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OPEN-FILE REPORT

Palynological Investigations in the Upper Cretaceous and Tertiary of the Mississippi Embayment Region - IV

by

Robert H. Tschudy

Denver, Colorado

July 1, 1967

This document has not been edited or reviewed for conformity with U. S. Geological Survey Standards or nomenclature.

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CONTENTS

Introduction

As a part of the cooperative mapping project between the Kentucky Geological Survey and the U. S. Geological Survey, a study of Cretaceous and Tertiary spores and pollen assemblages has been undertaken to aid in distinguishing formations and to facilitate surface and subsurface correlation of strata.

Reports completed from January 1, 1966, to the end of June 1967 are included in this report; others will be placed in open file as they are completed and released for general use.

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Upper Eocene-Oligocene

Kinds of fossils: Pollen & spores

General locality: Kentucky

Quadrangle or area: Water Valley quad.

Referred by: W. I. Finch, 5/5/62

Shipment No.: KG-62-2D
Regional Geology in Kentucky

Report prepared by: Robert H. Tschudy, 1/13/66

Date material received: 6/7/62

Status of work: Incomplete

[redacted]

In accordance with instructions in your memo of August 30, 1965, samples WIF-8 (D1898-1) and WIF-9 (D1898-2) were re-examined. The following palynomorphs were identified:

Code species	Sample Locality No.	WIF-8 D1898-1	WIF-9 D1898-2
P3-sm30A		x	x
P3-sm106		x	x
P3-sm6		x	x
P3-sm16		x	x
P3-sm16D		x	
P3-sm30C		x	x
P3-sm64		x	
P3-sm60		x	
P3-sm85			x
P3-sm26			x
P3-sm43			x
P3-sm72			x
P3-r40		x	
P3-r16			x
P3-r19			x
P3-foss 1			x
P3-rt7B		x	x
Pa3-sm4			x
Pa4-sm1		x	x
P4-foss new		x	x
P4-sm10B		x	
P4-sm15		x	
P5-sm6		x	
P5-sm5			x
P5-foss 1		x	x
Poo-sm3B		x	x
Pperi-sm1		x	

C3-sm1B	x	
C3-r8	x	x
C3-r16	x	
C3-r16B	x	x
C3-r36		x
C3-r38		x
C3-rt1A	x	
C3-rt36	x	x
C3-rt6	x	x
C3-rt40	x	
C3-rt42		x
C3-rt4		x
C3-rt12		x
Gothan-1	x	x
C4-sm10		x
C4-rt1	x	
CP3-sm34B	x	x
CP3-sm5	x	x
CP3-sm50	x	
CP3-r16	x	
CP3-r25	x	x
CP3-r24	x	
CP3-r2B	x	
CP3-r41	x	
CP3-r2D		x
CP3-P4		x
CP3-P7		x
CP3-st1B	x	
CP3-rt18	x	x
CP3-rt31	x	
CP3-synrt new		x
CP4-sm2	x	x
CP4-st new	x	
CP3-syn sm3	x	x
BCP3-rt2B	x	x
BCP3-rt8	x	x
BCP3-rt new	x	x
S1-rt8C	x	x
S1-rt22	x	
Gn-7C		x
M-sm8	x	x
M-p10	x	
M-p8	x	x
Peltate leaf hairs	x	x

Many of these forms are long-ranging from the middle Eocene into younger rocks. Some, not included in the above list are obviously re-deposited

Cretaceous forms. Other re-deposited forms from the Paleozoic were found also.

The assemblages are, in some aspects, intermediate between the Moodys Branch (Jackson) assemblage and the Bucutunna Clay (Oligocene) assemblage. The new species found are limited in our control material to the Bucutunna Clay. We have only one Jackson control sample. Consequently, although some of the code species are limited in their occurrence to the Oligocene control samples, the possibili y remains, that the above two samples may pertain to the upper Jackson, rather than to the Oligocene.

The two samples yielded very similar suites of key species. Although some differences are present, I am unable to determine which sample is the younger.

Robert H. Tschudy

Robert H. Tschudy

rhk

REPORT ON REFERRED FOSSILS

~~R&S Branch, Denver Lab, U.S.G.S.~~
~~Bldg. 25, Federal Center, Denver, Colo.~~

Stratigraphic range: Eocene

Kinds of fossils: Pollen and spores

General locality: Kentucky & Tennessee

Quadrangle or area: Jackson Purchase area & Hardeman County, Tenn.

Referred by: W. W. Olive, 6/22/65

Shipment No.: CS-61-1D and KG-65-10D

Report prepared by: R. H. Tschudy, 2/2/66

Date material received: 7/1/65

Status of work: Complete.

~~Report not to be quoted or paraphrased in publication without final approval by the Paleontology and Stratigraphy Branch.~~

This report is a re-evaluation of two samples and a comparison of these two samples with a third sample of purported Wilcox age. The samples are:

Olive 2, D1668 (from report CS-61-1D) ¼ mile north of Mt. Olive Church, Kirksey quadrangle, Kentucky.

OL-1, D3601 (from report KG-65-10D) Kentucky coordinates 98,100-203,950; ¼ mi. WSW Oak Level in left bank of Riley Branch, Marshall County, Kentucky.

Pine Top sample, D3659 (collected by Olive and Tourtelot) from cut at old Pine Top station, on Gulf, Mobile and Ohio railway, about 3 miles south of Silerton, Hardeman County, Tennessee.

The above three samples all yielded similar pollen assemblages. These assemblages are distinctly different from any we have from our control material. They show more similarity to the basal Claiborne than they do to the Wilcox, even though they possess the Wilcox lithology. They may be briefly characterized as follows: They all yielded an abundance of Carya, Sequoia and taxodiaceous pollen, a variety of bisaccate conifer pollen, and some re-deposited Cretaceous pollen. These assemblages, not directly correlative with either Wilcox or Claiborne control samples, perhaps can be explained by one of the following hypotheses:

1. That the assemblages represent a segment of the upper Paleocene that is not represented in our control samples. This hypothesis is unlikely because the samples yielded Pistillipollenites and a few juglandaceous pollen grains. The former genus is not known in our control material below the Wilcox, and the latter is not known in samples younger than basal Claiborne.

2. The assemblages could represent basal Claiborne as suggested by the presence of Juglandaceous pollen. However, several other characteristic Claiborne species are absent from the assemblages, and none of our Claiborne control material has yielded abundant Carya, Sequoia, and bisaccate conifer pollen.

3. The assemblages could represent a segment of the upper Wilcox from which we do not yet have control material. All Wilcox control samples have yielded Thomsonipollis, yet this genus was not represented in the three samples studied. Furthermore, none of our Wilcox control samples have yielded abundant Carya, Sequoia, and a variety of bisaccate conifer pollen.

4. The assemblages could represent a biofacies of the Wilcox. This hypothesis is supported by the abundance and variety of conifer pollen found, suggesting a temperate or highland forest source, and the relative scarcity of subtropical genera known from control material of the Wilcox and lower Claiborne. Redeposited Cretaceous plant microfossils is another feature common to these three samples, and rare or absent in our Wilcox and Claiborne controls. This feature may be supporting evidence for a highland as opposed to an exclusively lowland pollen source.

Even though I favor the latter hypothesis, until I have examined additional Wilcox and lower Claiborne material I will adopt the following procedure. First the Pine Top sample will be studied in detail. Then, any samples yielding an assemblage similar to the Pine Top sample will be correlated with Pine Top without mention of a specific age. The examination of a few additional strategic samples should serve to clarify this problem.

Robert H. Tschudy

Robert H. Tschudy

RHT

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Not determined.

Kinds of fossils: None

General locality: Kentucky

Quadrangle or area: Ballard County, Ky.

Referred by: W. W. Olive, 2/3/66

Shipment No.: KG-66-1D
Kentucky Geology Branch

Report prepared by: R. H. Tschudy, 2/14/66

Date material received: 2/9/66

Status of work: Complete.

[redacted]

The core sample from a depth of 89.5 feet, Kentucky coordinates 103,250-287,650 in U. S. Corps of Engineers test hole in the Ohio River, yielded no palynomorphs. There was not even any organic matter in the sample. No determination can be made on this sample.

Robert H. Tschudy

Robert H. Tschudy

RHK

REPORT ON REFERRED FOSSILS

~~P&S Branch, Denver Lab., U.S.G.S.~~
~~Bldg. 25, Federal Center, Denver, Colorado~~

Stratigraphic range: Eocene

Kinds of fossils: Pollen & spores

General locality: Kentucky

Quadrangle or area: Graves Co.

Referred by: W. I. Finch, 4/17/63

Shipment No.: KG-63-4D
Regional Geology in Kentucky

Report prepared by: Robert H. Tschudy, 3/4/66

Date material received: 4/19/63

Status of work: Complete--re-evaluation

Report not to be quoted or paraphrased in publication without a final recheck by the Paleontology and Stratigraphy Branch.

A re-examination of sample from the Mayfield Clay Mine (D3040) disclosed the presence of the following code species:

P3-sm98	P3-sm60	BCP3-rt7B
P3-sm16	CP4-sm2	CP3syn-rt
C3-rt28	CP4-r	S1-rt23
P3-sm1B	C3-p4B	S1-r24
P3-sm56	M-P8	P3-sm30C
C3-rt36	BCP3-rt2	Annonaceae
P3-sm30	Proteaceae	cf. Caprifoliaceae
cf. Castanopsis		

This assemblage is indicative of the upper Claiborne rather than the Jackson.

Robert H. Tschudy

Robert H. Tschudy

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REPORT ON REFERRED FOSSILS

~~Paleontology, Denver, U.S.G.S.~~
~~Bldg. 25, Federal Center, Denver, Colorado~~

Stratigraphic range: Paleocene-Eocene

Kinds of fossils: Palynomorphs

General locality: Tennessee

Quadrangle or area: Lauderdale Co., Tenn.

Referred by: E. Cushing

Shipment No.: Control material

Status of work: Complete

Report prepared by: Robert H. Tschudy
3/11/66

Date material received: 1/17/66

~~Report not to be quoted or paraphrased in publication without a final recheck by the Paleontology and Stratigraphy Branch.~~

This is a report on the side wall core material I obtained from the U.S. Geol. Survey Water well Fort Pillow No. 1, Lauderdale Co., Tennessee. The location of the well is Lat 35°38'38" N, Long 84°49'35" E. U.S.G.S. Paleobotanical locality numbers were given to the samples as follows:

Depth	No.
2340'	D3700A
2326'	D3700B
2310'	D3700C
1925'	D3701A
1803'	D3701B
1357-1365'	D3702
1255-57'	D3703
368-376'	D3704B
144-149'	D3705

All of the samples obtained yielded abundant palynomorphs. Listed below, are some of the code species recognized as being the more significant indicators of the several portions of the stratigraphic column sampled. Many more palynomorphs were present than have been listed in this report.

Samples D3700A, B, C are definitely of Paleocene age. They all yielded characteristic Porters Creek clay assemblages, and did not yield pollen indicative of a Cretaceous, Owl Creek age.

Sample D3701A, also yielded a Porters Creek assemblage but differed from the previous three samples in yielding few hystrichospheres and dinoflagellates. Hystrichospheres and dinoflagellates indicate marine deposition. The corroded pollen present in the first four samples, is also characteristic of our Porters Creek control material. This corrosion suggests that the pollen was in suspension for sufficient time for corrosion to occur, rather than having been buried soon after release.

Sample D3701B is unique. It yielded an abundance of Aquilapollenites. This genus is characteristically present in Late Cretaceous rocks of the Rocky Mountain region, and has not been found heretofore in rocks east of the Mississippi River. The only other record of Aquilapollenites is furnished by Jones. (Trans. Gulf Coast Association of Geological Societies, v. XII, p. 285-294, 1962) from the Porters Creek clay of Arkansas. I do not believe the specimens of Aquilapollenites from sample D3701B have been reworked from older rocks, because numerous masses (anthers) of these pollen grains were found. Reworking would certainly be expected to break up such masses. This sample, I believe, represents a near-shore or deltaic facies of the Porters Creek. The presence of Azolla and Botryococcus indicates fresh water deposition in contrast to marine deposition indicated by hystrichospheres and dinoflagellates in the other Porters Creek samples. We intend to examine this sample in detail and use it for upper Porters Creek control.

Sample D3702 represents the Wilcox. In our control material from the Mississippi Embayment the genera Carya and Pistillipollenites are not known before Wilcox time. The assemblage listed is consistent with a Wilcox determination.

Sample D3703 yielded species seen heretofore primarily in our Tallahatta and Recklaw control material. I conclude that this sample represents the lower Claiborne Group.

Sample D3704B yielded species seen in our Sparta and Cockfield control material. This sample probably represents the upper part of the Claiborne Group. Until we have worked our Moody's Branch and Yazoo clay control samples thoroughly, there remains some possibility that this sample pertains to the lower Jackson. At present I consider this possibility unlikely.

Sample D3705 yielded not only some species seen previously in a cursory examination of Jackson samples, but also a number of new species that at present are not in our files. This sample probably represents the Jackson, but we must await further work in order to be absolutely sure.

Robert H. Tschudy

Robert H. Tschudy

BMK

FORT PILLOW NO. 1

Control Material

Formation or Equiv.	Porters Ck.	Porters Ck.	Porters Ck.	Porters Ck.	Porters Ck?	Wilcox	lower Claiborne	upper Claiborne	Jackson?
Depth	2340'	2326'	2310'	1925'	1803'	1357-65'	1255-57'	368-376'	144-149'
D. No.	D3700A	D3700B	D3700C	D3701A	D3701B	D3702	D3703	D3704B	D3705
Code Species									
CP3-sml4C	x	x	x						
Gn-llB	x	x	x						
P3-sm1B	x	x	x	x	x				
C3-sml	x	x	x	x					
P3-sm48	x	x		x					
Pa3-sm30	x								
P3-sm47	x	x	x	x					
CP3-r31	x	x	x	x					
CP3-sm6	x		x						
Classo-3	x	x	x	x					
TT-rt3	x								
P3-r32	x								
V2L/r4	x	x	x	x					
P3-sm31B	x	x		x					
Hyst & Dino's	Abundant	Abundant	Abundant	Scarce					
Corroded pollen	x	x	x	x					
Pperi-sm5		x		x					
P3-r16B		x		x					
Illicium		x							
P3-sm24		x	x						
C3-r10		x	x	x					
TT-sm37		x	x	x	x				
C3-sm31		x	x						
P3-r29		x	x						
P3-sm60		x	x						
P3-sm6B		x		x					
P3-sm60B		x	x	x					
BCP3-rt2E		x							
P3-sm56C			x	x	x	x		x	
cf S1-rt8B			x						
Tax-r5				Abundant	Abundant	Abundant			
V2L/r4				x					
Tax-r2				x					
P3-sm75				x					
Pa4-rug1				x					
S1-r21B				x					
Sequoia				x	x	x			
CP3-r21				x					
Aquilapollenites					Abundant				
Thomsonipollis					x			x	
Pa4-sml					x				
Pa6-sml					x			x	
Bot-1					x				
P3-sm1C					x				
P3-sm71					x				
Azolla					x				
C3-pl4C						x		x	
P3-sm30B (Carya)						x			
P3-sm16C						x		x	
Pa3-sm25C						x			
P3-sm43B						x			
P3-pl (Pistillipollenites)						x			
BCP3-sm11B						x			
Pa3-sm16 (Platycarya)						x		x	
V2S/sm5						x			
P3-r42								x	
C3-p12								x	
BCP3-rt2D								x	
P3-st1					x				
Ana3					x				
Szon-for1					x				
BCP3-r11					x				
Hemi-1					x				
Gn-11					x				
CP4-sm2						x		x	
P3-rt3D						x			
P3-sml6						x		x	
S1-rt4B						x			
C3-rt35						x			
M-p8						x		x	
P3-sm98						x		x	
BCP3-rt7B						x			
C3-p12						x			
CP3-r38						x		x	
BCP3-p1						x			
P3-sm30A (Carya)								x	
P4-fossl								x	
CP3-sm								x	
P∞new (Yazoo)								x	
P4-sml								x	
P ∞ (Juglans)								x	
P ∞-sm3B								x	
Grass (new)								x	
BCP3-rt2B								x	
M-sp (new)								x	
CP3-rt (new)								x	

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Upper Cretaceous

Kinds of fossils: Pollen & spores

General locality: Kentucky

Quadrangle or area: Briensburg quad.

Referred by: W. W. Olive, 7/17/63

Shipment No.: KG-63-19D
Regional Geology in Kentucky

Report prepared by: Robert H. Tschudy, 3/21/66

Date material received: 7/22/63

Status of work: Complete--re-evaluation

[redacted]

Sample MBR-1 (D3142) was re-examined to try to determine if this sample represented the Tuscaloosa Formation. The following palynomorphs were found in addition to those reported previously.

Pa3-sm6 abundant	P3-sm20B	S1-sm8
Tax-p1	P3-sm85	cf. CP3-sm43
BCP3-sm3	V2L/rug5B	P3-sm75D
CP3-rt3	CP3-sm16	V2S/rug3
S1-rt10B?	C3-rt14	P3-sm35
Classo 3		

Pa3-sm6 has been found in our control material only in the Eutaw Formation and the Coffee Sand, and BCP3-sm3 only in the Eutaw. The remainder are common to the Eutaw, Magothy or Coffee Sand. This assemblage is younger than our control material from the Tuscaloosa. It most closely resembles the Eutaw assemblage.

The sample was poor, characterized by few pollen grains and much trash of uniform diameter of about 20u. Almost all of the pollen found was also small--under 30u in diameter. This phenomenon suggests winnowing and therefore deposition at some distance from shore. In spite of poor pollen representation, I feel fairly sure of the above determination.

Robert H. Tschudy

RHK

REPORT ON REFERRED FOSSILS

~~Paleobotany, Denver Lab., U.S.G.S.~~
~~Bldg. 25, Federal Center, Denver, Colorado~~

Stratigraphic range: Upper Cretaceous-Recent

Kinds of fossils: Pollen & spores

General locality: Kentucky

Quadrangle or area: Oak Level, Olmsted, La Center, Hico quads.

Referred by: W. W. Olive, 5/10/66

Shipment No.: KG-66-2D Regional Geology in Kentucky

Report prepared by: Robert H. Tschudy, 5/25/66 Date material received: 5/10/66

Status of work: Complete

~~Report not to be quoted or paraphrased in publication without a final recheck by the Paleontology & Stratigraphy Branch.~~

Nine samples were submitted for palynological examination. All were at least partially productive and were given USGS Paleobot. locality numbers as follows:

Sample	Locality	Number
OL-3	0.6 mi. SW of Brewers at an altitude of 450', Kentucky coords.: 1,209,900-169,200, Oak Level quad., Marshall Co., Ky.	D3743
OL-4	Undercut on rt. bank W. fork Clarks River, 1.1 mi. S. of Hale Spring, Kentucky coords.: 1,207,100-168,250, Oak Level quad., Marshal Co., Ky.	D3744
OL-5	0.4 mi. NNE of Oak Level, Kentucky coords.: 1,206,150-207,900, Oak Level quad., Marshall Co., Ky.	D3745
Od-3	Altitude of 190' in Corps of Engineers drill hole near rt. bank of Ohio River opposite Little Turner Lake, Kentucky coords.: 1,034,800-326,600, Ballard Co., Ky.	D3746
LLA-2	Depth of 52' in test hole at elbow in county road 3.95 mi. WNW of main RR crossing at La Center, Kentucky coords.: 1,053,850-299,700, La Center quad., Ballard Co., Ky.	D3747
Levings #1	Altitude 300', 1000' N. of Ohio River along W. boundary of sec. 18, T. 15 S., R. 2 E., Olmsted quad., Pulaski Co., Ill.	D3748

Sample	Locality	Number
Levings #2	Altitude 318', 800' N. of Ohio River along W. boundary of sec. 18, T. 15 S., R. 2 E., Olmsted quad., Pulaski Co., Ill.	D3749
OHi-2gl	600' SE Independence School, Kentucky coords.: 1,268,350-145,100, Hico quad., Calloway Co., Ky.	D3750
OHi-2hl	600' SE Independence School, Kentucky coords.: 1,268,350-145,100, Hico quad., Calloway Co., Ky.	D3751

Samples Levings #1 (D3748) and Levings #2 (D3749) are clearly of Late Cretaceous age. The pollen and spore flora can be correlated directly with upper McNairy floras.

Sample Od-3 (D3746) is also of Late Cretaceous age. This sample and sample Ohi-2gl (D3750) correspond closely to the uppermost Cretaceous sample D3546B examined previously. These samples suggest that the floral change from Cretaceous to Paleocene started in the Late Cretaceous, and that the floral change at the boundary defined by the first appearance of P3-sm1B is not as pronounced as was originally thought.

Sample Ohi-2hl (D3751) yielded a basal Paleocene assemblage. There is almost no evidence for marine Paleocene. This sample strongly suggests deltaic conditions during deposition. Some of the grains such as V2L/rug 5 may have been reworked from subjacent Cretaceous beds, but the majority of fossils identified are clearly of Paleocene age, and probably pertain to the Clayton Formation.

Sample LLA-2 (D3747) is definitely younger than Porters Creek. The flora found corresponds to that found previously in the lower Wilcox (early Eocene age).

Sample OL-3 (D3743) yielded a poor assemblage. The presence of P3-sm30 and P3-pl indicates that this sample is of Eocene age, and probably corresponds to the basal Wilcox.

Sample OL-5 (D3745) was also very poor. I am not sure of the age of this sample. It probably pertains to the basal Eocene Wilcox. It yielded several forms that were found previously in the Pine Top sample (D3659).

Sample OL-4 (D3744) from Pleistocene alluvium yielded an assemblage that, in the absence of direct control might pertain to the Miocene to Recent sequence.

All of the forms found grow in the area today, suggesting a Recent age. The very poor representation of bisaccate conifer pollen does not suggest a cold Pleistocene glacial climate, but rather a warm temperate interglacial or postglacial climate. I will be interested to learn of the results of the carbon 14 dating of this sample.

The scarcity of bisaccate conifer pollen in sample OL-4 is in direct contrast to its abundance in Ohi-1 (D1866). The presence of Caprifoliaceous pollen, abundant bisaccate pollen including Picea (spruce) and fern spores in sample D1866 suggests a colder climate during deposition than was reflected in the pollen flora from sample D3744.

Robert H. Tschudy

Robert H. Tschudy

RHT

Age	Late Cretaceous	Late Cretaceous	Late Cretaceous	Late Cretaceous	Paleocene	early Eocene	early Eocene	early Eocene?	Miocene-Recent
Sample	Levings #1	Levings #2	Od-3	Ohi-2gl	Ohi-2hl	LLA-2	OL-3	OL-5	OL-4
NO.	D3748	D3749	D3746	D3750	D3751	D3747	D3743	D3745	D3744
Code Species									
TO-rug 11B	x	x	x						
CP3-sml4	x	x	x		x				
V2L/rug5	x	x	x	x	x				
V2L/sml8	x	x							
S1-r18	x	x							
Tet-st1	x	x		x	x				
S1-r17	x	x		x					
P3-sm75D	x	x							
V2S/rug3	x	x	x						
CP3-r29	x	x							
P3-sm58	x	x	x		x				
P3-sm47	x	x	x	x					
VOT-r8	x	x							
Gleich4	x	x			x				
P1-rt1	x	x		x					
Fmem-sm5	x								
Fmem-rt1	x		x						
S1-sml6	x		x						
S1-sml2	x		x	x	x				
P3-sm6	x	x	x	x					
P3-r22c	x		x						
Fmem-sm6B	x		x						
TO-rug13		x							
Gn-5B	x								
V2S/rt1	x								
P3-rt4D	x			x					
App-1	x								
Bot-1	x				x				
TC-sm25	x								
P3-sm85B	x	x	x						
P3-sm88	x	x	x		x				
CP3-r21	x	x	x						
C3-sm31	x	x	x		x				
C3-rt1B	x	x							
P3-sm85		x	x						
Pa3-sm26		x							
P3-sm43		x	x						
cf. S1-rt8B		x							
TT-sm37		x							
CP3-rt16		x							
CP3-rt9		x	x		x				
C3-rt29			x						
P3-rt12			x						
CP3-rt21					x				
P3-sm1B					x	x	x	x	
P3-sm43B					x				
P3-sm56					x	x	x		
P3-sm56c					x				
S1-sm5					x				
Tax-r2					x	x			
Pperi-sm5					x			x	
S1-r8B					x				
cf. C4-rt1					x				
C3-rt3					x				
C3-sm32					x				
P3-p9B					x				
Gn-11B					x				
Classo-3					x				
Fmem-sm5B					x				
S1-r26					x				
V2L/r4					x	x			
P3-sm30						x	x		
P3-sml6D						x	x	x	
Pa6-sml						x	x	x	
C3-rt16B						x	x		
P3-p1						x	x		
C3syn-rt1						x			
Pa3-sm30B						x			
cf. BCP3-r11B						x			
CP3-sm5						x			
Pa3-sm25						x			
Tax-sml						x			
cf. V2L/sm5						x			
CP3-rt14						x			
P3-sm76						x			
Sequoia						x			
P3-p9C						x		x	
C3-p14						x			
Pa4-sml						x	x	x	
CP3-sm9							x		
P3-sm60						x	x		
P1-sp2								x	
C3-rt14B								x	
Betula									x
Nyssa									x
Liquidambar									x
Carya									x
Juglans									x
Ulmus									x
Pinus									x
Chenopodium									x
Tilia									x
cf. Gramineae									x
Compositae									x

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Paleocene - Eocene

Kinds of fossils: Pollen and spores

General locality: Kentucky

Quadrangle or area: Cottage Grove, Puryear, Kirksey, Wolf Island, Oak Level, and Dublin quadrangles

Referred by: W. W. Olive

Report prepared by: R. H. Tschudy

7/19/66

Shipment No.: KG-66-5D

Status of work: Complete

Date material received: 6/8/66

[redacted]

Seven samples were submitted for palynological examination. All were productive and were given USGS Paleobotanical locality numbers as follows:

Sample	Locality	Number
Tenn-12	4.1 mi. NE from Cottage Grove, Tenn. (Top Dark Ball Clay from Paschall #5 Clay Pit) Cottage Grove quadrangle, Henry Co., Tenn.	D3760
Tenn-13	"Dark wad" clay from Scott Mine, 2.35 mi. SW from junction of US 641 and Tenn. Rte. 140 at Puryear, Puryear Quadrangle, Henry Co., Tenn.	D3761
OK-1	Kentucky coordinates 1,212,100 - 151,150, in stream channel 0.25 mi. NW from Collie Cemetery, Kirksey Quadrangle, Calloway Co., Kentucky.	D3762
OWI-2	Kentucky coordinates 1,010,800 - 161,100 at Chalk Bluff bordering Mississippi River, Wolf Island Quadrangle, Hickman Co., Kentucky.	D3763
OL-5*	Kentucky coordinates 1,216,450 - 168,300 in stream channel S. of Ky. Rte. 80, 0.8 mi. ESE from Brewers, Oak Level Quadrangle, Marshall Co., Kentucky.	D3764
ODn-1	Kentucky coordinates 1,100,400 - 140,550 in RR cut, 0.24 mi. NNW from Baltimore Church, Dublin Quadrangle, Hickman Co., Kentucky.	D3765
OL-6	Kentucky coordinates 1,208,900 - 170,550, 0.69 mi. SSE from Hale Spring, Oak Level Quadrangle, Marshall Co., Kentucky.	D3766

* Not to be confused with Sample OL-5 (D3745) of shipment KG-66-2D.

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The palynomorphs identified have been recorded on the accompanying chart. The samples have been arranged on this chart from older to younger.

Sample OL-6 (D3766) yielded an assemblage characteristic of the Porters Creek, except for the general lack of dinoflagellates and hystrichospheres. This sample probably was deposited under near shore or deltaic conditions rather than under marine conditions.

Sample OL-5 (D3764) yielded a definite Paleocene assemblage. Most of the species found are characteristic of the Porters Creek, but a few have been seen only on slides from the Naborton Formation. I believe this sample represents the upper Paleocene, possibly the uppermost Porters Creek, or the Naborton equivalent. This sample yielded very few marine palynomorphs, suggesting near shore or deltaic deposition.

You assigned a Wilcox stratigraphic position to sample OK-1 (D3762). This sample yielded a definite Wilcox assemblage. There is, however, a closer resemblance to lower Wilcox than to upper Wilcox control samples.

Sample Tenn. 12 (D3760) definitely pertains to the Claiborne. The assemblage suggests an early Claiborne age. Many of the species found are characteristic species of the Recklaw and Tallahatta Formations.

Sample Tenn. 13 (D3761) is also of Claiborne age, although the assemblage obtained was different from that found in Sample Tenn. 12. This assemblage more nearly resembles assemblages obtained from the Zilpha and Sparta Formations. I conclude that this sample represents the upper Claiborne. The presence of a few marine hystrichospheres and dinoflagellates and the lacustrine Azolla suggests deltaic deposition.

Sample CWI-2 (D3763) yielded an assemblage whose individual species have not all been coded. The species found can be correlated with those previously found in the Moodys Branch and in the Yazoo Clay. I believe this sample represents the late Eocene Jackson Group. Very few marine palynomorphs were found.

Sample ODn-1 (D3765) yielded an assemblage very similar to that found in CWI-2. It is definitely younger than Claiborne. I believe that this sample also pertains to the Jackson Group.

Robert H. Tschudy

Stratigraphic Position		Paleocene	Paleocene	lower Eocene Wilcox Group	middl Eocene Claiborne Group	middle Eocene Claiborne Group	upper Eocene Jackson Group	upper Eocene Jackson Group
Code	Sample	D3766	D3764	D3762	D3760	D3761	D3763	D3765
Species	No.	OL-6	OL-5	OK-1	Tenn.12	Tenn.13	CWI-2	ODn-1
	Pl-Sp2	X	X		X			
	Pperi-sm5	X	X					
	Gn-l1B	X	X					
	P3-sm1B	X	X		X			
	P3-sm1C	X	X					
cf	Pa3-p4	X	X					
	Tax-r5	X	X				X	
	V2L/r4	X	X					
cf	Pa7-sm1	X	X					
	Pa5-sm1	X	X			X		
	P3-sm58	X	X	X				
	M-rt (New)	X	X					
	P3-sm75	X	X					
cf	P3-sm60	X	X					
	S1-sm12B	X	X					
	Pa3-sm30	X	X					
	Sequoia	X	X					
	Pperi-p2	X						
	P4-sm15	X						
	Pa4-rug1	X		X				
cf	C3-syn-rt1	X						
cf	P3-r32	X						
	Dino	X	X			X		
	Illicium		X					
cf	TO-rt12		X					
	TO-p4B		X					
cf	P3-sm21		X		X	X		
	Fdens-sm6		X					
	Pa3-sm16B			X				
	Pa3-sm25c			X				
	P3-sm30B			X				
	P3-sm56			X	X	X		
	P3-sm56D			X				
	P3-sm16D			X	X	X		
	C3-p14			X				
	P3-p1			X		X		
	BCP3-rt11B			X				
	P3-sm43B			X				
	V2L/sm18			X				
	Pa3-sm30B			X				
	P3-sm47			X				
	BCP4-r1			X				
	O-sp7			X				
	C ∞ (New)			X				
	P3-p9C			X				

Stratigraphic Position	Paleocene	Paleocene	lower Eocene Wilcox Group	middle Eocene Claiborne Group	middle Eocene Claiborne Group	upper Eocene Jackson Group	upper Eocene Jackson Group
Sample	D3766	D3764	D3762	D3760	D3761	D3763	D3765
Code Species No.	OL-6	OL-5	OK-1	Tenn.12	Tenn.13	OWI-2	ODn-1
P3-p9B			X				
CP3-sml4B			X				
CP3-r31			X				
Pa3-sml6E				X			
Pa3-sml6C				X			
P3-sm30B				X			
cf BCP3-rt8				X	X		
cf C3-rt27B				X			
cf P3-sm57				X			
cf S1-rt8C				X			
P3-sm72				X			
cf P3-sml01				X			
P3-sm56B				X			
Hemi-1				X			
Drimys ?				X			
P3-sm98				X	X		X
C4-rt2				X			
BCP3-rt2E				X			
CP3-r38					X		
P3-sm30C					X		
cf Pa4-sml					X		
P ω -sm3					X		
V2L/r5					X		
Tat-fov2					X		X
Gn-7c					X		
cf BCP3-rt9					X		
Pperi-r1B					X		
Gothan-1					X		X
Pediastrum					X		
Hyst.					X	X	
Azolla					X		
V2S/sm5					X		
C5-sml					X		
P3-sm30A						X	X
P4-foss1						X	X
P5-foss1						X	X
CP4-sm						X	X
CP3-p4						X	X
P ω						X	
V2L/p						X	
BCP3-r(a)						X	
BCP3-sm9						X	X
C3-sp						X	X
cf P5-sm4						X	X
BCP3-rt7B						X	X
cf P3-sm72						X	

Stratigraphic Position	Paleocene	Paleocene	lower Eocene Wilcox Group	middle Eocene Claiborne Group	middle Eocene Claiborne Group	upper Eocene Jackson Group	upper Eocene Jackson Group
Sample	D3766	D3764	D3762	D3760	D3761	D3763	D3765
Code Species No.	OL-6	OL-5	CK-1	Tenn.12	Tenn.13	CWI-2	ODn-1
BCP3-r(b)						X	
cf P3-rt4A						X	X
cf P ω -sm3						X	
Bombacaceae						X	
P4-sm5						X	X
BCP4-rt						X	
Schizocystia						X	
BCP3-p						X	X
Peltate hair						X	X
M-pl6							X
P ω -sp							X
P3-p							X
CP3-sm							X
P3-sp5							X
P3-sml6							X
CP3-rt(a)							X
CP3-rt(b)							X
C3-sm							X
CP3-r (new)							X

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Paleocene-Recent

Kinds of fossils: Pollen & spores

General locality: Kentucky

Quadrangle or area: Oak Level quad.

Referred by: W. W. Olive, 6/66

Shipment No.: KG-66-7D
Regional Geology in Kentucky

Report prepared by: Robert H. Tschudy, 7/25/66

Date material received: 7/11/66

Status of work: Complete

[redacted]

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9 samples were sent for palynological examination. Several yielded only marginal assemblages and two, OL-8 and OL-10 yielded so few palynomorphs that age determinations could not be made. The samples were given USGS Paleobotanical Locality Numbers as follows:

Sample	Locality	Number
OL-7	Kentucky Coordinates 1,201,700-166,850, at an altitude of 430 ft, 1.15 mi. ESE of New Home Church, Oak Level quad., Marshall Co., Ky.	D3767
OL-8	Kentucky Coordinates 1,222,500-165,650, at an altitude of 485 ft, 2.17 mi. ESE of school at Brewers, Oak Level quad., Marshall Co., Ky.	D3768
OL-9	Kentucky Coordinates 1,220,250-174,700, at an altitude of 440 ft, left bank of Patty Branch, 1 mi. SE of Soldier Creek Church, Oak Level quad., Marshall Co., Ky.	D3769
OL-10	Kentucky Coordinates 1,212,600-166,850, at an altitude of 450 ft, 0.77 mi. S. of school at Brewers, Oak Level quad., Marshall Co., Ky.	D3770
OL-11	Kentucky Coordinates 1,198,100-177,700 at an altitude of 400 ft, 1.72 mi. NNE of New Home Church, Oak Level quad., Graves Co., Ky.	D3771
OL-12	Kentucky Coordinates 1,201,550-203,750 at an altitude of 425 ft on left bank of Reeves Branch, 0.82 mi. SW of KY51 FR at Oak Level, Oak Level quad., Marshall Co., Ky.	D3772

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OL-13	Kentucky Coordinates 1,199,500-177,550 at an altitude of 400 ft, NE flowing tributary of W. Fork of Clarks River, 1.65 mi. WNW of Hale Spring, Oak Level quad., Marshall Co., Ky.	D3773
OL-14	Kentucky Coordinates 1,204,850-204,900 at an altitude of 450 ft, 0.2 mi. SW of church at Oak Level, Oak Level quad., Marshall Co., Ky.	D3774
OL-15	Kentucky Coordinates 1,203,900-203,550 at an altitude of 460 ft, 0.52 mi. SW of church at Oak Level, Oak Level quad., Marshall Co., Ky.	D3775

The fossil recovery from all samples is listed on the accompanying chart.

Sample OL-7 (D3767) yielded a poor flora. The presence of P3-sm30B and P3-p1 definitely indicates post-Paleocene. This sample probably pertains to the Wilcox. No hystrichospheres or dinoflagellates indicating marine deposition were seen.

Sample OL-8 (D3768) was oxidized and yielded almost no organic residue. The only pollen found was Tax-r5. Micrhystridium, Pterospermopsis and Botryococcus suggest marine deposition. This sample is non-diagnostic. Previous Porters Creek samples have also failed to yield diagnostic fossils. This sample may be similar to some of these, but I cannot verify this hypothesis.

Sample OL-9 (D3769) yielded a corroded assemblage including palynomorphs indicating marine deposition. This sample can definitely be assigned to the Paleocene Porters Creek.

Sample OL-10 (D3770) was oxidized and almost barren. Pterospermopsis and Botryococcus suggest marine deposition. This sample is non-diagnostic.

Sample OL-11 (D3771) yielded a sparse corroded assemblage. The presence of Pperi-sm5 and P3-sm57c point strongly to a Paleocene, Porters Creek age for this sample. Marine hystrichospheres and dinoflagellates were also recovered.

Sample OL-12 (D3772) yielded a poor, corroded assemblage. It is definitely of Paleocene age and probably pertains to the Porters Creek. Marine hystrichospheres and dinoflagellates were present.

Sample OL-13 (D3772) yielded an abundant well preserved pollen and spore flora. The presence of at least three species of the Compositae indicates a Miocene or younger age. I was unable to find any genera represented which are not native to the area today. This fact and the

abundance of pine pollen suggests a Pleistocene to Recent age.

Sample OL-14 (D3774) yielded a sparse corroded pollen and spore flora of Paleocene age. Tasmanites and Pterospermopsis suggest marine deposition. This sample probably pertains to the Porters Creek.

Sample OL-15 (D3775) yielded an abundant pollen and spore flora. The assemblage is definitely of Paleocene age, and resembles the upper Porters Creek. Deposition was near-shore or deltaic. Very few dinoflagellates were seen.

Robert H. Tschudy

Robert H. Tschudy

PMK

Stratigraphic Position	cene Wilcox?	?	Paleocene Porters Creek	?	Paleocene Porters Creek?	Paleocene Porters Creek?	Miocene-Recent	Paleocen Porters Creek?	Paleocene upper Porters Creek
Sample No.	OL-7 D3767	OL-8 D3768	OL-9 D3769	OL-10 D3770	OL-11 D3771	OL-12 D3772	OL-13 D3773	OL-14 D3774	OL-15 D3775
Code Species									
P3-sm1B	x		x		x	x		x	x
Tax-r5	x	x	x		x	x		x	x
P3-sm56C	x		x						x
P3-p1	x								
P3-sm21	x		x		x	x			x
O-sp7	x								
P3-r37	x								
P3-sm30B	x								
C3-sm27	x								
CP3-rt13	x								x
cf P3-sm60	x		x	x					
P ∞-p1	x							x	
Micr.		x			x				
Botryococcus		x		x	x	x			x
Pterospermopsis		x		x		x		x	
Hyst.					x	x			
Dino.						x			x
Gn-11B			x						
Gn-11C			x						
Fdens-sm6B			x						x
Pperi-sm5			x		x			x	x
Classo-3			x						
C3-sm31			x						
Pa3-sm30			x					x	x
CP3-r29			x						
TO-rug24			x						
P3-r29			x						
P3-sm79			x					x	
P3-sm58			x					x	x
cf C3-rt17				x					
Pa5-sm1					x	x			x
P3-sm1A					x				x
S1-sm12					x				x
P3-sm57C					x				
P1-sp2					x	x		x	
Pediastrum					x	x			x
cf Pa4-rug1						x			
Aquila						x			x
P3-sm60B						x		x	x
Pinus							x		
Compositae							x		
Caprifoliaceae							x		
Carya							x		
Betula							x		
Ilex							x		
cf. Osmunda							x		
Ericaceae							x		
Ulmus							x		
Chenopodiaceae							x		
Grass							x		
cf. Juglans							x		
Liquidambar							x		
Abies							x		
P∞-sm								x	
V2L/r4								x	x
cf P3-p9B								x	
Tas.								x	x
Sequoia									x
Wodehouseia									x
TO-p3									x
V2L/sm5									x
TO-rug11B									x
TO-rt2									x
P4-p4									x
cf P4-sm15									x
P3-sm75									x
P3-sm56									x
Pa6-sm1									x

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Eocene

Kinds of fossils: Palynomorphs

General locality: Tennessee

Quadrangle or area: Lauderdale Co., Tenn.

Referred by: E. Cushing

Shipment No.: Control material

Report prepared by: Robert H. Tschudy, 8/8/66

Date material received: 1/17/66

Status of work: Complete; supplement to previous report.

[redacted]

At the time that the original report on samples from water well Fort Pillow #1, core sample from 429-436 feet was inadvertently omitted. It has been given USGS Paleobotanical locality number D3704A. The following code species were identified:

Gothan-1, Ana-2, CP3-r39, Tet-fov2, P3-sm16, CP3-r28, CP3-rt19C, CP3-p12, S1-rt23, CP3-r38, P3-sm98, CP3-p7, P3-sm72.

This assemblage contains species found previously in the Sparta, Cook Mountain and Cockfield Formations. Our control material from the Cook Mountain is poor, consequently I am not sure that I can distinguish between the Cook Mountain and the Sparta. Several of the species found are common in the Sparta but have never been found above the Sparta. I am confident that the assemblage found pertains to the Cook Mountain-Sparta sequence, rather than to the overlying Cockfield. The absence of some of the species found in this sample from the Cook Mountain control may be due to the sparce recovery obtained from the Cook Mountain control, rather than to their absence from the Cook Mountain sequence.

The overlying sample from 368-376 feet (D3704B) undoubtedly pertains to the Cockfield.

Sample D3705 yielded at least two species that have been found previously only in the Moodys Branch Formation and in the Yazoo Clay. Therefore this sample probably pertains to the Jackson Group.

Robert H. Tschudy

Robert H. Tschudy

RHT

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REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Eocene-Recent

Kinds of fossils: Palynomorphs

General locality: Kentucky

Quadrangle or area: Milburn, Arlington and Wolf Island quads.

Referred by: W. I. Finch, 9/22/66

Shipment No.: KG-66-9D
Regional Geology in Kentucky

Report prepared by: R. H. Tschudy, 11/1/66

Date material received: 9/26/66

Status of work: Complete

[redacted]

Six samples were sent for palynological analysis; three were barren, the remainder were given USGS Paleobotanical Locality Numbers as follows:

Sample	Locality	Number
DMn-1	Auger hole at 120' elevation of L.S. 353', 2½ mi. E. of Arlington, Kentucky coords., S1,057.3-181.9, Milburn quad., Carlisle Co., Ky.	D3819
DA-1	At river's edge, elevation 290' below Columbus-Belmont State Park, Kentucky coords., S1,015.0-175.2, Arlington quad., Hickman Co., Ky.	D3820
HWI-1	Auger hole on Wolf Island, L.S. elevation 298', sample from 130-138', Kentucky coords., S997.4-150.35, Wolf Island quad., Hickman Co., Ky.	D3821

Samples FCC-1, FCC-2 and FCC-3 were all barren. The black color was due to the presence of pyrite rather than organic material. After treatment, very little organic material remained, and that did not yield any diagnostic fossils.

The productive samples yielded the following palynomorphs:

Code	Species	DMn-1 D3819	HWI-1 D3821	DA-1 D3820
P3-sm16		x	x	x
P3-sm30		x	x	x
Pa4-sm1		x		
BCP3-rt7B		x		

Code Species	DMn-1 D3819	HWI-1 D3821	DA-1 D3820
P5-sm6	x		
CP3syn-rt	x		
P4-sm1	x	x	
M-p8	x	x	
P3-sp5	x		
CP3-sm51	x	x	
M-r6	x	x	
CP3-sm53	x		
Pa5-sm2	x		
C3-rt16c	x		
cf. CP3-rt19C	x		
CP3-r38	x		
CP3-r39	x	x	
Peltate leaf hair	x	x	
Tet-fov new	x	x	
P3-sm98		x	
P∞-sm3		x	
CP3-syn-sm2		x	
P3-sm56		x	
M-P 16		x	
Tet-fov 2		x	
CP3-r34		x	
C3-rt36		x	
BCP3-rt2 var		x	
CP3-rt14		x	
CP3-rt28		x	
Hyst			x
Dino			x
Lycospora			x
Laevigatosporites			x
Densosporites			x
Tasmanites			x
BCP3-rt8 (Tilia)			x
I-st1			x
V2L			x
Betula			x
Aquilapollenites 1			x
Ulmus			x
P3-sm1B			x
Compositae			x

Sample DMn-1 (D3819) yielded an assemblage which contained some code species not found previously except in Moodys Branch and Yazoo Clay samples. Other species have been found previously in the Cockfield. This sample is clearly younger than the Sparta represented by our control material. I believe that this sample represents the lower Jackson. The possibility of it representing the uppermost Claiborne remains, as our control material from the Cockfield and Cook Mountain did not yield assemblages as good as we would prefer.

Sample HWI-1 (D3821) yielded an assemblage slightly older than the above. The species P3-sm56, for example is common in the Eocene through the Claiborne, but has never been found in younger samples. Most of the assemblage has been found previously in Cockfield and Cook Mountain control samples.

Sample DA-1 (D3820) yielded a peculiar mixture of palynomorphs. All were in a poor condition of preservation. Hystrichospheres, dinoflagellates and Tasmanites representing marine deposition were present. The dominant spores were Pennsylvanian. A few post-Pennsylvanian pollen grains were found also. This sample is clearly a mixture of re-deposited species. Aquilapollenites 1 (a Cretaceous species) is not indigenous to the Mississippi embayment, and probably arrived there from the west. The presence of Compositae pollen denotes a Miocene or younger age. This sample undoubtedly is from alluvium.

Robert H. Tschudy

RHT

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Eocene-Paleocene

General locality: Kentucky

Referred by: W. I. Finch, 10/10/66

Report prepared by: Robert H. Tschudy, 1/10/67

Status of work: Complete

Kinds of fossils: Palynomorphs

Quadrangle or area: Arlington, Milburn, Lovelaceville, LaCenter and Oak Level quads.

Shipment No.: KG-66-11D Regional Geology in Kentucky

Date material received: 10/24/66.

[redacted]

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10 samples (9 from W. I. Finch, Oct. 10, 1966 and one from W. W. Olive, Oct. 21, 1966) were sent for pollen analysis. Samples FCC-4 and FLO-3 were barren. The remainder were given USGS Paleobotanical locality numbers as follows:

Sample	Locality	Number
DA-2	Auger hole near Fish Lake, L.S. elev. 302', depth about 40', Ky. coords. S1016.5-189.8, Arlington quad., Carlisle Co., Ky.	D3836
DMn-2	Auger hole, L.S. elev. 407' about 1 mile N. of Ky. 80 near west edge of quadrangle, Ky. coords. S1052.8-190.7, Milburn quad., Carlisle Co., Ky.	D3837
FLO-2	Drill hole [illegible], depth 56-67', Ky. coords. S1,088,800-232,750, Lovelaceville quad., Carlisle Co., Ky.	D3838
FLO-4	J. W. Roark test hole, depth 500-505', Ky. coords. S1,097,700-245,300, Lovelaceville quad., Ballard Co., Ky.	D3839A
FLO-5	J. W. Roark test hole, depth 490-495' west side of Lovelaceville (town), Ky. coords. S1,097,700-245,300, Lovelaceville quad., Ballard Co., Ky.	D3839B
FLO-6	J. W. Roark test hole, depth of 225-230'. Same locality as FLO-4, FLO-5.	D3839C

FLA-1	Drill hole 1 mile E. of Ingleside, depth 89-100' Ky. coords. S1,086,300-302,800, LaCenter quad., McCracken Co., Ky.	D3840
OL-2	500 ft NW of Shemweld Cemetery, on right bank of Woodall Branch, Ky. coords. S1,204,900-197,400, Oak Level quad., Marshall Co., Ky.	D3841

Palynomorphs recovered are shown on the accompanying chart.

Sample	DA-2	DMn-2	FLO-2	FLO-4	FLO-5	FLO-6	FLA-1	OL-2
No.	D3836	D3837	D3838	D3839A	D3839B	D3839C	D3840	D3841
Code Species								
P3-sm30C	x		x					
Pa4-rug1	x							
P∞ r1	x							
BCP3-rt2B	x		x					
BCP3-rt (large)	x							
P3-sm25C	x							
P3-sm44	x							
TT-sm31B	x							
V2L/r4	x	x		x				
Gn-7C	x	x					x	
TT-fov1	x							
cf P4-sm5	x							
cf Pa3-sm30	x						x	x
CP3-sm53	x		x					
P3-sm72	x		x					
cf Pperi-r1	x							
BCP3-rt3	x	x	x					
P3-sm98		x						
P3-sm6		x						
C3-r30		x						
P3-sm30A		x		x	x	x		
C3-rt36		x						
M-P8		x						
P3-sm16		x	x					
CP3-sm53B		x						
CP3-p4C		x						
Gothan-1		x	x					
CP3syn-rt1		x	x					
Tet-sm1		x						x
P3-sm16D		x	x					
C3-rt44		x						
P3-r42A		x	x					
Peltate leaf hair		x	x					
M-p16		x						

Code	Species	D3836	D3837	D3838	D3839A	D3839B	D3839C	D3840	D3841
	cf p∞-sm8		x						
	BCP3-p1		x						
	P4-sm6		x						
	C3-rt 16C		x						
	CP4-sm2B		x	x					
	CP3-rt30			x					
	CP3-rt28			x					
	CP3-r39			x					
	C3-p20B			x					
	P3-sm56D			x					
	P ∞ sm3			x					
	P3-sm60			x			x		
	P5-foss1			x					
	C3-p20			x					
	P∞-sp1			x					
	S1-sm5				x				
	Tax-r1				x	x		x	x
	P3-sm58				x			x	
	P3-sm43B				x	x			
	P3-sm6B				x				
	P3-p1				x				
	cf P3-sm91				x				
	P3-sm43				x				
	P1-sp2				x				
	P3-sm47				x	x			
	P3-sm71				x				
	P3-sm1B				x			x	x
	Pa3-sm16				x	x	x		
	Hys-sim6				x				
	Hy1-sm1				x				
	Din-DC15				x	x		x	
	Tub-sim7B				x			x	
	Can.				x				
	Pa3-sm25					x	x		
	Pa5-sm2					x			
	Pperi-r5					x		x	
	Classo-3					x		x	
	Din-A16					x		x	
	Tub-com 3					x		x	
	Aquila sp						x		x
	C3-rt6						x		
	P3-sm62						x		
	C3-pl4C						x		x
	Pa6-sm1						x		
	M-sm5						x		
	C3-rt1B						x		
	C3-rt17						x		
	C3-sm35						x		
	P3-sm56						x	x	x
	C3-rt28						x		

Code	Species	D3836	D3837	D3838	D3839A	D3839B	D3839C	D3840	D3841
P3-p9B							x		x
Pa3-sm30B								x	
P3-sm57								x	
Gn11C								x	
P3-r32								x	
Fdens-sm6B								x	
P3-sm79								x	
O-rt22								x	
Tub-com5								x	
Pa5-sm1									x
Pa6-sm1									x
P3-sm75									x
Bot-1									x
P3-sm1C									x
C3syn-rt1									x
Pa3-sm26									x
Pperi-r3									x
V2S/sm5									x
Pperi-p1									x
V2L/sm12									x
O-sp12									x
Gn5B									x
CP3-r31									x
Pe1m1									x

The assemblage obtained from sample DA-2 (D3836) is young, but cannot possibly represent Recent alluvium. Most of the palynomorphs are common to the Eocene Jackson, and a few such as Pperi-r1, BCP3-rt (large) have been found previously only in the Eucutunna control sample. Sample DA-2 probably represents the upper Jackson, with the possibility that it may even be of early Oligocene age.

Sample DMn-2 (D3837) yielded an assemblage with fewer species than usually is obtained from the Sparta although many of the forms found have been found previously in the Sparta. Several species have been found previously only in the Moodys Branch and Yazoo Clay. This leads me to postulate that the sample represents sediments of Jackson age.

Sample FLO-2 (D3838) also yielded an assemblage somewhat intermediate between Claiborne and Jackson. The presence of species found previously only in the Yazoo Clay leads me to postulate a Jackson age for this sample.

Samples FLO-4 (D3839A), FLO-5 (D3839B), and FLO-6 (D3839C) particularly the first two pose a serious problem. The stratigraphically lower two samples were made up largely of marine hystrichosphaerids and dinoflagellates. The total yield of palynomorphs was scanty, a characteristic often present in marine samples. In sample FLO-4 no Cretaceous palynomorphs were found. A few pollen grains characteristic of the Porters Creek Clay were present. One of these, P3-sm71 has been recovered only from the Clayton and Porters Creek. Unfortunately, several species such as Carya and Platycarya that are known only from Wilcox and younger rocks were

present. Samples FLO-5 (D3839B) yielded a very poor essentially marine assemblage, but the sample yielded Wilcox species also. Samples FLO-6 (D3839C) yielded an abundant non-marine assemblage that is clearly of Wilcox age. These three samples came from the same test hole, and consisted of unconsolidated sediments. I think it is likely that the lower two marine samples were contaminated with material from up the hole. If this is true, then the slight amount of evidence available suggests a Paleocene age for the lower two marine samples.

Samples FLA-1 (D3840) yielded an assemblage of marine forms and corroded pollen. The pollen present is characteristic of the Porters Creek Clay. This sample is clearly of Paleocene age.

The determination of sample OL-2 (D3841) was transmitted by telephone. The pollen found clearly indicates a Wilcox age.

Robert H. Tschudy

Robert H. Tschudy

RHK

REPORT ON REFERRED FOSSILS

~~P&G Branch, Denver Lab, U.S.G.S.~~
~~Bldg. 25, Federal Center, Denver, Colorado~~

Stratigraphic range: Eocene

General locality: Kentucky & Missouri

Referred by: W. W. Olive, 12/9/66

Report prepared by: Robert H. Tschudy, 2/13/67

Status of work: Complete

Kinds of fossils: Palynomorphs

Quadrangle or area: Wickliffe, Hickman & Lynn Grove quadrangles

Shipment No.: KG-66-13D
Regional Geology in Kentucky

Date material received: 12/12/66

~~Report not to be quoted or paraphrased in publication without a final recheck by the Paleontology and Stratigraphy Branch.~~

Eight samples were sent for palynological examination. All eight samples yielded at least a few palynomorphs. They were given USGS Paleobotanical locality number as follows:

Sample	Locality	Number
LW-1	Well sample from 56-66 ft at city's water works; Kentucky coords. S1023.35-247.55, Wickliffe quadrangle, Ballard Co., Ky.	D3884
LHK-1	From auger hole 31 ft above river at new ferry landing at a depth of 154-162 ft; Kentucky coords. S983.0±-110.75±, Hickman quadrangle, Mississippi Co., Missouri.	D3885
LHK-2	Auger hole west of Locust Grove School, depth 141-145 ft; Kentucky coords. S976.45-121.8, Hickman quadrangle, Mississippi Co., Missouri.	D3886
LHK-3	From a depth of 130 ft in a 24" bored well 22 mi. SSW of Wiswell; Kentucky coords. S1222.5-90.3, Lynn Grove quadrangle, Calloway Co., Ky.	D3887
LW-5	From a depth of 100-110 ft in auger hole at center west of Cane Island; Kentucky coords. S1022.7-228.1, Wickliffe quadrangle, Carlisle Co., Ky.	D3888

LW-2	From a depth of 66-76' at city's water works; Kentucky coords. S1023.35-247.55, Wickliffe quadrangle, Ballard Co., Ky.	D3889
LW-3	From a depth of 76-86'. Same locality as LW-2.	D3890
LW-4	From a depth of 147 ft in well field at Wickliffe, Kentucky coords. S1023.35-247.55, Wickliffe quadrangle, Ballard Co., Ky.	D3891

The palynomorphs identified from the above samples are listed on the accompanying chart.

Sample LW-1 (D3884) yielded no evidence of Recent Alluvium. The assemblage pertains to the Middle Eocene Claiborne group.

Sample LHK-1 (D3885) yielded an assemblage that is somewhat difficult to identify. Samples at or near the Claiborne-Jackson boundary often do not yield definitive assemblages. The presence of the species C3-rt44, C3-rt16B, P∞-sm7B and CP3syn-sm3 heretofore found only in the Yazoo Clay, strongly points to a Jackson age for this sample.

Sample LHK-2 (D3886) yielded an assemblage similar to that from LHK-1. This assemblage is also similar to one obtained from Moodys Branch samples. I believe this sample pertains to the lower Jackson.

Sample LHK-3 (D3887) yielded only four identifiable palynomorphs. Those found suggest Wilcox rather than Porters Creek. The yield from this sample was so poor that a definite determination cannot be made.

Sample LW-5 (D3888) yielded an assemblage that compares favorably with one obtained from the Cockfield Formation. This sample pertains to the upper Claiborne group. Redeposited Paleozoic spores were also found in this sample.

Sample LW-2 (D3889) yielded a very poor assemblage. Those palynomorphs identified, however, indicate that the age of this sample is probably of the same age as samples LW-3 and LW-1, that is Middle Eocene (Claiborne). There is no evidence pointing to Recent Alluvium pollen.

Sample LW-3 (D3890) yielded a Middle Eocene (Claiborne) assemblage. There is no evidence of pollen from Recent Alluvium.

Sample LW-4 (D3891) was poor. Nevertheless the assemblage found pertains to the Claiborne group--and possibly to the lower Claiborne.

Robert H. Tschudy

Robert H. Tschudy

RHT

KG-66-13D

Code Species	Sample Number	LW-1 D3884	LHK-1 D3885	LHK-2 D3886	LHK-3 D3887	LW-5 D3888	LW-2 D3889	LW-3 D3890	LW-4 D3891
P3-sm16D		x				x		x	x
P4-foss1		x	x	x				x	x
Ia3-sm16		x					x		
P3-sm30B		x	x				x	x	x
P3-sm30C		x	x	x		x		x	x
P3-sm6B		x							x
P6-sm8		x	x						
Pa4-sm1		x					x	x	x
CP3-sm53		x	x	x		x		x	
Pperi-r1B		x					x		
Gn-7c		x	x						
P [illegible]-sm3B		x		x		x	x	x	x
V2S/r		x				x			
CP3-r26		x							
CP3-r22		x							
Pa5-sm1		x	x	x		x	x	x	x
C3-rt16C		x	x	x					
C3-rt36		x	x	x		x	x		
P [illegible]-sm7B			x	x					
Peltate leaf hair			x	x					x
P3-sm16			x	x				x	
cf Anemia 16			x	x					
M-p8			x	x		x			
Ea-sm (new)			x						
CP4-sm2B			x	x					
P3-sp3			x						
cf P3-sm97			x						
P3-sm70			x						
CP3-r16			x						
C3-rt44			x						
BCP3-rt2F			x						
C3-rt16B			x	x		x			
CP3syn-sm3			x						
P4-sm (new)			x						
cf TF-r12				x					
P3-sm56D				x					
P [illegible]-sm8				x					
Gothan 1				x		x			x
P5-foss1				x		x			
CP3syn-rt				x					
Pa3-sm25c					x				
P3-sm1B					x				
CP3-sm36					x				
P3-sm56D					x				
P3-sm106B						x			
cf C4-sm6						x			
CP3-rt44						x			
BCP3-rt2B						x			
Pediastrum						x		x	
P3-rt3D						x			
P3-sm98						x			
Tet-fov2						x			
Dinoflagellate						x			
P3-sm6							x	x	
C6-r (new)							x		
P3-sm72								x	
C3-P20B								x	
P3-p1								x	
P4-sm10									x
BCP3-rt8									x
P4-sm1									x
C3-r1c									x
C3-rt40									x
CP3-st1B									x

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA GEN. REG. NO. 27

5010-107

UNITED STATES GOVERNMENT

Memorandum

TO : W. I. Finch

DATE: February 15, 1967

FROM : R. H. Tschudy

SUBJECT: Re-evaluation of samples OL-2, FPW-27 and FPW-14

All three samples were re-examined in detail as can be seen from the accompanying chart. Those species with a circle around the x are species found during the present examination which were not seen in previous examinations. I previously said that sample OL-2 (D3841) was clearly Wilcox. This determination is confirmed.

Sample FPW-27 (D3528), as can be seen from the chart, yielded almost a completely different assemblage than that from OL-2. The new species found are known from the Recklaw, Tallahatta and Sparta Formations. The previous estimate was that this sample pertained to the basal Claiborne. Re-examination confirms that this sample is of Claiborne age.

Sample FPW-14 (D3381) presents a different story. Originally I determined this sample as Wilcox. Upon re-examination (Memo of Jan. 5, 1966) I found what I thought was a species of Juglanspollenites. The presence of this genus and my inability to find specimens of Thomsonipollis, characteristic of the Wilcox, led me to place this sample in the lower Claiborne. Upon more detailed examination I found Thomsonipollis in sample FPW-1 Furthermore, I concluded that what I had previously determined as a multiporate member of the genus Juglanspollenites, is a new code species not previously seen. The assemblage compares very favorably with the one from Pine Top (D3659) which I now believe to belong to the Wilcox. Numerous re-deposited Cretaceous species may have led me to ignore some of the specimens pertaining to formations older than Claiborne. I am sure now that sample FPW-14 (D3381) pertains to the Wilcox. I'm glad that you called this to my attention, and sorry for the misidentification. I really have no excuse to offer other than that the diagnostic fossils were rare.

Robert H. Tschudy

Sample	OL-2	FPW-27	FPW-14
Number	D3841	D3528	D3381
Code Species			
Pa5-sm1	x	x	x
Pa6-sm1	x		x
P3-sm75	x		
Pa3-sm30	x		(x)
Aquila	x		(x)
Bot-1	x		
P3-sm91	x		
Tax-sm1	x		x
P3-sm1C	x		x
cf. C3syn-rt1	x		x
P3-sm1B	x	x	
Dinoflagellate	x		x
Tet-sm1	x		
P3-p9B Thomsonipollis	x		(x)
Pa3-sm26	x		
Pperi-r3	x		(x)
V2S/sm5	x		
Pperi P2 Pachysandra	x		
V2L/sm12	x		
O-sp12	x		
P3-sm56	x	x	x
C3-p14C	x		
Gn-5B	x		
CP3-r31	x		
P3-sm30A		x	x
P3-sm16		x	
P3-sm6		x	
P3-sm43B		x	
P3-sm21		x	
P3-r16		x	
P3-sm98		x	
P3-sm85B		x	
P3-sm48		x	
P3-sp4		x	
Pa3-sm25c		x	x
Pa3-sm16E Platycarya		X	
Pa4-sm1		x	
C3-p14B		x	
C3-rt16		x	
C3-sm1B		x	
C3-rt43		x	
C3-r32		x	
C4-rt2		x	
CP3-sm5		x	
CP3-r26		x	
CP3-P4B		x	
CP3-r38		x	x

CP3-r100		x	
CP3-sm46		x	
CP4-sm6		x	
P3-sm58			x
P5-sm6 new	(x)		x
Classo			x
P3-p1 Pistillipoll.			x
P4-sm6			x
BCP3-r4			x
P3-sm14B			x
Pa4-rug1			x
P3-sm76			x
P3-r30			x
Sequoia			x
cf CP3-sm53		(x)	
P4-rt1		(x)	
P6-sp1		(x)	
C3-rt24		(x)	
cf CP3-rt27		(x)	
C5-sm1		(x)	
CP3-r31			(x)
P3r-22C			(x)
Pediastrum			(x)
P3-sm43			(x)

REPORT ON REFERRED FOSSILS

~~P&S Branch, Denver Lab., U.S.G.S.~~
~~Bldg. 25, Federal Center, Denver, Colorado~~

Stratigraphic range: Paleocene-Eocene

Kinds of fossils: Palynomorphs

General locality: Kentucky

Quadrangle or area: Hickman, Arlington & Hardin quadrangles

Referred by: W. I. Finch, 1/4/67

Shipment No.: KG-67-1D
Regional Geology in Kentucky

Report prepared by: Robert H. Tschudy, 2/28/67

Date material received: 1/4/67

Status of work: Complete

~~Report not to be quoted or paraphrased in publication without a final recheck by the Paleontology and Stratigraphy Branch.~~

Five samples were sent for palynological examination. All were productive and were given USGS Paleobotanical locality numbers as follows:

Sample	Locality	Number
FHK-1	0.2 miles N. of Hickman, drill hole depth 85-102', Kentucky coords., 995,650-110,000, Hickman quad., Fulton Co., Ky.	D3879
FHK-2	0.2 miles NE of Hickman, drill hole depth 42-62', Kentucky coords., 997,700-109,800, Hickman quad., Fulton Co., Ky.	D3880
FHK-3	1 mile N. of Hickman, drill hole depth 69-112' (upper part), Kentucky coords., 994,750-114,000, Hickman quad., Fulton Co., Ky.	D3881
DA-2	2.5 miles W. of Bardwell, auger hole at 130', Kentucky coords., S1034.3-211.5, Arlington quad., Carlisle Co., Ky.	D3882
SHR-1	2.5 miles S. of Benton, well sample from an altitude of 405', Kentucky coords., 1,238,000-187,600, Hardin quad., Marshall Co., Ky.	D3883

The palynomorphs identified are shown on the accompanying chart.

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Samples FHK-1 (D3879), FHK-2 (D3880), FHK-3 (D3881) and DA-2 (D3882) all yielded floras that I believe represent the Jackson. I base this conclusion on the absence of several forms common to the upper Claiborne, such as Anacolosidites and Gothanipollis, and the presence of several species that I have not found except in samples from Moodys Branch and Yazoo Clay. These code species are Pperi-sm7B, C3-rt16C, CP3-r47, C3-r38, CP3-r new and CP3-rt44. All of these samples yielded species common to the upper Claiborne also. My hesitancy in making a firm or unequivocal determination stems from the fact that the Cockfield and Cook Mountain control samples have yielded poor assemblages. It is possible that better samples from these formations might yield assemblages with greater numbers of species. On the basis of the control now available, I have to conclude that the above samples represent the Jackson.

Sample FHK-2 yielded a comparatively poor assemblage dominated by CP3-r new, and C3-r38. This sample is unlike any control sample quantitatively, but somewhat similar to the Moodys Branch sample qualitatively. None of the FHK samples yielded species that would suggest Quaternary alluvium.

Sample DA-2 yielded an excellent assemblage. This assemblage compares much more favorably with Moodys Branch and Yazoo Clay samples than it does to Sparta or Zilpha control samples. For example, the distinctive species CP3-r47 has been found only in the Yazoo Clay. I am fairly sure of this determination.

Sample SHR-1 (D3883) it will be noted, yielded only one species in common with the other four samples, namely Pa4-rug 1. The assemblage, dominated by marine hystrichospheres and dinoflagellates, yielded comparatively few pollen grains. The assemblage is clearly of Paleocene age, and resembles assemblages from the Porters Creek Clay more closely than it does assemblages from the Clayton. I believe this sample pertains to the lower Porters Creek.

Robert H. Tschudy

Robert H. Tschudy

FHK

Code Species \ Sample Number	FHK-1 D3879	FHK-2 D3880	FHK-3 D3881	DA-2 D3882	SHR-1 D3883
P3-sm16	x	x	x	x	
P5-foss1	x	x	x		
cf Gn 7	x				
Pperi-sm7B	x			x	
C3-rt16C	x	x	x	x	
P3-sm30C	x	x	x	x	
P3-sm30A	x		x		
C3-P4C	x	x	x	x	
CP3-r47		x		x	
Pa4-sm1	x				
cf BCP3-rt2B	x				
Pperi-sm8	x		x	x	
Peltate leaf hair	x			x	
BCP3-rt7B	x		x		
P3-sm109	x				
C3-p20 var	x		x		
P3-sm16D	x				
Tax-r5	x		x	x	
P3-rt42A	x	x			
C3-r38	x	x	x	x	
Pa4-rug 1	x	x	x	x	x
CP3-r new	x	x	x	x	
M-p16		x			
CP3-rt33B		x			
CP4-sm2		x		x	
S1-r1		x	x		
CP3-rt44			x	x	
C3-rt44			x	x	
BCP3-rt new			x	x	
Gn 7C			x	x	
BCP3-rt3			x		
P3-sm72			x	x	
cf P1-sp2				x	
cf CP4-sm34B				x	
BCP3-r14				x	
P4-sm6				x	
CP3-sm53B				x	
grass				x	
O-rt22					x
Din-BC8					x
P3-sm56					x
P3-sm79					x
Gn-11D					x
Pediastrum					x
P3-sm1B					x
Din-C5					x
Pa3-sm30					x

P3-sm60B	x
Hyl-br2	x
Pper1-sm5	x
CP3-sml4	x
P3-sm58	x
P3-sm75	x
C3-rt17B	x
P3-sm78	x
V2S/rt1	x
P3-sm6B	x
cf C3-pl4	x

REPORT ON REFERRED FOSSILS

[redacted]

Stratigraphic range: Paleocene, Eocene, Oligocene?

Kinds of fossils: palynomorphs

General locality: Kentucky

Quadrangle or area: Oakton, Olmstead, Barlow, and Hickman quads.

Referred by: W. W. Olive

Shipment No. KG-67-2D

Report prepared by: R. H. Tschudy, 4/5/67

Date material received: 1/30/67

Status of work: Complete

[redacted]

Seven samples were sent for palynological examination. All yielded palynomorphs and were given USGS Paleobotanical locality numbers as follows:

Sample	Locality	Number
AOk-1	3.0 miles SSE of intersection of US 51 and Ky. 80, in Arlington, Kentucky, coordinates S1047.75 - 166.95, Oakton quad., Hickman Co., Ky.	D3940
AOd-1	5.3 miles N of intersection of US 60 and Ky. 1105, in Barlow, Kentucky, coordinates S1042.6 - 306.34, Olmstead quad., Ballard Co., Ky.	D3941
ABw-1	4.8 miles NW of intersection of US 60 and Ky. 1105, in Barlow, Kentucky, coordinates S1018.2 - 292.8, Barlow quad., Ballard Co., Ky.	D3942
ABw-2	4.6 miles NNE of intersection of US 60 and Ky. 1105, in Barlow, Kentucky, coordinates S1047-1 - 301.15, Barlow quad., Ballard Co., Ky.	D3943
ABw-3	5.1 miles NE of intersection of US 60 and Ky. 1105, in Barlow, Kentucky, coordinates S1052.2 - 301.4, Barlow quad., Ballard Co., Ky.	D3944
ABw-4	Same as ABw-3	D3945
FHk-4	Drill hole FH-13 (depth 103-107'). 150 ft from waters edge of Mississippi River about 2½ miles from city limits of Hickman, Kentucky, coordinates 972,300 - 101,350, Hickman quad., Fulton Co., Ky.	D3946

The palynomorphs identified from these samples are shown on the accompanying chart.

Sample AOk-1 (D3940) yielded an abundant microfossil flora indicative of a Jackson age.

Sample AOd-1 (D3941) yielded little organic material. That obtained was corroded and characterized by small pollen and small, more or less isodiammetric debris. The palynomorphs identified clearly indicate that this sample is from the Porters Creek Clay of Paleocene age, rather than from the Wilcox.

Sample ABw-1 (D3942) was similar in all respects to sample AOd-1. It also represents the Porters Creek Clay.

Sample ABw-2 (D3943) yielded a characteristic Porters Creek Clay assemblage. Hystrichospheres and dinoflagellates were more abundant in this sample than in any other sample from this shipment.

Sample ABw-3 (D3944) was sent with the notation "younger than ABw-4." This sample also pertains to the Paleocene Porters Creek Clay, although probably deposited nearer to the shoreline as suggested by the paucity of fossils of marine origin (dinoflagellates and hystrichospheres). This sample also yielded many redeposited Cretaceous and Paleozoic species.

Sample ABw-4 (D3945) yielded a characteristic Paleocene Porters Creek Clay assemblage. The presence of Aquila-1 suggests upper Porters Creek. I cannot determine that this sample is older than sample ABw-3. It also yielded many redeposited Paleozoic species.

Sample FHk-4 (D3946) was difficult to evaluate. Of purported Jackson age, it did not yield a palynomorph assemblage similar to the assemblage we have from our Jackson control material. Species that we associate as being characteristic of the Jackson (such as CP_3-r47, CP_3-sm53, C_3-rtl6c) were absent. Furthermore 7 species confined so far to the Bucutunna Clay, and two new species were found. A comparison between samples AOk-1 and FHk-4 (on accompanying chart) shows only two species in common. I am forced to conclude that sample FHk-4 either represents a part of the upper Jackson for which we do not have control, or, as is more probable, it is from the lower Oligocene.

Robert H. Tschudy

R. H. Tschudy

RHT

Sample	AOk-1	AOd-1	ABw-1	ABw-2	ABw-3	ABw-4	FHk-4
number	D3940	D3941	D3942	D3943	D3944	D3945	D3946
P3-sml6	X						X
CP3-r38	X						
P3-sml06B	X						
C3-rtl6B	X		X				
CP3-rtl4	X						
MPl6	X						
C3-p20B	X						
BCP3-rt2F	X						
BCP3-pl	X						
C3-sm	X						
P3-r42A	X						
P3-sml10	X						
CP3-sm5	X						
M-r6	X						
C3-rt	X						
C3-rtl6C	X						
CP3-rt8	X						
Sl-rt23	X						
CP3-rt44	X						
CP3-r47	X						
CP4-sm2	X						X
TAX-r5		X	X	X	X	X	
dinoflagellates		X	X	X	X	X	
V2L/p5B		X		X		X	
C3-sm29		X	X				
P3-sm1B		X	X	X	X	X	
GN-llB		X	X	X		X	
TT-sm37		X	X		X	X	
Anl9		X					
P3-sm6B		X	X	X			
P3-sm60		X	X	X		X	
CP3-r3l		X					
Classo-3		X	X	X	X	X	
Pperi-sm5		X	X	X	X	X	
hystrichospheres			X	X			
Pa5-sml			X		X	X	X
CP3-r20			X				
P3-sm2l				X	X		
P3-sm56c				X		X	
Pa3-sm30				X		X	
P3-sm60B				X	X		
CP3-r2l				X			
Pa4-rugl				X	X		
Bot-l				X		X	
P3-r22				X			
V2S/sm27					X		
TO-p4B					X		
P3-sm75					X	X	
P3-sm53						X	

(continued)

Sample	AOk-1	AOd-1	ABw-1	ABw-2	ABw-3	ABw-4	FHk-4
number	D3940	D3941	D3942	D3943	D3944	D3945	D3946
GN-11c						X	
Pediastrum						X	
Sequoia-1						X	
Aquila-1						X	
Pperi-sm7B							X
P3-sm30c							X
Gn-7c							X
VOT-r							X
P4-foss							X
C3-rt (large)							X
CP3-rt							X
V2S/r (large)							X
Pinus							X
P∞-r (new)							X
P5-rug (large)							X
P5-sm (new)							X
cf M-p8							X
VOT-sm (small)							X
P∞-sm8							X
P4-sml							X