> Cret.-NP8	-	X	-	prob.	X	-	X	-	-	-	X	-	X	-	-	-	-	-	-	-	-	-
<i>Choanopollenites</i> sp. cf. <i>C. consanguineus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Choanopollenites conspicuus</i> Low. Paleocene-NP8	-	X	-	X	-	-	-	-	-	X	-	-	X	-	-	-	-	-	-	X	-	-
<i>Choanopollenites patricius</i> NP5-NP8 or ?9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Faguspollenites</i> sp.	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
<i>Favritocolporites baculoferus</i> Low. Paleocene - NP 10 or 15	-	X	-	X	X	-	-	-	-	X	X	-	X	X	X	X	X	X	X	X	X	-
<i>Holkopollenites chemardensis</i>	-	X	-	X	-	X	X	X	X	-	-	-	X	-	X	X	X	X	-	-	-	-
<i>Interpollis paleocenicus</i>	X	X	-	-	X	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	-
<i>Intratrirporopollenites pseudinstructus</i>	-	-	-	-	X	X	X	X	-	X	-	-	X	X	-	-	X	X	X	X	X	-
<i>Jarzenipollis trinus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Labrapollis globosus</i>	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
<i>Lanagiopollis cribellatus</i>	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
<i>Lanagiopollis lihokus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-
<i>Matanomadhiasulcites maximus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Milfordia incerta</i>	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-
<i>Milfordia minima</i> Base = NP4	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
<i>Momipites actinus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
<i>Momipites coryloides</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Momipites dilatus</i>	-	X	-	-	-	X	X	X	-	-	-	-	X	-	-	-	X	-	-	X	-	-
<i>Momipites flexus</i>	-	-	-	-	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
<i>Momipites microfoveolatus</i>	-	X	-	-	-	X	X	X	-	-	-	X	-	-	-	-	X	-	-	-	X	-
<i>Momipites strictus</i>	-	X	-	X	-	-	X	X	-	-	-	X	X	-	-	-	-	-	-	-	-	-
<i>Momipites tenuipolus</i> group	X	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Nudopollis endangulatus</i> NP6?-9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Nudopollis terminalis</i>	-	-	-	X	X	-	X	-	X	-	X	-	X	X	X	X	X	X	X	X	X	X
<i>Nudopollis thiergartii</i> Cret.-NP9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
<i>Nyssapollenites paleocenicus</i> type Rhems	X	X	X	X	poss.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Osculapollis ? colporatus</i> NP 3-5	-	-	-	-	-	X	X	X	-	-	-	X	-	X	X	X	X	X	X	X	X	X
<i>Platycarya platycaryoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Platycaryapollenites swasticoides</i> NP 10-?15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Platycarya</i> sp. A Base = NP8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Platycarya</i> sp. cf. <i>P.</i> sp. A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Plicatopollis triobicularis</i> type	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
<i>Plicatopollis triradiatus</i>	-	X	-	-	X	-	X	-	-	-	X	-	X	X	-	X	X	X	X	X	X	X
<i>Porocolpopollenites ollivierae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X
<i>Pseudoplicapollis limitatus</i> NP-3? - NP9	-	-	-	-	-	-	X	-	X	X	X	X	-	-	X	X	X	-	-	-	X	-
<i>Pseudoplicapollis serenus</i> Cret. and Danian	X	X	-	X	-	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Retitrescolpites anguloluminosus</i>	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
<i>Sparganiaceapollenites</i> sp.	-	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Spinaepollis spinosus</i> Top = NP9	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	X	-	-	-
<i>Subtriporopollenites anulatus</i> NP3-12 or 15	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
<i>Subtriporopollenites nanus</i> NP5-12 or 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Thomsonipollis magnificus</i> Cret.? - NP10	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-	-	X	X	X	X
<i>Tricolpites asper</i>	-	-	-	X	-	X	X	X	-	-	-	X	X	-	X	-	X	X	X	X	X	X
<i>Tricolpites crassus</i> NP 7 or 8 - 9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Triporopollenites microgranulatus</i>	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
<i>Trudopollis</i> spp., including <i>p. plenus</i> <sup>s</sup>	-	-	-	-	-	-	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Ulmipollenites krempii</i>	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
<i>Ulmipollenites tricostatus</i>	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X

\*Depths recorded at the time of sampling. To convert to log depths, add 5 ft.  
 \*\*The Rhems Formation appears to be mainly or entirely of Danian (early Paleocene) age.

Figure 18. Distribution of pollen taxa in Paleocene samples from the USGS Clubhouse Crossroads No. 1 corehole (DOR-37), Dorchester County, South Carolina.

Core depth (Ft)*	518.5	506	500	488	478	466.9-468.6	466.8	451	450	448	434
Sample	R4209B	R4209A	DC-12	R5113E	DC478	R5113C	DC466'9"	DC451	DC-11	DC448	DC-10
Age or NP zone equivalent	Mid-NP5 to NP8	Mid-NP5 to NP8 or 9	NP 8-9	Mid-NP5 to NP9	NP 8-9	Late Paleocene	NP 7 or 8 to NP9	NP 7 or 8 to NP9	Mid-NP5 to NP9	NP 7 or 8 to NP9	Prob. NP 10
Taxa; known biostratigraphic ranges											
<i>Aesculiidites circumstriatus</i> NP 4-10	.	X	X	.	.	.	X	.	.	.	X
<i>Bombacacidites nacimientoensis</i>	.	.	X	X	C	.	.	.	.	X	.
<i>Bombacacidites reticulatus</i>	X	X	X	X	X	.	X	.	.	.	.
<i>Carya</i> <29µm Mid-NP5-NP16	X	X	X	X	X	.	X	X	X	X	X
<i>Caryapollenites prodromus</i> group	X	X	X	X	.	.	X	.	.	X	.
<i>Choanopollenites alabamicus</i> Cret.-NP8	.	.	.	.	.	.	.	.	.	.	.
<i>Choanopollenites</i> sp. cf. <i>C. consanguineus</i>	.	X	.	.	.	.	.	.	.	.	.
<i>Choanopollenites conspicuus</i> Low. Paleocene-NP8	X	.	.	.	.	.	.	.	.	.	.
<i>Choanopollenites patricius</i> NP5-NP8 or ?9	.	X	.	.	.	.	.	.	.	.	.
<i>Faguspollenites</i> sp.	.	.	.	.	.	.	.	.	.	.	.
<i>Favriticolporites baculoferus</i> Low. Paleocene - NP 10 or 15	X	X	X	X	.	.	X	.	.	.	X
<i>Holkopollenites chemardensis</i>	X	X	X	.	.	.	.	.	.	.	.
<i>Interpollis paleocenicus</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Intratrirporopollenites pseudinstructus</i>	.	X	X	X	.	.	X	.	X	X	.
<i>Jarzenipollis trinus</i>	.	X	X	.	.	.	.	.	.	.	X
<i>Labrapollis globosus</i>	.	X	X	.	.	.	.	.	.	.	.
<i>Lanagiopollis cribellatus</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Lanagiopollis lihokus</i>	.	.	X	.	.	.	.	.	.	.	.
<i>Matanomadhiasulcites maximus</i>	.	.	.	.	.	X	.	.	.	.	.
<i>Milfordia incerta</i>	.	.	.	.	.	.	.	.	.	.	X
<i>Milfordia minima</i> Base = NP4	X	.	X	.	X	.	X	.	X	X	X
<i>Momipites actinus</i>	.	X	X	.	.	.	.	.	.	.	.
<i>Momipites coryloides</i>	X	X	X	.	X	.	.	.	.	X	X
<i>Momipites dilatus</i>	X	X	X	.	.	.	.	.	.	.	.
<i>Momipites flexus</i>	X	X	.	.	.	.	X	.	.	X	.
<i>Momipites microfoveolatus</i>	.	.	X	.	X	.	X	.	X	X	X
<i>Momipites strictus</i>	X	X	X	X	X	.	X	X	X	X	.
<i>Momipites tenuipolus</i> group	X	X	X	.	.	.	X	.	.	X	.
<i>Nudopollis endangulatus</i> NP6?-9	X	X	.	.	.	.	.	X	.	X	.
<i>Nudopollis terminalis</i>	X	X	X	X	X	.	X	X	X	X	X
<i>Nudopollis thiergartii</i> Cret.-NP9	X	.	X	.	.	.	.	.	.	X	.
<i>Nyssapollenites paleocenicus</i> type Rhems	.	.	.	.	.	.	.	.	.	.	.
<i>Osculapollis ? colporatus</i> NP 3-5	.	.	.	.	.	.	.	.	.	.	.
<i>Platycarya platycaryoides</i>	.	.	.	.	.	.	.	.	.	.	X
<i>Platycaryapollenites swasticooides</i> NP 10-?15	.	.	.	.	.	.	.	.	.	.	X
<i>Platycarya</i> sp. A Base = NP8	.	.	X	.	X	.	Q	P	.	.	X
<i>Platycarya</i> sp. cf. <i>P.</i> sp. A	.	.	.	.	.	.	.	.	.	X	.
<i>Plicatopollis triorbicularis</i> type	.	X	X	.	.	.	X	.	.	.	X
<i>Plicatopollis triradiatus</i>	X	X	X	.	.	.	X	.	X	X	X
<i>Porocolpopollenites ollivierae</i>	.	.	.	X	X	.	X	.	.	X	.
<i>Pseudoplicatopollis limitatus</i> NP-3? - NP9	Q	X	.	.	.	.	.	X	.	.	X
<i>Pseudoplicatopollis serenus</i> Cret. and Danian	.	.	.	.	.	.	.	.	.	.	.
<i>Retitrescolpites anguloluminosus</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Sparganiceapollenites</i> sp.	.	X	X	X	X	.	X	.	.	X	.
<i>Spinaepollis spinosus</i> Top = NP9	X	X	.	X	.	.	.	.	.	.	.
<i>Subtriporopollenites anulatus</i> NP3-12 or 15	.	X	.	.	.	.	.	.	.	.	.
<i>Subtriporopollenites nanus</i> NP5-12 or 15	.	X	.	.	.	.	.	.	.	.	X
<i>Thomsonipollis magnificus</i> Cret.? - NP10	X	X	X	X	.	.	X	.	.	.	.
<i>Tricolpites asper</i>	X	X	X	X	X	.	X	X	X	.	X
<i>Tricolpites crassus</i> NP 7 or 8 - 9	.	.	X	.	X	.	X	X	.	X	.
<i>Tripopollenites microgranulatus</i>	.	.	.	.	.	.	.	.	.	.	X
<i>Trudopollis</i> spp., including <i>plenus</i> <sup>s</sup>	X	X	X	X	X	.	X	X	.	X	.
<i>Ulmipollenites krempii</i>	.	X	.	.	.	.	X	.	X	.	.
<i>Ulmipollenites tricostatus</i>	.	.	X	.	.	.	.	.	.	.	.

\*Depths recorded at the time of sampling. To convert to log depth:

\*\*The Rhems Formation appears to be mainly or entirely of Danian

Figure 18. Distribution of pollen taxa in Paleocene samples from the USGS C.

	Depth (Ft)	337.0	326.3	317.1	274.8	258.8															
	Inferred Nannofossil Zone	NP 9	NP 9	NP 9	Contaminated	Contaminated															
Taxa; Biostratigraphic Ranges							Legend:														
<i>Biscutum</i> spp. NP 1-12?		X																			
<i>Braarudosphaera bigelowii</i> Cret-Recent			X	X																	
<i>Campylosphaera dela</i> NP 9-17		1																			
<i>Chiasmolithus bidens</i> NP 5-16		X	X	X																	
<i>Coccolithus eopelagicus</i>					C																
<i>Coccolithus pelagicus</i>		X	X	X																	
<i>Cribocentrum reticulatum</i> NP 16-20		C			C																
<i>Cruciplacolithus</i> spp.			X																		
<i>Cyclagelosphaera prima</i> NP 1-10		X	X																		
<i>Cyclococcolithus formosus</i> NP 12-21		C			C																
<i>Dictyococcites scrippsae</i> NP 16-24?					C																
<i>Discoaster barbadiensis</i> NP 11?-20					C																
<i>Discoaster lenticularis</i> NP 9-10			X																		
<i>Discoaster</i> sp. aff <i>D. mohleri</i>		X																			
<i>Discoaster multiradiatus</i> NP 9-11			X	X																	
<i>Discoaster saipanensis</i> NP 14-19/20		C																			
<i>Discoaster salisburgensis</i> NP 8-12?			X																		
<i>Ericsonia obruta</i> NP 16?-25?					C																
<i>Ericsonia subpertusa</i> NP 1-12?		X	X	X																	
<i>Fasciculithus alanii</i> NP 9			?	X																	
<i>Fasciculithus aubertae</i> NP 8-10			?	?																	
<i>Fasciculithus involutus</i> NP 5-10		X	X	X																	
<i>Fasciculithus tympaniformis</i> NP 5-10			X																		
<i>Heliolithus</i> spp.		2																			
<i>Neochiastozygus concinnus</i> NP 2?-11		?	X	X																	
<i>Neochiastozygus imbricatus</i>		X																			
<i>Neococcolithes</i> spp.		X			X																
<i>Neocrepidolithus</i> spp.		X																			
<i>Placozygus sigmoides</i> NP 1-10		X																			
<i>Pontosphaera</i> spp.					X																
<i>Prinsius</i> spp.		X																			
<i>Reticulofenestra daviesii</i> NP 13-					C																
<i>Reticulofenestra floridana</i> NP 13?-NN 6?					C																
<i>Reticulofenestra umbilicus</i> NP 16-22					C																
<i>Reticulofenestra</i> spp.		C			C																
<i>Rhabdosphaera</i> spp.					C																
<i>Scapholithus apertus</i> NP 5-10		X																			
<i>Sphenolithus moriformis</i>					C																

Depth (Ft)	337.0	326.3	317.1	274.8	258.8													
Inferred Nannofossil Zone	NP 9	NP 9	NP 9	Contaminated	Contaminated													
Taxa; Biostratigraphic Ranges						Legend:												
<i>Sphenolithus primus</i>	X																	
<i>Thoracosphaera</i> spp.	X																	
<i>Toweius callosus</i> NP 9-12	X	X																
<i>Toweius eminens eminens</i> NP 5?-10	X	X																
<i>Toweius eminens tovae</i> NP 5-9	X	X																
<i>Toweius pertusus</i> NP 4-12	X	X	X	X														
<i>Toweius serotinus</i> NP 9-10			X															
<i>Transversopontis pulcher</i> NP 9-17?				X														
<i>Transversopontis pulcheroides</i> NP 12-24?					C													
<i>Zygodiscus herlyni</i> NP 7-11	X	X																
<i>Zygrhablithus bijugatus</i> NP 5?-NN 1																		
Abundance	C-	F+	F+	F+	R													
Preservation	M	M-	M	M-														
<b>Figure 19.</b> Distribution of calcareous nannofossil taxa in Paleocene samples from the USGS Pregnall corehole (DOR-208), Dorchester County, South Carolina.																		

Depth (Ft)	510	376	300
Sample	R3001 AC	R3001 AD	R3001 AE
<b>Taxa; Stratigraphic Ranges</b>			
<i>Adnatosphaeridium robustum</i> (Morgenroth 1966) de Coninck 1975	.	.	X
<i>Amphorosphaeridium ? multispinosum</i> (Davey & Williams 1966) Sarjeant 1981	.	.	X
<i>Apectodinium homomorphum</i> (Defl. & Cook. 1955) Lentin & Williams 1977	.	.	X
<i>Cerodinium diebelii</i> (Alberti 1959) Lentin & Williams 1987	X	.	.
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	X	.	.
<i>Cordosphaeridium gracile</i> (Eisenack 1954) Davey & Williams 1966	X	.	X
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	X	.	.
<i>Deflandrea phosphoritica</i> Eisenack 1938	.	.	X
<i>Fibradinium annetorpense</i> Morgenroth 1968	X	.	.
<i>Hafniasphaera septata</i> (Cookson & Eisenack 1967) Hansen 1977	X	.	.
<i>Heteraulacacysta</i> Drugg & Loeblich 1967 sp.	.	.	X
<i>Hystriochosphaeridium tubiferum</i> (Ehrenberg 1838) Deflandre 1937	.	.	X
<i>Impagidinium</i> Stover & Evitt 1978 sp.	.	.	X
<i>Isabelidinium bakeri</i> (Defl. & Cook. 1955) Lentin & Williams 1977	X	.	.
<i>Kallosphaeridium brevibarbatum</i> de Coninck 1969	.	.	X
<i>Lejeunecysta</i> Artzner & Dörhöfer 1978 sp.	X	.	.
<i>Palaeocystodinium golzowense</i> Alberti 1961	X	.	.
<i>Palaeocystodinium</i> Alberti 1961 sp.	X	.	.
<i>Palaeoperidinium pyrophorum</i> (Ehrenberg 1838) Sarjeant 1967	X	.	.
<i>Phelodinium</i> sp. of Edwards (1989)	X	.	X
<i>Senegalinium microgranulatum</i> (Stanley 1965) Stover & Evitt 1978	X	.	.
<i>Senegalinium obscurum</i> (Drugg 1967) Stover & Evitt 1978	X	.	.
<i>Senegalinium ? dilwynense</i> (Cookson & Eisenack 1965) Stover & Evitt 1978	.	.	X
<i>Spiniferites</i> Mantell 1850 spp.	X	.	X
<i>Thalassiphora pelagica</i> (Eisenack 1954) Eisenack & Gocht 1960	?	.	.
<i>Turbiosphaera</i> sp. aff. <i>T. magnifica</i> Eaton of Edwards (1989)	.	.	?
miscellaneous areoligeracean forms	X	.	.
small peridiniacean forms	X	.	.
dinoflagellate fragments, indeterminate	.	X	.
<i>Pediastrum</i> (freshwater alga)	.	X	X

**Figure 20.** Distribution of dinocyst taxa in Paleocene samples from the USGS St. George corehole (DOR-211), Dorchester County, South Carolina. X = present; ? = questionable.

Depth (Ft)	506.5	445.0	425.8	407.0	404.0	320.7
Calcareous Nannofossil Zone	upper NP 5	upper NP 5	upper NP 5	NP 8	NP 8	NP 9
<b>Taxa; Biostratigraphic Ranges</b>						
<i>Braarudosphaera bigelowii</i> Cret–Recent	X					
<i>Chiasmolithus bidens</i> NP 5–16			X	X	X	X
<i>Coccolithus cribellum</i>	X	X				
<i>Coccolithus pelagicus</i>		X	X	X	X	X
<i>Cribocentrum reticulatum</i> NP 16–20			C			
<i>Cruciplacolithus asymmetricus</i> NP 1–5	X					
<i>Cruciplacolithus tenuis</i> NP 2–9	X	X		X		
<i>Cruciplacolithus</i> spp.		X	X			X
<i>Cyclagelospaera prima</i> NP 1–10			1			
<i>Cyclagelosphaera reinhardtii</i> NP 1–5	X	X				
<i>Cyclagelosphaera</i> spp.		X				
<i>Discoaster falcatus</i> NP 9–10						X
<i>Discoaster lenticularis</i> NP 9–10						1
<i>Discoaster multiradiatus</i> NP 9–11						X
<i>Discoaster salisburgensis</i> NP 8–12?						X
<i>Ellipsolithus bollii</i> NP 4–5	X	X				
<i>Ericsonia subapertura</i> NP 1–12?	X	X	X		X	X
<i>Fasciculithus aubertae</i> NP 8–10						X
<i>Fasciculithus involutus</i> NP 5–10						X
<i>Heliolithus cantabriae</i> NP 5–8	2	1				
<i>Heliolithus riedellii</i> NP 8–9				2	1	
<i>Markalius inversus</i> NP 1–21			X			
<i>Neochiastozygus concinnus</i> NP 2?–11?	X					
<i>Neococcolithes</i> sp. aff. <i>protenus</i>		X	X			
<i>Neococcolithes</i> spp.	X				X	
<i>Neocrepidolithus</i> spp.					X	
<i>Placozygus sigmoides</i> NP 1–10	X	X	X	X	X	
<i>Reticulofenestra</i> spp.			1C			C
<i>Thoracosphaera</i> spp.	X	X	X	X		
<i>Toweius callosus</i> NP 9–12						X
<i>Toweius eminens</i> NP 5?–10						X
<i>Toweius pertusus</i> NP 4–12	X	X	X	X	X	X
<i>Toweius serotinus</i> NP 9–10						X
<i>Toweius tovae</i> NP 5–9						X
<i>Zygodiscus herlynii</i> NP 7–11						X
Cretaceous forms			R			
Abundance	C–C	C–C	C–C	C–C	C–C	C–C
Preservation	M	M	M	M	M	G
<b>Legend</b>						
Species range with known FAD's & LAD's						
Interval where species is absent but should occur						
Species range with unknown FAD's & LAD's						
reworked, contaminated, aberrant occurrences			R	C		
FAD's and LAD's for Martini (1971) zones						
FAD's and LAD's used to define age of unit						
FAD's and LAD's consistent with known ranges						
1, 2, 3 specimens in sample				1	2	3
Martini (1971) zonal markers ( <b>bold</b> )						
Abundance: C, Common; F, Frequent; R, Rare; B, Barren						
Preservation: G, Good; M, Moderate; P, Poor						

**Figure 21.** Distribution of calcareous nannofossil taxa in Paleocene samples from the USGS St. George corehole (DOR-211), Dorchester County, South Carolina.

Depth (Ft)	1030	1010	1000	970	950	930	885	865	850	820	800	760	730	700
	NP 1?	??	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	upper NP 5	upper NP 5	NP 6	contaminated	contaminated
Calcareous Nannofossil Zone														
Taxa	Biostratigraphic Ranges													
<i>Blackites</i> spp.														X
<i>Braarudosphaera bigelowii</i> Cret-Recent	X		X		X									X
<i>Cepekiella lumina</i> NP 11-24?														C
<i>Chiasmolithus bidens</i> NP 5-16		X	X	X				X	X	X		X		
<i>Chiasmolithus</i> sp. aff. <i>C. bidens</i> NP 4							1?							
<i>Chiasmolithus consuetus</i> s.l. NP 3-		X	X					X						
<i>Chiasmolithus grandis</i> NP 14-17														C
<i>Chiasmolithus</i> spp. small unsplit												X		
<i>Coccolithus pelagicus</i>			X	X	X		X		X	X	X	X	X	X
<i>Cribocentrum reticulatum</i> NP 16-20													C	C
<i>Cruciplacolithus asymmetricus</i> NP 1-5	X		X	X	X	X	X							
<i>Cruciplacolithus intermedius</i> NP 1-	X													
<i>Cruciplacolithus primus</i> NP 1-5	X										X			
<i>Cyclagelosphaera prima</i> NP 1-10					X				X					
<i>Cyclococcolithus formosus</i> NP 12-21													C	C
<i>Daktylolethra punctulata</i> NP 15-17														C
<i>Dictyococcites bisectus</i> NP 16-NN 1														C
<i>Dictyococcites scrippsae</i> NP 16-24?													C	C
<i>Discoaster barbadiensis</i> NP 11?-20														C
<i>Discoaster mohleri</i> NP 7-8?											C?			
<i>Ellipsolithus bollii</i> NP 4-5				X	X									
<i>Ellipsolithus distichus</i> NP 4-12								X						
<i>Ellipsolithus macellus</i> NP 4-12								X						
<i>Ericsonia subpertusa</i> NP 1-12?	X		X	X	X	X	X	X	X	X	X	X	X	
<i>Fasciculithus janii/billii</i> NP 4-5								X						
<i>Fasciculithus involutus</i> NP 5-10								X					X	
<i>Fasciculithus tympaniformis</i> NP 5-10									X		X			
<i>Fasciculithus</i> spp.								X			X			
<i>Goniolithus fluckigeri</i> Cret-NP 25?	X													
<i>Helicosphaera compacta</i> NP 16-24														C
<i>Heliolithus cantabriae</i> NP 5-8										X	X	X		
<i>Heliolithus kleinpellii</i> NP 6-8												X		
<i>Hornibrookina arca</i> NP 3-10														1
<i>Markalius inversus</i> NP 1-21	X													X
<i>Neochiastozygus concinnus</i> NP 2?-11			X											
<i>Neococcolithes</i> sp. aff. <i>N. protenus</i>	X		X	X				X	X					
<i>Neococcolithes</i> spp.			X										X	
<i>Placozygus sigmoides</i> NP 1-10	X		X	X				X	X	X				
<i>Praeprinsius</i> spp.	X													
<i>Reticulofenestra floridana</i> NP 13?-NN 6?														C
<i>Reticulofenestra umblicus</i> NP 16-22														C
<i>Reticulofenestra</i> spp.														C
<i>Reticulofenestra</i> spp. small														C
<i>Thoracosphaera</i> spp.	X		X	X	X	X		X	X					
<i>Toweius eminens eminens</i> NP 5?-10									X			X		
<i>Toweius eminens tovae</i> NP 5-9									X	X	X			
<i>Toweius pertusus</i> NP 4-12		X	X	X			X	X	X	X	X	X		1 X
<i>Transversopontis pulcher</i> NP 9-17?														C
<i>Transversopontis pulcheroides</i> NP 12-24?														C
<i>Zygodiscus herlyni</i> NP 7-11											X			
<i>Zygrhablithus bijugatus</i> NP 5?-NN 1														X
placoliths		X												



	Depth (Ft)													
	1030	1010	1000	970	950	930	885	865	850	820	800	760	730	700
Calcareous Nannofossil Zone	NP 1?	?	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	lower NP 5	upper NP 5	upper NP 5	NP 6	contaminated	contaminated
Taxa	Biostratigraphic Ranges													
Cretaceous forms	R			R	R		R							
Abundance	F-	R	F+	F+	F+	F-	F+	F+	F+	F+	C-	F+	A	F+
Preservation	M	P	M+	M+	M+	M+	M+	M+	M	M	G	P	G	P
<b>Legend</b>														
Species range with known FAD's & LAD's														
Interval where species is absent but should occur														
Species range with unknown FAD's & LAD's														
Reworked, contaminated, aberrant occurrences				R	C									
FAD's and LAD's for Martini (1971) zones														
FAD's and LAD's used to define age of unit														
FAD's and LAD's consistent with known ranges														
Questionable occurrences				?										
1, 2, 3 specimens in sample						1	2	3						
Martini (1971) zonal markers ( <b>bold</b> )														
Abundance: C, Common; F, Frequent; R, Rare; B, Barren														
Preservation: G, Good; M, Moderate; P, Poor														
<p><b>Figure 22.</b> Distribution of calcareous nannofossil taxa in Paleocene sidewall-core samples from the DNR/DOE C-15 borehole (JAS-426), Jasper County, South Carolina.</p>														

	Depth (Ft)	73	66	46
	Sample R5508	C	B	A
	Series	Paleocene		
Taxa				
<i>Andalusiella polymorpha</i> (Malloy 1972) Lentin & Williams 1977	X	.	.	
<i>Andalusiella</i> sp. aff. <i>A. polymorpha</i> of Edwards (1980)	.	.	.	X
<i>Carpatella cornuta</i> Grigorovich 1969 (fragment)	X	.	.	
<i>Cordosphaeridium inodes</i> (Klumpp 1953) Eisenack 1963	.	X	.	
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	X	.	.	
<i>Deflandrea</i> n. sp. aff. <i>D. truncata</i> Eisenack 1938	?	.	.	
<i>Fibrocysta</i> Stover & Evitt 1978 sp.	.	X	.	
<i>Hafniasphaera septata</i> (Cookson & Eisenack 1967) Hansen 1977	.	X	.	
<i>Oligosphaeridium complex</i> (White 1842) Davey & Williams 1966	.	X	.	
<i>Operculodinium</i> Wall 1967 sp.	.	X	.	
<i>Palaeocystodinium</i> Alberti 1961 sp. (almost <i>golzowense</i> )	.	.	.	X
<i>Palaeocystodinium</i> Alberti 1961 sp. (fat)	X	.	.	
<i>Palaeoperidinium pyrophorum</i> (Ehrenberg 1838) Sarjeant 1967	.	X	.	
<i>Phelodinium</i> sp. of Edwards (1989)	.	X	X	
<i>Phelodinium</i> Stover & Evitt 1978 spp.	.	X	.	
<i>Spiniferites</i> Mantell 1850 spp.	.	X	X	
<i>Tanyosphaeridium xanthiopyxides</i> (Wetzel 1933) Stover & Evitt 1978	.	X	.	
<i>Tectatodinium rugulatum</i> (Hansen 1977) McMinn 1988 (sensu amplo)	X	.	.	
<i>Tenua</i> sp. cf. <i>T. formosa</i> of Kurita and McIntyre (1995)	X	.	.	
<i>Trigonipyxidina ginella</i> (Cookson & Eisenack 1961) Downie & Sarjeant 1965	.	.	.	X
<i>Trithyroidinium</i> sp.	X	.	.	
miscellaneous areoligeracean forms	.	X	.	
small peridiniacean forms	X	X	X	
X=present; .=not present; ?=questionable				

**Figure 23.** Distribution of dinocyst taxa in Paleocene samples from the USGS/DNR Swansea corehole (LEX-844), Lexington County, South Carolina.

Depth in ft	73	66	46
Sample	R5508C	R5508B	R5508A
Age or NP zone equivalent	Danian; younger than type Rhems?	NP5 and younger	No useful species
Taxa; age range			
<i>Alnus</i> sp.	.	.	X
<i>Bombacacidites paulus</i>	.	.	X
<i>Bombacacides reticulatus</i>	X	X	X
Diporate, tiny	X	.	.
<i>Favitricolporites baculoferus</i>	X	X	.
<i>Lanagiopollis cribellatus</i>	X	.	.
<i>Momipites coryloides/microfoveolatus</i>	X	X	X
<i>Momipites tenuipolus</i> group	X	X	.
<i>Nudopollis terminalis</i>	X	.	X
<i>Nyssapollenites paleocenicus</i>	.	.	X
<i>Plicatopollis triradiatus</i>	X	X	.
<i>Pseudoplicapollis limitatus</i>	.	.	X
<i>Pseudoplicapollis serenus</i>	X	.	.
<i>Subtriporopollenites nanus</i> NP5 and younger	.	X	.
<i>Thomsonipollis magnificus</i>	.	X	.
<i>Tricolpites asper</i>	X	X	.
<i>Trudopollis</i> spp., including <i>T. plenus</i>	.	X	X

**Figure 24.** Distribution of pollen taxa in Paleocene samples from the USGS/DNR Swansea corehole (LEX-844), Lexington County, South Carolina.

Depth (Ft)	298	289.0-289.1	278.0-278.1	274	272
	BE	V	W	BD	BC
Sample R5317	Paleocene				
Series	Lower				
Subseries					
Taxon					
? <i>Andalusiella rhombohedra</i> of Edwards and others (1984)	X	X	.	X	.
<i>Achomosphaera alcicornu</i> (Eisenack 1954) Davey & Williams 1966	.	.	.	.	P
<i>Andalusiella polymorpha</i> (Malloy 1972) Lentin & Williams 1977	.	.	.	X	.
<i>Andalusiella</i> sp. aff. <i>A. polymorpha</i> of Edwards (1980)	?	.	.	.	.
<i>Areoligera volata</i> Drugg 1967	X	.	.	X	P
<i>Carpatella cornuta</i> Grigorovich 1969	.	.	X	X	P
<i>Catillopsis abdita</i> Drugg 1970	.	.	.	.	P
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	X	X	X	.	.
<i>Cordosphaeridium</i> Eisenack 1963 spp.	.	.	.	X	P
<i>Cribroperidinium</i> Neale & Sarjeant 1962 sp.	X	.	.	.	.
<i>Cyclapophysis monmouthensis</i> Benson 1976	X	.	.	.	.
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	.	.	X	X	P
<i>Deflandrea</i> cf. <i>D. diebelii</i> Alberti of Drugg (1967)	?	.	X	?	?
<i>Deflandrea</i> n. sp. aff. <i>D. truncata</i> Eisenack 1938	X	X	.	X	P
<i>Diphyes colligerum</i> (Deflandre & Cookson 1955) Cookson 1965	.	.	.	X	P
<i>Exochosphaeridium</i> Davey et al. 1966 sp.	.	.	X	X	.
<i>Fibrocysta</i> Stover & Evitt 1978 spp.	X	.	.	.	.
<i>Hafniasphaera</i> Hansen 1977 spp.	X	.	X	.	.
<i>Hystrichosphaeridium</i> Deflandre 1937 spp.	X	.	.	X	.
<i>Ifecysta</i> Jan du Chêne & Adediran 1985 sp.	X	.	.	.	.
<i>Impagidinium</i> Stover & Evitt 1978 sp.	.	.	.	.	P
<i>Operculodinium</i> Wall 1967 spp.	X	X	.	X	P
<i>Palaeocystodinium</i> Alberti 1961 (fat)	.	.	.	X	P
<i>Palaeocystodinium golzowense</i> Alberti 1961	.	X	.	.	P
<i>Pentadinium</i> group	.	.	C	.	.
<i>Phelodinium magnificum</i> (Stanley 1965) Stover & Evitt 1978	X	.	X	X	P
<i>Polyspheridium zoharyi</i> (Rossignol 1962) Bujak et al. 1980	.	.	.	.	P
<i>Senoniasphaera inornata</i> (Drugg 1970) Stover & Evitt 1978	.	.	X	X	P
<i>Spinidinium pulchrum</i> (Benson 1976) Lentin & Williams 1977	X	X	X	?	?
<i>Spinidinium</i> Cookson & Eisenack 1962 spp.	X	X	X	X	P
<i>Spiniferites</i> Mantell 1850 spp.	X	X	X	X	P
<i>Tectatodinium rugulatum</i> (Hansen 1977) McMinn 1988	X	.	X	.	cfP
<i>Tenua</i> sp. cf. <i>T. formosa</i> of Kurita and McIntyre (1995)	.	.	X	X	P
<i>Turbiosphaera</i> Archangelsky 1969 sp.	X	X	.	.	.
miscellaneous areoligeracean forms	X	X	.	X	P
small peridiniacean forms	X	X	X	X	P
X=present; .=not present; ?=questionable; P=present in the sample, but not necessarily in place stratigraphically.					

**Figure 25.** Distribution of dinocyst taxa in Paleocene samples from the USGS/DNR Clark School No. 1 corehole (ORG-393), Orangeburg County, South Carolina.

Depth (Ft)	298	289.0-289.3	278.0-278.3	274.0
Sample	R5317BE	R5317V	R5317W	R5317BD
Age, correlation, or NP zone equivalent	Danian	Type Rhems Formation or slightly younger*	NP 3-5	Rare pollen
Pollen Taxa And Known Ranges				
<i>Bombacacidites nacimientoensis</i>	X	.	X	.
<i>Bombacacides reticulatus</i>	X	X	X	X
<i>Caryapollenites prodromus</i> group	.	?	X	.
<i>Choanopollenites alabamicus</i> NP8 & older	.	X	X	.
Diporate, tiny	X	X	.	.
<i>Favitricolporites baculoferus</i>	.	.	X	.
<i>Holkopollenites chemardensis</i>	.	.	X	.
<i>Interpollis paleocenicus</i>	.	.	X	.
<i>Intratropollenites pseudinstructus</i>	?	.	.	.
<i>Milfordia minima</i>	.	X	.	.
<i>Momipites coryloides/microfoveolatus</i>	X	.	X	X
<i>Momipites dilatus</i>	.	X	.	.
<i>Momipites dilatus/flexus</i>	.	X	.	.
<i>Momipites tenuipolus</i> group	X	X	X	X
<i>Nudopollis terminalis</i>	.	.	X	.
<i>Nudopollis thiergartii</i>	.	X	.	.
<i>Nyssapollenites paleocenicus</i> - type Rhems	.	X	.	.
<i>Osculapollis? colporatus</i> NP 3-5	.	X	X	.
<i>Pseudoplicapollis serenus</i> Up Cret.-top of Danian	X	X	.	.
<i>Retitrescolpites anguloluminosus</i>	?	.	.	.
<i>Sparganiaceaepollenites</i> sp.	.	.	X	.
<i>Subtriporopollenites anulatus</i>	.	.	X	.
<i>Tricolpites asper</i>	.	.	X	.
<i>Tricolpites microreticulatus</i>	.	X	.	.
*The Rhems Formation is mainly or entirely Danian in age.				

**Figure 26.** Distribution of pollen taxa in Paleocene samples from the USGS/DNR Clark School No. 1 corehole (ORG-393), Orangeburg County, South Carolina.

Depth (feet)	298.0-298.1	277.7-277.7
Sample R5979	E	J
Series	Paleocene	
Subseries	Lower	
Taxa		
<i>Andalusiella polymorpha</i> (Malloy 1972) Lentin & Williams 1977	X	.
<i>Andalusiella</i> Riegel 1974 spp.	.	X
<i>Areoligera volata</i> Drugg 1967	?	X
<i>Carpatella cornuta</i> Grigorovich 1969	.	X
<i>Catillopsis</i> Drugg 1970 sp.	.	cf
<i>Cordosphaeridium fibrospinosum</i> Davey & Williams 1966	X	X
<i>Cribooperidinium</i> Neale & Sarjeant 1962 spp.	X	.
<i>Damassadinium californicum</i> (Drugg 1967) Fensome et al. 1993	.	X
<i>Deflandrea</i> cf. <i>D. diebelii</i> Alberti of Drugg (1967)	?	X
<i>Deflandrea</i> n. sp. aff. <i>D. truncata</i> Eisenack 1938	X	X
<i>Diphyes colligerum</i> (Deflandre & Cookson 1955) Cookson 1965	X	X
<i>Exochosphaeridium</i> Davey et al. 1966 sp.	.	X
<i>Fibrocysta</i> Stover & Evitt 1978 spp.	X	.
<i>Hafniasphaera</i> Hansen 1977 spp.	X	.
<i>Hystrichokolpoma unispinum</i> Williams & Downie 1966	.	X
<i>Hystrichosphaeridium tubiferum</i> (Ehrenberg 1838) Deflandre 1937	.	X
<i>Phelodinium magnificum</i> (Stanley 1965) Stover & Evitt 1978	.	X
<i>Phelodinium</i> Stover & Evitt 1978 sp.	X	.
<i>Senoniasphaera inornata</i> (Drugg 1970) Stover & Evitt 1978	.	X
<i>Spinidinium pulchrum</i> (Benson 1976) Lentin & Williams 1977	.	X
<i>Spinidinium</i> Cookson & Eisenack 1962 spp.	X	X
<i>Spiniferites</i> Mantell 1850 spp.	X	X
<i>Tectatodinium rugulatum</i> (Hansen 1977) McMinn 1988 <i>sensu amplo</i>	X	X
<i>Tenua</i> sp. cf. <i>T. formosa</i> of Kurita and McIntyre (1995)	.	X
miscellaneous areoligeracean forms	.	X
small peridiniacean forms	X	X
X=present; .=not present; ?=questionable; cf=comparable		

**Figure 27.** Distribution of dinocyst taxa in Paleocene samples from the USGS/DNR Clark School No. 2 corehole (ORG-430), Orangeburg County, South Carolina.

Depth in ft	298.0-298.1	295.3-295.5	295.5-295.6	291.4-291.5	284.9-285.0	281.3-281.4	277.7-277.8
Sample	R5979E	R5979F	R5979CE	R5979CD	R5979CC	R5979CB	R5979CA
Age or correlation	Type Rhems Formation	Type Rhems Formation	Type Rhems Formation	Rare pollen grains	Upper type Rhems Fm. or slightly younger	Sparse, useless pollen grains	Sparse, useless pollen grains
Sample							
Taxa							
<i>Bombacacides reticulatus</i>	X	X	.	.	X	.	.
Diporate, tiny	.	.	.	.	X	.	.
<i>Momipites coryloides/microfoveolatus</i>	.	X	.	.	.	.	.
<i>Momipites dilatus</i>	.	.	.	.	X	.	.
<i>Momipites flexus</i>	.	.	.	.	X	.	.
<i>Momipites tenuipolus</i> group	.	.	X	.	X	.	.
<i>Nyssapollenites paleocenicus</i>	X	.	X	.	X	.	.
<i>Sparganiaceapollenites</i> sp.	X	X	X	.	.	.	.
<i>Tricolpites microreticulatus</i>	X	X	.	.	.	.	.

**Figure 28.** Distribution of pollen taxa in Paleocene samples from the USGS/DNR Clark School No. 2 corehole (ORG-430), Orangeburg County, South Carolina.