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OPEN-FILE REPORT

Palynological Investigations in the Pennsylvanian of Kentucky - IV

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by

Robert M. Kosanke

Denver, Colorado

U. S. GEOLOGICAL SURVEY
WASHINGTON, D. C.
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1. Preliminary surficial geologic map and materials test data of the Golden quadrangle, Jefferson County, Colorado, by Richard Van Horn. 1 map, 1 table (3 sheets), scale 1:24,000. 8102 Federal Office Bldg., Salt Lake City, Utah, 84111; 1012 Federal Bldg., Denver, Colo. 80202. Material from which copy can be made at private expense is also available in this Denver office.

2. Palynological investigations in the Pennsylvanian of Kentucky - IV, by Robert M. Kosanke. 39 p. 710 West High St., Lexington, Ky. 40508; Kentucky Geological Survey, 307 Mineral Industries Bldg., 120 Graham Ave., Lexington, Ky. 40506. Material from which copy can be made at private expense is available in the Library, Bldg. 25, Federal Center, Denver, Colo. 80225.

3. Preliminary materials map of the Goshen quadrangle, Massachusetts, by G. William Holmes. 1 map, 4 tables. Scale 1:24,000. Massachusetts Dept. of Public Works, 100 Nashua St., Boston, Mass. 02114; and USGS, 80 Broad St., Boston, Mass. 02110. Material from which copy can be made at private expense is available in the USGS Boston office.

4. Preliminary materials map of the North Adams quadrangle, Massachusetts-Vermont, by G. William Holmes. 1 map, 7 tables, scale 1:24,000. Massachusetts Dept. of Public Works, 100 Nashua St., Boston, Mass. 02114; and USGS, 80 Broad St., Boston, Mass. 02110. Material from which copy can be made at private expense is available in the USGS Boston office.

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5. Geologic map of the Harwich quadrangle, Barnstable County, Cape Cod, Massachusetts, by Robert N. Oldale. 16 p., 1 map, explanation, cross-sections, scale 1:24,000.

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CONTENTS

INTRODUCTION

This is the fourth open-file report concerned with palynological analyses of Pennsylvanian coals, underclays, and shales. It is part of the cooperative mapping project between Kentucky and the U. S. Geological Survey.

This report contains palynological analyses of samples from Elkhorn City, Majestic, Williamson, Millard, Belfry, Redbush, Paintsville, and Jenkins West quadrangles of eastern Kentucky, and Belle quadrangle of West Virginia. One hundred samples of coal, underclay and shale have been examined. Statistical analyses have been run on 92 of the 100 samples, and more than 24,250 specimens were identified and counted.

All analyses completed during 1967 are included in this report: others will be placed in open-file when they are completed and are released for general use.

REPORT ON REFERRED FOSSILS

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

Stratigraphic range: Pennsylvanian

General locality: Kentucky

Referred by: Donald C. Alvord (7/14/65)
and W. F. Outerbridge (10/31/66)

Report prepared by: Robert M. Kosanke
3/23/67

Status of work: KG-65-11D incomplete,
KG-66-12D complete

Kinds of fossils: Spores and pollen

Quadrangle or area: Elkhorn City
and Majestic quads.

Shipment No.: Alvord KG-65-11D
Outerbridge KG-66-12D

Date material received:
KG-65-11D (7/22/65)
KG-66-12D (11/7/66)

Macerations 93 A-C 37 inches of weathered coal from the type locality of the Auxier coal, Alvord R-2 samples from mouth of Beaver Creek, 6,100' N. 47° W. of the gaging station in Elkhorn City, Elkhorn City quad., Pike County, Kentucky.
93-A = 19" coal, weathered
93-B = 14" coal, weathered
10" Ss. and Sts., no sample
93-C = 4" coal, weathered

Macerations 173 A-H 44¼ inches shale, coal, and fireclay from some coals known locally as the Splash Dam coals. Outerbridge samples USD 1-3 and LSD 1-3 from roadside by Knox Creek about 1 mile above mouth, Lat. 37° 31' 23.8" N., Lon. 82° 03' 29.8 W., Majestic quad., Pike County, Kentucky.
173-A = 2" shale (USD-1)
173-B = 10" coal)
173-C = 10" coal) (USD-2)
173-D = 10" coal)
173-E = 2" fireclay and ganister (thickness 24", sample 2" thick) (USD-3)
173-F = 3" shale (LSD-1)
173-G = 7" coal (LSD-2)
173-H = ¼" fireclay (LSD-3)
ganister, grades into Ss. (no sample)

GENERAL COMMENTS

The preservation or quality of recoverable spores and pollen left much to be desired in macerations 93 A-B. Preservation of spores and pollen is somewhat better in 93-C. Although it was possible to obtain a generic count in both 93 A-B, I am reasonably confident the preservation factor has altered the results. This is because Lycospora appears to be under-represented while Densosporites is over-represented. The few specimens that could be identified as belonging to Lycospora were very thin. Although badly corroded, Densosporites is usually represented by the thick equatorial portion which is extremely resistant to degradation. In 93 A-B, more than 75 percent of the specimens assignable to Densosporites are "rings" or the thickening equatorial portions of specimens without the possibility of species identification in most instances.

The preservation in macerations 173 A-H was generally good except for the 2 inch shale sample (A) and the $\frac{1}{4}$ inch fireclay (H). A generic count was impossible for 173-A and the numerous specimens assignable only to the generalized category monosaccates for 173-H is indicative of poor preservation, but also a high percentage of monosaccate genera for this sample.

TYPE AUXIER COAL - MACERATIONS 93 A-C

I cannot give a definitive answer in terms of a correlation or a separate and distinct coal for these samples because of the preservation factor. Clearly the coal could correlate with the Upper Banner or Splash Dam coal, but no specimens of Schulzospora were observed. It is possible that some of the poorly preserved specimens assigned to the monosaccates could be corroded specimens of Schulzospora. If this is not the case and Schulzospora is absent from the assemblage, a slightly younger coal could be indicated.

Only 48 species assignable to 17 genera (see table 1) have been identified from macerations 93 A-C. The bulk of the species identified are those observed in this general part of the Breathitt Formation. Two of these species, Cristatisporites 1132 and Punctatisporites 1350, suggest that the samples represented by macerations 93 A-C are not older than the Upper Banner or possibly the Elswick coal.

The composite generic abundance data is as follows:

Cristatisporites	8.3%
Densosporites	70.5
Granulatisporites	3.3
Laevigatosporites	4.1
Lycospora	7.0
	93.2%

Allowing for over-representation of Densosporites and possibly Cristatisporites, and under representation of Lycospora as previously discussed, these samples could represent the Upper Banner or Splash Dam coal based on generic abundance data.

MACERATIONS 173 A-H

Macerations 173 A-H are in the Schulzospora rara - Dictyotriletes bireticulatus overlap zone (see report of 2/2/67). Twenty-four genera (table 2) and 82 species have been identified. All of these genera are present in the Upper Banner coal except Camptotrilletes and Knoxisporites. These two genera are extremely rare in occurrence in 173 A-H. Reinschospora and Vestispora, both numerically unimportant in the Upper Banner coal, have not been observed in 173 A-H.

The following compares the upper coal segments (173 B, C, D) with the composite of all coal segments. See table 2 for the percentages for the lower coal segment (173-G).

	Upper coal segments	Composite - all coal segments
Cristatisporites	8.5%	7.9%
Densosporites	42.6	46.7
Granulatisporites	10.6	9.8
Laevigatosporites	6.6	5.5
Lycospora	14.5	15.2
	82.8%	85.1%

These percentages together with the overall generic composition suggest a relationship with the Upper Banner coal (see report 2/2/67). The 7 inch lower coal segment does not compare with 104-F (report 2/2/67) based on generic abundance. This 7 inch coal segment looks more like a split of 173 B-D.

The presence of Calamospora 76, Cristatisporites 810 and 1132, Reticulatisporites 1237, and Alatisporites sp. further suggest a relationship to the Upper Banner coal.

Robert M. Kosanke

Robert M. Kosanke

TABLE 1

GENERIC SUMMARY OF THE SMALL SPORES OF THE AUXIER COAL FROM THE TYPE LOCALITY

(Mouth Beaver Creek, 6,100' N.47°W. of the gaging station in Elhorn City, Elkhorn City quad., Pike County, Kentucky)

	93-A	93-B	93-C
AHRENSISPORITES	+	.4	
CALAMOSPORA			1.2
CAMPTOTRILETES			.8
CIRRATRIRADITES		+	.4
CRISTATISPORITES	1.6	18.4	4.0
DENSOSPORITES	85.2	70.0	3.2
DICTYOTRILETES	.4		
ENDOSPORITES	1.2	+	.8
FLORINITES			.4
GRANULATISPORITES	4.8	.8	5.2
KNOXISPORITES			+
LAEVIGATOSPORITES	3.2	1.2	18.8
LYCOSPORA	.8	3.2	50.4
PUNCTATISPORITES	.8	2.0	5.6
RAISTRICKIA	+	.8	2.4
SAVITRISPORITES		+	+
WILSONITES		.8	.4
MONOSACCATE	2.0	2.4	6.0
ALL OTHER TAXA			.4
	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 750 specimens counted

93 A-C = 37" coal, Alvord sample R-2 (Hagy ? Splash Dam)
93-A = 19" coal, weathered
93-B = 14" coal, weathered
10" Ss. and Sts., no sample
93-C = 4" coal, weathered

TABLE 2

GENERIC SUMMARY OF THE SMALL SPORES OF
SOME COALS KNOWN LOCALLY AS THE SPLASH DAM COALS

(At roadside by Knox Creek about 1 mile above mouth, Lat. 37°31'23.8"N., Lon. 82°03'29.8"W., Majestic quad., Kentucky)

	173-A	173-B	173-C	173-D	173-E	173-F	173-G	173-H
AHRENSISPORITES			6.0		.8		1.2	1.2
ALATISPORITES						.4		
CALAMOSPORA	+	+	.4		1.2	4.4		2.0
CAMPTOTRILETES		+		.4	+	.4	+	2.0
CIRRATRIRADITES			+		+		+	2.4
CONVOLUTISPORA		+	2.0	.4	+			
CRASSISPORA					.4			
CRISTATISPORITES		+	2.0	23.6	.8	4.4	5.6	1.6
DENSOSPORITES	+	75.2	10.4	42.4	16.8	6.0	64.0	23.6
DICTYOTRILETES		.4	+			+	.4	
ENDOSPORITES		2.4	5.2		.8	.4	1.2	5.6
FLORINITES		+	.4	.4	.4	1.2		2.0
GRANULATISPORITES	+	7.2	19.6	5.2	3.6	15.6	6.4	15.6
KNOXISPORITES	+	+	.4	.4	+			.4
LAEVIGATOSPORITES	+	5.6	6.8	7.6	1.6	2.8	.8	2.4
LYCOSPORA	+	6.0	31.6	6.0	68.4	44.4	18.4	6.8
PUNCTATISPORITES		.8	1.6	4.4	1.2	6.4	.4	2.4
RAISTRICKIA	+	+	2.0		.4	3.2	.4	1.2
RETICULATISPORITES		.4	.4	.4	+	.8		.4
SAVITRISPORITES			2.0	.8	.8	+		.4
SCHULZOSPORA	+	1.2	4.8			4.0	.4	
SIMOZONOTRILETES					?		+	
TRIQUITRITES			.4			.4		
WILSONITES			+	1.6	.4	.4	+	2.0
MONOSACCATES	+	.8	4.0	6.0	2.4	4.8	.8	27.2
ALL OTHER TAXA				.4	+	+		.8
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 1,750 specimens counted

173 A-H = 4 1/4" shale, coal, and fireclay
- 173-A = 2" shale (USD-1)
- 173-B = 10" coal)
- 173-C = 10" coal) (USD-2)
- 173-D = 10" coal)
- 173-E = 2" fireclay and ganister (total thickness 24", sample 2" thick) (USD-3)
- 173-F = 3" shale (LSD-1)
- 173-G = 7" coal (LSD-2)
- 173-H = 1/4" fireclay (LSD-3)
  ganister, grades into sandstone (no sample)

REPORT ON REFERRED FOSSILS

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

Stratigraphic range: Pennsylvanian

Kinds of fossils: Spores and pollen

General locality: Kentucky and West Virginia

Quadrangle or area: Williamson quad. (107 and 108); Belle quad. (121)

Referred by: Donald C. Alvord 5/20/66 and 9/15/66

Shipment No.: KG-66-3D (107 and 108)
KG-66-8D (121)

Report prepared by: R. M. Kosanke 6/20/67

Date material received:
KG-66-3D 5/31/66
KG-66-8D 9/7/66

Status of work: KG-66-3D Complete
KG-66-8D Incomplete

Maceration 107 A-E $48\frac{1}{2}$" shale, coal, and seat rock from near the type locality of the Taylor coal. This sample was collected from near the N. margin of the Williamson $7\frac{1}{2}$' quad on the E. side of Right Fork of Lick Branch of Big Creek from highwall of an active auger operation, Martin County, Kentucky. This is $5\frac{1}{2}$ miles NNW of Hunt's type Taylor locality No. 137. Alvord samples Z-3 1-5 through Z-3 5-5.

107-A = 4" shale
107-B = 13" coal
107-C = 13.5" coal
107-D = 14" coal
107-E = 4" seat rock

Maceration 108 A-H 87.75" coal, clay, and underclay from the type Winifrede coal of the miners of the Tug Fork region and of Huddle and Alvord (Buffalo Creek coal of Hennen and Reger). This sample was collected 0.45 miles up 1st left hand fork of Swinge Camp Branch on the south side at alt. 1080' from highwall 25' east of abandoned entry to active workings on the Lynn Fork Coal Co. No. 1 Mine. This is slightly less than $3\frac{1}{4}$ miles NW of Hunt's type Taylor locality No. 137, Williamson quad., Pike County, Kentucky. Alvord samples Z-4 1-8 through Z-4 8-8.

108-A = 17.75" coal
108-B = 6.00" clay
108-C = 12.00" coal
108-D = 7.50" coal
108-E = 12.00" coal
108-F = 14.00" coal
108-G = 12.50" coal
108-H = 6.00" underclay

Maceration 121 A-E $54\frac{1}{2}$" of coal and claystone from the type locality of the Winifrede coal. This sample is from the head of Fields Creek on the west side of North Hallow from rib 10' inside old cutout opening of "South Mine" behind No. 2 Machine Shop of the Carbon Fuel Company, track level 1039' alt. 10,135' N of south line and 14,900' from east line of $7\frac{1}{2}$' Belle quad., Kanawha County, West Virginia. This is $1\frac{1}{2}$ miles SE of original Winifrede location. Alvord samples W S-1 through W S-5.

121-A	=	16"	weathered coal
121-B	=	16"	weathered coal
121-C	=	4"	claystone and coal rash
121-D	=	9.5"	coal
121-E	=	9"	coal

GENERAL COMMENTS

The quality of recoverable spores and pollen was excellent except for macerations 107-A, 107-B, 121-D, and 121-E. It was possible to obtain statistical data for all of the macerations except 121-E.

TYPE TAYLOR COAL - MACERATIONS 107 A-E

Twenty-one genera and 68 species were identified from these samples. See table 1 for statistical data on the occurrence of these genera. Five genera occurring in the coal portions of the Taylor samples are of numerical significance on a composite overall basis and are:

Densosporites	27.5%
Granulatisporites	10.0
Laevigatosporites	29.9
Lycospora	11.5
Triquitrites	7.1
	86.0%

The presence of Triquitrites at the overall rate of 7.1 percent is significant, and the occurrence of this genus at the rate of 17.2 percent in 107-C is very unusual. Also, 10 of the 68 species identified from this maceration series belong to Triquitrites. The assemblage of spores and pollen recorded for this coal is not duplicated in any coals thus far examined from this area of Kentucky.

TYPE WINIFREDE COAL - MACERATIONS 121 A-E

All of the 18 genera listed in table two for the Winifrede coal are present in the Taylor coal (107 A-E). A single specimen of Knoxisporites has recently been recorded for 121-A and this does not appear in table 2. Sixty-five species have been identified from the 121 maceration series. Only 25 of these species are present in the Taylor coal. Four genera occurring in the coal portions of the Winifrede samples are of numerical significance on a composite overall basis and are:

Densosporites	13.3%
Granulatisporites	13.8
Laevigatosporites	53.1
Lycospora	11.6
	91.8%

Triquitrites, of numerical significance in the Taylor coal, has a maximum abundance of 1.2 percent in 121-B. However, eight species of this genus are common to both the Taylor and Winifrede coals. The Winifrede coal contains Laevigatosporites minutus and L. globosus in all of the samples. These two species are absent from the Taylor coal. As a matter of fact, the overall combined percentages for L. minutus and L. globosus in the coal portion of the Winifrede coal are 6.5 and 24.2 percent respectively. So far as I know at the present, these two species originate in Eastern Kentucky in the Winifrede coal.

Certainly the Taylor and Winifrede coals from their respective type localities are separate and distinct based on their palynological content.

TYPE WINIFREDE COAL OF MINERS OF TUG FORK REGION - MACERATIONS 108 A-H

All of the samples of the 108 maceration series yielded abundant and well preserved spores and pollen. Twenty-six genera (see table 3) and 109 species have been identified from these samples. Four genera occurring in the coal portions of these Winifrede samples are of numerical significance on a composite overall basis and are:

Densosporites	8.4%
Granulatisporites	3.4
Laevigatosporites	65.4
Lycospora	11.6
	88.9%

These percentages, with some exceptions, compare with the type Winifrede coal (121 A-E). Further, 50 of the 65 species recorded for the 121 maceration series are present in the 108 maceration series including 6 of the 8 species of Triquitrites. Further, Laevigatosporites minutus and L. globosus are present in every sample of the 108 maceration series. However, their rate of occurrence at 3.8 percent for L. minutus and 11.0 percent for L. globosus is just about one-half of that for the type Winifrede coal (121 A-E).

Based on what was recovered from the type Winifrede samples (121 series) a comparison may be made with the Winifrede coal (108 series). There are minor differences in generic percentages of these two coals and the 108 series contains 7 genera not recorded for the 121 series as can be observed by comparing tables 2 and 3. Although the presence of these 7 genera would appear to be a major discrepancy, statistically the composite overall percentage for these 7 genera is only a fraction of 1 percent. Perhaps a more significant difference between the 121 and 108 maceration series would be the rate of occurrence of Laevigatosporites minutus and L. globosus. These two species are about twice as abundant

in the 121 maceration series. If I had sufficient samples from this stratigraphic interval it might be possible to postulate that the 121 series was somewhat younger than the 108 series based on the percentages of these two species, or this could be related to preservational factors.

Robert M. Kosanke

Robert M. Kosanke

TABLE 1

GENERIC SUMMARY OF THE SMALL SPORES OF THE TAYLOR COAL FROM NEAR TYPE LOCALITY (Near N. margin Williamson 7½' quad. on E. side of Right Fork of Lick Branch of Big Creek from highwall of an active auger operation, Martin County, Kentucky. This is 5½ mi. NNW of Hunt's type Taylor locality No. 137.)

	107-A	107-B	107-C	107-D	107-E
AHRENSISPORITES		1.2	1.2		
ALATISPORITES			+	+	
CALAMOSPORA		1.2	+		+
CIRRATRIRADITES	2.4	1.6	3.2	4.4	+
CONVOLUTISPORA		.8	+		
CRISTATISPORITES	12.0		.4		+
DENSOSPORITES	14.8	10.8	34.4	36.4	+
DICTYOTRILETES		1.2	.4		
ENDOSPORITES	+	+	+		
FLORINITES	2.0	+	+	+	+
GRANULATISPORITES	4.8	14.0	11.6	4.8	+
KNOXISPORITES		.4		.4	
LAEVIGATOSPORITES	38.4	33.6	19.2	36.8	+
LYCOSPORA	13.6	28.8	3.2	4.0	+
PUNCTATISPORITES	1.6	1.6	3.2	4.4	+
RAISTRICKIA	.4		1.2	.4	+
RETICULATISPORITES		.4	.4	.4	+
SAVITRISPORITES					+
STELLISPORITES					?
TRIQUITRITES	.8	3.6	17.2	.8	+
WILSONITES	.8	.4	.8	4.0	
MONOSACCATE	8.4		3.6	2.8	+
ALL OTHER TAXA		.4	+	.4	
	100.0%	100.0%	100.0%	100.0%	

+ = present but not observed in statistical count. 1000 specimens counted

Macerations 107 A-E = 48½" shale, coal, and seat rock
107-A = 4" shale
107-B = 13" coal
107-C = 13.5" coal
107-D = 14" coal
107-E = 4" seat rock

TABLE 2

GENERIC SUMMARY OF THE SMALL SPORES OF THE WINIFREDE COAL FROM TYPE LOCALITY (At the head of Fields Creek on west side of North Hallow, from rib 10' inside old cutout opening of "South Mine" behind No. 2 Machine Shop of the Carbon Fuel Company, track level 1039' Alt. 10,135" N. of South line and 14,900' from East line of 7½' Belle quad., Kanawha County, West Virginia. This is 1½ miles SE of original Winifrede location.)

	121-A	121-B	121-C	121-D	121-E
CALAMOSPORA	+	2.8		1.6	.4
CIRRATRIRADITES				.4	.8
CONVOLUTISPORA	+	+			+
CRISTATISPORITES		.4		.4	
DENSOSPORITES	14.4	6.4	7.2	33.6	3.2
DICTYOTRILETES		.8			.8
ENDOSPORITES	+	+	.4		1.2
FLORINITES	.8	.4			.4
GRANULATISPORITES	4.0	26.4	2.0	4.0	19.6
LAEVIGATOSPORITES	61.2	48.4	86.8	50.0	41.2
LYCOSPORA	16.0	7.2	.4	5.6	18.4
PUNCTATISPORITES	2.0	3.6	2.8	2.0	6.8
RAISTRICKIA		+		4	1.6
RETICULATISPORITES	.4			.4	.8
SAVITRISPORITES	+			+	2.0
STELLISPORITES (?)				.4	
TRIQUITRITES	+	1.2	.4	+	.8
WILSONITES	.4	+		+	+
MONOSACCATES	.8	2.4		.8	2.0
ALL OTHER TAXA	+		+	.4	+
	100.0%	100.0%	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 1250 specimens counted

Macerations 121 A-E = 54½" of coal and claystone
121-A = 16" weathered coal
121-B = 16" weathered coal
121-C = 4" claystone and coal rash
121-D = 9½" coal
121-E = 9" coal

TABLE 3

GENERIC SUMMARY OF THE SMALL SPORES OF THE TYPE WINIFREDE COAL OF THE MINERS OF THE TUG FORK REGION AND OF HUDDLE AND ALVORD (BUFFALO CREEK COAL OF HENNEN AND REGER)

(0.45 miles up 1st left hand fork of Swinge Camp Branch on south side at alt. 1080'. Sample from highwall 25' east of abandoned entry to active workings of the Lynn Fork Coal Co. No. 1 Mine. This is slightly less than 3¼ miles NW of Hunt's type Taylor locality No. 137, Williamson quad., Pike County, Kentucky.)

	108-A	108-B	108-C	108-D	108-E	108-F	108-G	108-H
AHRENSISPORITES		.4						
ALATISPORITES	+	+				+	+	
CALAMOSPORA	+				+	.4	+	.4
CIRRATRIRADITES	.4	.4	+				2.0	
CONVOLUTISPORA	+		+	+		1.2	.4	+
CRISTATISPORITES	+			.4				.4
CRASSISPORA								+
DENSOSPORITES	2.4	7.6	2.8	19.6	16.8	14.4	1.6	1.2
DICTYOTRILETES		.4	+	+		1.2	+	+
ENDOSPORITES	+	+		.4	4.4	2.4		14.0
FLORINITES	.8	+	.8		1.6		1.6	.4
FOVEOLATISPORITES		+					.4	
GRANULATISPORITES	2.8	36.0	+	2.8	2.8	5.6	6.0	12.8
KNOXISPORITES						1.2	.4	
LAEVIGATOSPORITES	85.2	28.4	90.4	64.0	49.6	43.6	54.4	8.8
LYCOSPORA	2.4	20.0		7.6	19.2	23.6	18.0	54.0
MUROSPORA	.4				.4			
PUNCTATISPORITES	.4	1.6	2.0	2.0	.8	2.0	8.8	4.4
RAISTRICKIA	.4	.4		+	+	+	1.2	+
REINSCHOSPORA		+						
RETICULATISPORITES	.4	+	+	.8	.4	.4	+	.4
SAVITRISPORITES		.4			1.2			+
STELLISPORITES ?						.4		
TRIQUITRITES	.4	.4	+		+	.4	1.2	.4
VESTISPORA		+						+
WILSONITES	.4	1.2	+	.4	+	.4	.4	.4
MONOSACCATE	3.6	2.4	3.6	2.0	2.8	2.4	3.6	2.4
BISACCATE		.4	+					
ALL OTHER TAXA	+	+	.4	+		.4		
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 2000 specimens counted.

Maceration 108 A-H = 87.75" coal, clay, and underclay
108-A = 17.75" coal
108-B = 6.00" clay
108-C = 12.00" coal
108-D = 7.50" coal
108-E = 12.00" coal
108-F = 14.00" coal
108-G = 12.50" coal
108-H = 6.00" underclay

REPORT ON REFERRED FOSSILS

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

Stratigraphic range: Pennsylvanian

General locality: Kentucky

Referred by: Don C. Alvord, 7/14/65

Report prepared by: Robert M. Kosanke, 8/23/67

Status of work: Incomplete

Kinds of fossils: Spores and pollen

Quadrangle or area: Millard, Elkhorn and Belfry quads.

Shipment No.: KG-65-11D Regional Geology in Kentucky

Date material received: 7/22/65

Macerations 96 A-J - 75.5" shale, coal, clay, and ganister seat rock from the type locality of the Millard coal 550' S.62°E. of BM-708 at railroad cut 11' above tracks, 1.5 miles NW of Millard, Kentucky. This is in the Millard 7½' quad., and Alvord D9 samples.

96-A = 6" roof shale
96-B = 1" coal)
2.5" shale) separated by specific gravity
96-C = 12" coal, weathered
96-D = 11" coal, weathered
96-E = 11" clay-shale
96-F = 6" coal, weathered
96-G = 3.5" clay
31" Ss. and clay, no sample
96-H = 6" of 27.5" clay unit
96-I = 13.5" coal
96-J = 3" seat rock, ganister

Macerations 97 A-B - 26.5" coal with fusain from the Bingham coal at the type locality near head of Bingham Fork of Abners Fork of Ferrell Creek. Samples from open coal bank (Alt. 1275'), 24,500' N.9°E. of gaging station at Elkhorn City, Elkhorn City quad., Pike County, Kentucky. Alvord samples B17.

97-A = 13" coal with fusain partings
97-B = 13.5" coal with fusain partings

Macerations 98 A-C - 22" of shale, coal, and seat rock from locality of the Pond Creek Leader coal. Samples from road cut on the W. side of U.S. 119, 250' S.36°W. of BM-762 (Alt. 785'), Huddy, Kentucky, Belfry quad., Pike County, Kentucky. Alvord samples R51.

98-A = 6" roof shale, silty
98-B = 12" coal, weathered
98-C = 4" seat rock, sandy and silty

Although all samples yielded sufficient spores and pollen grains to permit statistical counts except for 96-E, several other samples contained numerous corroded specimens that could not be identified beyond the generic level.

MILLARD COAL

These samples from the type locality contained 21 genera and 118 species. The generic composition and abundance is shown in table 1. The composite overall average for the numerically significant genera occurring in the coal samples (96-B coal, C, D, F, and I) follows:

Calamospora	2.7%
Densosporites	17.4
Granulatisporites	8.7
Laevigatosporites	7.6
Lycospora	51.7
Raistrickia	2.6
	90.7%

Clearly, Lycospora is the dominant genus on this overall basis of the coal. Calamospora and Raistrickia are included in this group because they occur in significant amounts in some of the segment samples.

Laevigatosporites medius (L. 159) was observed in 96-E and this represents the oldest occurrence of this species I know of in eastern Kentucky. A number of new species were recorded and assigned numbers, but only 9 of these species belonging to 6 genera were present in the coal portions of the Millard coal as more than single occurrences and thus of potential significance for correlation purposes.

Macerations 96 A-J representing the Millard coal is characterized by a dominance of Lycospora in 96 A-F. Densosporites is more abundant than Lycospora in 96 G-I, with Lycospora clearly dominant in 96-J. Calamospora occurs in significant amounts in 96-B (coal) and 96-C. Raistrickia occurs in significant numbers in 96-C (coal), 96 C, G, and J. Six species, new in eastern Kentucky, appear to help characterize this coal and are: Punctatisporites 1448, Raistrickia 1442, 1443, 1455, Densosporites 1446, and Reticulatisporites 1452.

BINGHAM COAL

The Bingham coal from the type locality contains 15 genera and 35 species. All 5 genera, see table 2, are present in the Millard coal (96 A-J). Twenty-two of the 35 species present in the Bingham coal are present in the Millard coal. The composite average for the samples follows:

Cristatisporites	6.3%
Densosporites	37.2
Laevigatosporites	29.6
Lycospora	11.5
	84.6%

Densosporites is most abundant followed by Laevigatosporites and Lycospora. The presence of Laevigatosporites at the rate of 29.6 percent on this overall basis represents the highest occurrence of this genus thus far encountered in the lower coals from eastern Kentucky. Laevigatosporites medius, discussed previously under the Millard coal, is present in both samples of the Bingham coal. Three species assigned to 2 genera are new and are Cristatisporites 1488, 1489, and Granulatisporites 1486. Five of the new species reported from the Millard coal are present in the Bingham coal.

The Bingham coal differs from the Millard coal by the increased numerical importance of Laevigatosporites and the significant decrease in Lycospora, Calamospora, and Raistrickia.

POND CREEK LEADER COAL

The coal portion (98-B) contains 13 genera and only 21 species. Including the roof shale and seat rock, 21 genera (see table 3) and 56 species have been identified. Eleven of the 21 species occurring in the Pond Creek Leader coal are present in the Bingham coal (97 A-B). Only 1 new species was encountered in the Pond Creek Leader coal, Raistrickia 1491, but 4 species occurring in the seat rock may be new. Laevigatosporites medius (L. 159), present in both the Millard and Bingham coals, is present in the coal portion of the Pond Creek Leader coal (98-B).

The Pond Creek Leader coal is characterized by a dominance of Lycospora. Laevigatosporites is the only other genus present at the rate of more than 10 percent.

Robert M. Kosanke

Robert M. Kosanke

GENERIC SUMMARY OF THE SMALL SPORES OF THE MILLARD COAL FROM THE TYPE LOCALITY

(Sample locality is 550' S. 62° E. of B. M. 708 at railroad cut 11' above tracks, 1.5 miles NW of Millard, Millard 7½' quad., Kentucky. Alvord samples D9-1 through D9-10)

	96-A	96-B(C)	96-B(S)	96-C	96-D	96-E	96-F	96-G	96-H	96-I	96-J
AHRENSISPORITES					+		+	.8	+	.4	.4
CALAMOSPORA	2.0	22.4	.8	6.0	.4		1.2	.8		1.6	4.0
CIRRATRIRADITES					.4						+
CONVOLUTISPORA				+		+					.8
CRASSISPORA											6.4
CRISTATISPORITES						+			.4	.8	.4
DENSOSPORITES				10.8	10.8	+	2.4	26.0	46.8	36.8	5.2
DICTYOTRILETES									.4	+	
ENDOSPORITES	2.8	2.8	.8	.8			.4		1.2	2.0	.4
FLORINITES		+		.4			+	1.6	.4	.8	+
GRANULATISPORITES	2.8	4.0	31.6	4.4	2.0	+	14.0	12.4	6.4	16.0	4.4
KNOXISPORITES			+					.4	.4		.8
LAEVIGATOSPORITES		10.4	2.8	5.6	11.6	+	8.8	7.6	1.6	5.6	6.0
LYCOSPORA	86.8	36.4	59.2	61.6	63.6	+	63.6	24.0	39.2	29.2	58.4
PUNCTATISPORITES	+	5.6	2.4	2.4	4.0	+	4.4	2.8	1.2	1.6	1.6
RAISTRICKIA	.8	16.8	2.0	6.0	1.2	+	.4	14.4	+	.8	4.8
REINSCHOSPORA					.4						
RETICULATISPORITES		.8	+	.4	.4	+	.8				+
SAVITRISPORITES	2.8	.4	+	+			.4	4.0			
VESTISPORA		.4	.4	1.2		+					+
WILSONITES	+			.4	1.2	+	1.2	.4		.8	.8
MONSACCATES	2.0				3.6		2.0	4.4	2.0	3.6	4.8
ALL OTHER TAXA			+		.4		.4	.4			.8
	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

+ = present but not observed in statistical count. 2,500 specimens counted.

Maceration 96 A-J 75.5" of shale, coal, clay, and seat rock of 128" interval.

96-A = 6" roof, shale
96-B (coal) 1"
96-B(shale) 2.5"
96-C = 12" coal, weathered
96-D = 11" coal, weathered
96-E = 11" clay-shale
96-F = 6" coal, weathered
96-G = 3.5" clay
31" of Ss. and clay, no sample
96-H = 6" of 27.5" clay unit
96-I = 13.5" coal
96-J = 3" seat rock, ganister

TABLE 2 KG-65-11D

GENERIC SUMMARY OF THE SMALL SPORES OF THE BINGHAM COAL FROM THE TYPE LOCALITY

(Sample locality - near head of Bingham Fork of Abners Fork of Ferrell Creek, open coal bank (Alt. 1275'), 24,500' N.9°E. of gaging station at Elkhorn City, Elkhorn City quad., Pike County, Kentucky)

	97-A	97-B
AHRENSISPORITES	1.6	.4
CIRRATRIRADITES	.4	
CONVOLUTISPORA	.4	
CRISTATISPORITES	9.6	3.2
DENSOSPORITES	38.0	36.4
DICTYOTRILETES		+
ENDOSPORITES		.4
FLORINITES	.8	
GRANULATISPORITES	6.0	2.0
KNOXISPORITES		.4
LAEVIGATOSPORITES	20.4	40.8
LYCOSPORA	14.0	9.2
PUNCTATISPORITES	2.4	1.2
RAISTRICKIA		+
WILSONITES	+	+
MONOSACCATE	6.4	5.6
ALL OTHER TAXA	+	.4
	100.0%	100.0%

+ = present but not observed in statistical count. 500 specimens counted

Macerations 97 A-B = 26½" coal containing fusain partings. Alvord samples S-1 and S-2.
97-A = 13" coal with fusain partings
97-B = 13½" " " " " " "

TABLE 3

GENERIC SUMMARY OF THE SMALL SPORES OF THE POND CREEK LEADER COAL

(Road cut W. side of U. S. 199, 250' S. 36° W. of BM 762, Huddy, Kentucky, Alt. 785', Belfry quad., Pike County, Kentucky. Alvord R51 samples)

	98-A	98-B	98-C
AHRENSISPORITES	+	.8	2.0
ALATISPORITES			+
CALAMOSPORA	.4	.4	1.2
CAMPTOTRILETES	2.8		
CIRRATRIRADITES	+		+
CONVOLUTISPORA		+	.4
CRASSISPORA	.8		1.6
DENSOSPORITES	1.2	.8	1.2
DICTYOTRILETES	.4		
ENDOSPORITES	2.8	3.2	
FLORINITES	.8		.4
GRANULATISPORITES	4.4	1.2	34.4
KNOXISPORITES			.4
LAEVIGATOSPORITES	7.2	11.2	27.6
LYCOSPORA	58.8	76.8	2.8
PUNCTATISPORITES	2.8	1.2	2.4
RAISTRICKIA	.4	.8	3.2
RETRICULATISPORITES		.4	.8
SAVITRISPORITES	1.6		13.6
VESTISPORA	.8	.8	1.2
WILSONITES		+	
MONOSACCATE	14.8	2.4	5.2
ALL OTHER TAXA			1.6
	100.0	100.0	100.0

+ = present but not observed in statistical count. 750 specimens counted.

Macerations 98 A-C = 22" of shale, coal, and seat rock.
98-A = 6" roof shale
98-B = 12" coal, weathered
98-C = 4" sandy-silty seat rock

REPORT ON REFERRED FOSSILS
P&S Branch, Denver Lab, U.S.G.S.
Bldg. 25, Federal Center, Denver, Colorado

Stratigraphic range: Pennsylvanian Kinds of fossils: Spores and pollen

General locality: Kentucky Quadrangle or area: Belfry and Williamson quads., Pike County, Kentucky

Referred by: Don C. Alvord 7/14/65

Report prepared by: Robert M. Kosanke 10/20/67 Shipment No.: KG-65-11D

Status of work: Complete Date material received: 7/22/65

Macerations 83 A-F = 69½' shale, coal, and seat rock from the type locality of the Pond Creek coal from road cut on N. side of U.S. 119, Alt. 860', 1,350' S. 36° W. of BM 762, Huddy, Belfry quad., Pike County, Kentucky. Alvord samples R52, S-1 through S-7.

83-A = 10" roof shale, claystone, laminated
83-B = 8½" coal, weathered + clay
83-C = 8" coal, weathered + clay
83-D = 11½" coal, weathered
83-E = 13" coal, weathered
83-F = 12½" coal, weathered
83-G = 6" seat rock, claystone, carbonaceous, Stigmaria

Macerations 84 A-I = 57 3/4" claystone roof, coal, and seat rock from the type locality of the Pond Creek Rider coal from road cut on N. side of U.S. 119, Alt. 910', 1,750' S. 59° W. of BM 762, Huddy, Belfry quad., Pike County, Kentucky. Alvord samples R53, S-1 through S-9.

84-A = 10" roof, claystone, silty
84-B = 13½" coal, weathered
84-C = 6" coal, weathered with clay and rash
84-D = 1 3/4" clay, coaly rash
84-E = 2¼" coal with ¼" to ½" clay at base
84-F = 5" coal, weathered
84-G = 7" coal, weathered
84-H = 2¼" coal, impure
84-I = 10" seat rock, silty claystone

Macerations 99-A = 65½" siltstone, shale, clay, coal, and seat rock from the type locality of the Williamson coal. Samples collected from truck mine located 3,500' NE of Memorial Medical Center of South Williamson, Williamson quad., Pike County, Kentucky. Samples

taken 5' inside of new heading at Alt. 920'. Alvord samples R54, S-1 through S-8. Note: Alvord reported Hennem and Reger's type at Williamson mines Nos. 66 and 67 impossible to sample. Samples collected represent best available and are mapped as Williamson on both sides of Tug Fork.

99-A	= 12"	clayey siltstone
99-B	= 3"	coal, weathered
99-C	= $\frac{1}{2}$"	shale
99-D	= 5"	coal, weathered
99-E	= $2\frac{1}{2}$"	clay
99-F	= 25"	coal, weathered
99-G	= 1"	clay
99-H	= $10\frac{1}{2}$"	coal, weathered
99-I	= 6"	seat rock, clay

GENERAL COMMENTS

The quality of preservation and abundance of spores and pollen grains recovered from these macerations is good to excellent. Only 83-A, 84-H, 99-A, and 99-B failed to yield abundant and well preserved spores and pollen grains. Two of these four macerations are of roof shales, one represents $2\frac{1}{4}$" of impure coal, and the last is of 3" of weathered coal.

TYPE POND CREEK COAL - MACERATIONS 83 A-G

Twenty-two genera, see table 1, and 77 species have been identified from macerations 83 A-G. Five of the 22 genera occurring in the coal portion of these samples are of numerical significance on a composite overall basis and are:

Cristatisporites	10.2%
Densosporites	23.0
Granulatisporites	3.1
Laevigatosporites	10.0
Lycospora	42.6
	88.9%

The presence of Cristatisporites in the coal portions of the Pond Creek samples (83 A-F) at the rate of more than 10% is significant because this genus is not known to occur in the Pond Creek Leader coal (98 A-C) below and occurs only at the rate of 2.6% in the Pond Creek Rider coal (84 A-I) above. Compared to the Pond Creek Leader coal below, the Pond Creek coal contains significantly fewer specimens of Lycospora and a corresponding increase in Densosporites.

Wilsonites 1502 represents the smallest species assigned to the genus. This species is of potential value because it appears limited in occurrence to the Pond Creek coal, but it is not abundant. Laevigatosporites 1094 and Raistrickia 1168 occur in the Pond Creek and older coals, but have not been observed in the Pond Creek Rider or Williamson coals.

TYPE POND CREEK RIDER COAL - MACERATIONS 84 A-I

Twenty-three genera, see table 2, and 91 species have been identified from macerations 84 A-I. Five of these 23 genera occurring in the coal portions of these samples are of numerical significance on a composite overall basis and are:

Cristatisporites	2.6%
Densosporites	1.9
Granulatisporites	4.8
Laevigatosporites	17.3
Lycospora	63.5
	89.0%

In comparison to the Pond Creek coal, the Pond Creek Rider coal contains significantly fewer specimens assignable to Cristatisporites and Densosporites with an apparent important increase in abundance for Lycospora. Ahrensisporites remains fairly consistent in occurrence, but this is not true for Alatisporites and Reinschospora does not appear to be present.

The occurrence of Granulatisporites 101 in the Pond Creek Rider coal represents the oldest occurrence of this species in eastern Kentucky.

TYPE WILLIAMSON COAL - MACERATIONS 99 A-I

Twenty-two genera, see table 3, and 66 species were identified from macerations 99 A-I. Four of the 22 genera present in the coal portions of these samples are of numerical importance on a composite overall basis and are:

Florinites	2.1%
Granulatisporites	4.8
Laevigatosporites	74.4
Lycospora	10.2
	91.5%

The presence of Laevigatosporites in the coal samples at the rate of 74.4 percent represents the highest abundance for the genus thus far encountered in this part of the Breathitt Formation. In this respect, the Williamson spore assemblage is similar to that of the Winifrede coal, see report of 6/20/67, in which case species of the genus Laevigatosporites represented more than half of the assemblage. However, Densosporites in the coal samples of the Winifrede occurs at a significantly higher rate than in the Williamson coal samples. Ahrensisporites occurs consistently in the Williamson samples as in the other samples discussed in this report. Although Alatisporites and Reinschospora are present in the Williamson they occur more consistently in the Pond Creek coal samples.

The Williamson coal contains Laevigatosporites minutus (L. 103) which is the oldest occurrence of this species in eastern Kentucky. This species is a prominent member of the assemblages of younger Pennsylvanian coals. L. minutus represents only about 1 percent of the overall assemblage of Williamson coal, but I consider this occurrence significant. Also, Ahrensisporites 471, Alatisporites 784, and Lycospora 1542 appear to originate with the Williamson coal. This species of Lycospora is rare and may not prove to be of much help.

The Williamson coal, 99 A-I, is distinct from coals below it in the Breathitt Formation both in part based on generic abundance and species content.

Robert M. Kosanke

TABLE 1.

GENERIC SUMMARY OF THE SMALL SPORES OF THE POND CREEK COAL FROM THE TYPE LOCALITY

(Road cut on N. side of U. S. 119, Alt. 860', 1,350' S. 36° W. of BM 762, Huddy, Pike County, Belfry quad., Kentucky. Alvord samples R52, S-1 through S-7)

	83-A	83-B	83-C	83-D	83-E	83-F	83-F
AHRENSISPORITES		.8	4.0	.4	.8	2.4	+
ALATISPORITES		+	+	.4	+		1.2
CALAMOSPORA					.8	.4	
CIRRATRIRADITES		+		+	+	.4	+
CONVOLUTISPORA			+				3.2
CRISTATISPORITES		2.8	8.8	2.4	+	34.0	4.4
DENSOSPORITES	+	39.6	28.4	34.8	25.2	11.6	31.6
DICTYOTRILETES		.4	3.2	3.2	.8	.4	.8
ENDOSPORITES		.4	.4		.8	3.6	1.2
FLORINITES		.8	+			+	+
GRANULATISPORITES	+	2.4	.8	3.2	2.8	5.2	10.4
KNOXISPORITES		.4	.4	.8			.4
LAEVIGATOSPORITES		1.2	1.6	18.8	5.6	18.0	28.4
LYCOSPORA	+	48.8	51.2	34.8	62.4	19.6	6.8
PUNCTATISPORITES	+	.8	+	.8	.4	1.6	2.0
RAISTRICKIA		+	.8	+	+	+	2.0
REINSCHOSPORA			.4	.4		.4	+
RETICULATISPORITES		.8	+	+			.4
SAVITRISPORITES						1.6	1.6
SIMOZONTRILETES		+					+
VESTISPORA			+				
WILSONITES			+	+	.4	+	
MONOSACCATE		.8				.8	5.6
BISACCATE							+
ALL OTHER TAXA			+	+			
		100.0	100.0	100.0	100.0	100.0	100.0

+ = present but not observed in statistical count. 1,500 specimens counted

83 A-G = 69½" shale, coal, and seat rock
- 83-A = 10" roof shale, claystone, laminated
- 83-B = 8½" coal, weathered + clay
- 83-C = 8 " coal, weathered + clay
- 83-D = 11½" coal, weathered
- 83-E = 13" coal, weathered
- 83-F = 12½" coal, weathered
- 83-G = 6" seat rock, claystone, carbonaceous, Stigmaria

TABLE 2

GENERIC SUMMARY OF THE SMALL SPORES OF THE POND CREEK RIDER COAL (PEERLESS?) FROM THE TYPE LOCALITY

(Road cut on N. side of U. S. 119, Alt. 910', 1750' S.59° W. of BM 762, Huddy, Pike County, Belfry quad., Kentucky. Alvord samples R53, S1 through S9)

	84-A	84-B	84-C	84-D	84-E	84-F	84-G	84-H	84-I
AHRENSISPORITES	.8	+		.4		2.8	+	+	1.2
ALATISPORITES	+	.4							
CALAMOSPORA	.8	.8	2.0	5.2	.8	1.2	.4		.4
CIRRATRIRADITES	.4	1.2	.4	+		1.2	+		.8
CONVOLUTISPORA		+	+		.4	+	+		.4
CRASSISPORA	+								
CRISTATISPORITES	.8					3.6	10.0		1.2
DENSOSPORITES	2.8	.8		.4		5.6	4.0	+	12.8
DICTYOTRILETES	1.2	+					+		
ENDOSPORITES	5.6	.8					+		
FLORINITES		.4	.4	+	.4	.4			4.8
GRANULATISPORITES	11.6	3.2	3.6	8.4	5.6	8.4	.8	+	12.8
KNOXISPORITES	+	.4		6.0	.4	+		+	
LAEVIGATOSPORITES	12.0	14.4	10.8	6.8	13.6	19.6	14.0	+	25.2
LYCOSPORA	48.8	70.0	77.6	60.0	72.8	19.2	67.6		27.2
PUNCTATISPORITES	2.0	1.6	.8	2.0	1.2	3.6	1.2	+	5.6
RAISTRICKIA	1.2	1.2	2.0	1.2	1.2	.8	+	+	.8
RETICULATISPORITES	+		+	+	+				
SAVITRISPORITES			+	6.0	.8	1.2	+	+	1.6
SIMOZONOTRILETES								+	
TRIQUITRITES	.8					?			
VESTISPORA				.8	+				
WILSONITES	3.2	+	.8	+	.8	4.0	.4		.8
MONOSACCATE	8.0	4.8	1.6	2.0	2.0	8.4	1.6		4.4
ALL OTHER TAXA				.8				+	
	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0

present but not observed in statistical count. 2,000 specimens counted.

84 A-I = 57 3/4" roof claystone, coal, and seat rock
- 84-A = 10" roof, claystone, silty
- 84-B = 13½" coal, weathered
- 84-C = 6" coal, weathered with clay and rash
- 84-D = 1 3/4" clay, coaly rash
- 84-E = 2¼" coal with ¼" to ½" clay at base
- 84-F = 5" coal
- 84-G = 7" coal, weathered
- 84-H = 2¼" coal, impure
- 84-I = 10" seat rock, silty claystone

TABLE 3

GENERIC SUMMARY OF THE SMALL SPORES OF THE WILLIAMSON COAL FROM THE TYPE LOCALITY

(Samples collected from truck mine located 3,500' NE of Memorial Medical Center of South Williamson, Williamson quad., Pike County, Kentucky. Samples taken 5' inside of new heading at Alt. 920'. Alvord samples R54, S-1 through S-8. Note: Alvord reported Hennen and Reger's type at Williamson mines Nos. 66 and 67 impossible to sample. Samples collected represent best available and are mapped as Williamson on both sides of Tug Fork.)

	99-A	99-B	99-C	99-D	99-E	99-F	99-G	99-H	99-I
AHRENSISPORITES	+	+	+	+	8.0	.4	+		+
ALATISPORITES			+	+	+				
CALAMOSPORA	+	+	.4	2.0		+	1.6	.4	.4
CIRRATRIRADITES	+	+	.4	.8			.4	.4	.4
CONVOLUTISPORA				.4	.8		+		.4
CRASSISPORA			+						.4
CRISTATISPORITES			+						?
DENSOSPORITES	+		1.2		17.2	1.2	.8	.4	5.6
DICTYOTRILETES			.4		+				
ENDOSPORITES			.4			+		.4	+
FLORINITES		+	3.6	5.2	1.6	1.2	.4	2.8	1.2
GRANULATISPORITES	+	+	8.4	3.6	29.6	4.4	4.8	6.4	9.2
KNOXISPORITES	+	+		.4	.4			+	+
LAEVIGATOSPORITES	+	+	14.0	66.4	5.6	86.4	34.4	49.6	11.6
LYCOSPORA	+	+	61.6	8.8	19.6	4.0	48.4	34.4	64.8
PUNCATISPORITES	+	+	.8	2.4	3.6	.4	.4	2.8	+
RAISTRICKIA	+	+	1.2	.8	4.4	.4	1.2	.8	1.2
REINSCHOSPORA					+				
RETICULATISPORITES		+		3.6	.8	+	2.8		+
SAVITRISPORITES	+		.4	.8	+		2.8		1.6
? TRIQUITRITES					.8				
VESTISPORA			+				.4		
WILSONITES		+	.4	.8		+			
MONOSACCATE	+	+	6.8	4.0	7.6	1.6	1.6	1.6	2.8
ALL OTHER TAXA			+			+			.4
			100.0	100.0	100.0	100.0	100.0	100.0	100.0

+ = present but not observed in statistical count. 1,750 specimens counted.

99 A-I = 65½" siltstone, shale, clay, coal and seat rock
- 99-A = 12" clayey siltstone
- 99-B = 3" coal, weathered
- 99-C = ½" shale
- 99-D = 5" coal, weathered
- 99-E = 2½" clay
- 99-F = 25" coal, weathered
- 99-G = 1" clay
- 99-H = 10½" coal, weathered
- 99-I = 6" seat rock, clay

REPORT ON REFERRED FOSSILS

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

Stratigraphic range: Pennsylvanian

General locality: Kentucky

Referred by: Charles L. Rice 6/10/66
Donald C. Alvord 4/25/63

Report prepared by: Robert M. Kosanke
12/3/67

Status of work: Incomplete

Kinds of fossils: Spores and pollen

Quadrangle or area: Redbush, Paintsville, and Elkhorn City quads.

Shipment No.: KG-66-6D (Rice)
KG-63-5D (Alvord)

Date material received:
KG-66-6D 6/15/66
KG-63-5D 5/2/63

Macerations 174 A-C, samples of shale, coal, and underclay from about 14,150' W. and 6,000' N. of SE corner of Redbush quad., Johnson County, Kentucky. Rice samples off RR-A-1 through RR-A-3 from just above Lee Sandstone.

174-A = 4" shale and clay
174-B = 4½" coal
174-C = 6" shale, carbonaceous, gradational into underclay

Macerations 175 A-D, samples of shale, coal, and underclay from about 2,750' W. and 9,650' N. of SE corner of Redbush quad., Johnson County, Kentucky. Rice samples RR-C-1 through RR-C-4. These samples occur 20 to 40' above those assigned to maceration series 174 A-C.

175-A = 1" shale, carbonaceous
175-B = 7" coal
175-C = 4" coal
175-D = 2" underclay

Macerations 176 A-H, samples of sandstone, shale, coal, and underclay from about 8,050' W. and 1,650' N. of SE corner of Paintsville quad., Johnson County, Kentucky. Rice sample RP-1 through RP-8 of Van Lear coal from type locality.

176-A = 1" sandstone over 1" shaly coal
176-B = 7" coal, weathered
176-C = 7¼" coal
176-D = 5" coal
176-E = 5½" coal
176-F = 5" coal
176-G = 4¼" coal
176-H = ¼" shale, 1" coal, and 2" underclay

Macerations 177 U-CC, samples of shale, cannel coal, coal, and underclay from USGS DDH #7, Elkhorn City, K87, 10,450' FEL, 4,400' FSL, just S. of top of Beaver Knob, Elkhorn City quad., Pike County, Kentucky.

177 U-W, cannel coal, coal, and underclay with coal top reported to be 324.6' which would be to the top of 177-V.

177-U = $4\frac{1}{4}$" cannel coal
177-V = $8\frac{1}{2}$" coal
177-W = 3" underclay

177 X-Z, shale, coal, and underclay with coal top reported to be 327.4'.

177-X = 3" shale
177-Y = 11" coal
177-Z = 3" underclay

177 AA-CC, shale, coal, and underclay from coal interval reported to be 400.5-404.0'.

177-AA = 3" shale
177-BB = 7" coal available for maceration from 3.5' reported
177-CC = 3" underclay

All 24 samples reported on yielded sufficient spores and pollen grains to make statistical counts except for two underclay samples: 177-W and 177-CC.

Macerations 174 A-C

The generic summary is shown in table 1 and reveals the coal contains a dominance of Lycospora. Based on the occurrence of Laevigatosporites medius (L. 159), this could not be older than the Millard coal as indicated in my report of 8/23/67. Based on generic abundance, 174-B could be related to either the Pond Creek Leader coal, report of 8/23/67, macerations 98 A-C, or the Pond Creek Rider coal, report of 10/20/67, macerations 84 A-I. Because 174-B represents only $4\frac{1}{2}$" of coal, there is a possibility that this sample represents only a small segment of the Pond Creek coal, macerations 83 A-F. The coal represented by 174-B is extremely difficult to place within the Pond Creek coal based on generic abundance. Neither Densosporites or Cristatisporites appear to be present in 174 A-C while 18 species assigned to these two genera are consistently present in the Pond Creek coal. Only 27 species have been identified from 174-B. This $4\frac{1}{2}$" coal, 174-B, could represent a portion of the Pond Creek Leader coal or possibly a split of the Pond Creek Rider coal.

Macerations 175 A-D

Twenty-one genera (see table 2) and 51 species have been identified from 175 A-D. The spore and pollen content is very similar to that of 174 A-C, but is more diversified in the number of genera and species present. Lycospora is the dominant genus with Laevigatosporites next in numerical importance. The underclay is different from any previous samples examined in that Punctatisporites represents more than 50 percent of the spore-pollen assemblage. Fifty-one species have been identified from 175 A-D, and most of these show a relationship to the upper half of the Pond Creek Rider coal.

The two thin coals represented by the 174 and 175 maceration series clearly are within the Pond Creek coal zone so that any concern for thinning of the section toward the northwest does not seem to be warranted.

Van Lear coal - macerations 176 A-H

Twenty-four genera, table 3, and 61 species have been identified from the Van Lear coal. This coal is characterized by a dominance of Lycospora in 176-D through 176-G while the top part of the coal is dominated by species of Laevigatosporites. All of the abundant species occurring in the Van Lear coal also occur in the Upper Elkhorn No. 3 coal (maceration series 76). Three species of minor numerical significance that occur in the Upper Elkhorn coal No. 2 are present in the Van Lear coal. On the strength of this, it would appear that the Upper Elkhorn No. 3 could be represented by 176 D-H. The top two coal samples, 176 B-C, are not present in the "type" Upper Elkhorn No. 3 of Hunt (1933). I wonder if the top two coal samples of the Van Lear coal could have a relationship to a rider coal?

The composite overall abundance percentages for the numerically significant genera occurring in all coal samples of the Van Lear coal follows:

Densosporites	2.8%
Endosporites	1.2
Laevigatosporites	41.9
Lycospora	45.8
	91.7%

Based on coal samples 176 D-G, the following percentages apply:

Densosporites	4.4%
Endosporites	1.8
Laevigatosporites	15.4
Lycospora	72.1
	93.7%

The composite overall percentages for 176 D-G is definitely within the scope of the Upper Elkhorn No. 3 coal.

Macerations 177 U-CC

Fourteen genera (table 4) and 24 species have been identified from 177 U-W, the cannel and bright bituminous coal occurring at 324.6' in DDH #7. Seventeen genera (table 4) and 36 species have been identified from 177 X-Z from the 11" of coal occurring at 327.4' in DDH #7. The spore and pollen assemblages for the coal portions of both sets of samples are very similar and are related to the Pond Creek Rider coal.

Although only about 7" of core from the 400.5-404.0' interval of DDH #7 was available for study, 177-B compares very well with the Pond Creek coal reported on 10/20/67. Table 5 records the presence of 17 genera and their abundance. The abundance data for 177-B, the coal, are strikingly similar to that of the Pond Creek coal. Thirty one species have been identified from 177-B and 26 of these occur in the Pond Creek coal including all of the numerically significant species. There is every reason to believe that 177-B is the Pond Creek coal.

Robert M. Kosanke

Robert M. Kosanke

TABLE 1

GENERIC SUMMARY OF THE SMALL SPORES FROM A COAL JUST ABOVE THE LEE SANDSTONE

(About 14,150' W. and 6,000' N. of SE corner of Redbush quad., Johnson County, Kentucky. Rice samples RR-A-1 through RR-A-3)

	174-A	174-B	174-C
AHRENSISPORITES	+		
CALAMOSPORA	.4	1.6	2.8
CONVOLUTISPORA	.4		
CRASSISPORA			+
CRISTATISPORITES	+		?
ENDOSPORITES	28.0	3.2	
FLORINITES	+	+	
GRANULATISPORITES	5.2	2.4	.8
KNOXISPORITES			.8
LAEVIGATOSPORITES	7.2	15.2	4.8
LYCOSPORA	54.0	75.6	86.8
PUNCTATISPORITES	1.2	+	.4
RAISTRICKIA			+
RETICULATISPORITES			+
VESTISPORA	+	.4	2.4
WILSONITES	+	+	.4
MONOSACCATE	3.6	1.6	.4
BISACCATE			.4
	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 750 specimens counted

174 A-C = 14½" shale, coal, and underclay
174-A = 4" shale and clay
174-B = 4½" coal
174-C = 6" shale, carbonaceous, gradational into underclay

TABLE 2

GENERIC SUMMARY OF THE SMALL SPORES FROM A COAL ABOVE THE LEE SANDSTONE*

(* This coal occurs 20 to 40' above Rice's samples RR-A-1 through RR-A-3 and were designed by Rice as samples RR-C-1 through RR-C-4. These samples were collected from about 2,750' W. and 9,650' N of the SE corner of Redbush quad., Johnson County, Kentucky)

	175-A	175-B	175-C	175-D
AHRENSISPORITES	+			1.2
CALAMOSPORA	.8	1.2	2.8	2.4
CIRRATRIRADITES	.4		+	
CONVOLUTISPORA		+		.4
CRASSISPORA	4.4	+	+	
DENSOSPORITES	+	.4		+
DICTYOTRILETES	+	2.0	5.2	
ENDOSPORITES	9.6	.8	.4	2.0
FLORINITES		+	+	3.2
GRANULATISPORITES	2.0	4.0	2.0	12.0
KNOXISPORITES	+			
LAEVIGATOSPORITES	8.8	28.4	14.8	12.8
LYCOSPORA	64.4	60.4	73.2	3.6
PUNCTATISPORITES	5.6	.8	.8	52.4
RAISTRICKIA	.8	.8	.4	1.2
RETICULATISPORITES		+	+	.4
REINSCHOSPORA		+		
SAVITRISPORITES	+	+	.4	2.0
TRIQUITRITES				+
VESTISPORA	+	.8	+	.4
WILSONITES		+	+	.8
MONOSACCATE	2.8	.4		4.0
BISACCATE	.4			.4
ALL OTHER TAXA	+			.8
	100.0%	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 1,000 specimens counted

175 A-D = 14" of shale, coal, and underclay
- 175-A = 1" shale, carbonaceous
- 175-B = 7" coal
- 175-C = 4" coal
- 175-D = 2" underclay

TABLE 3

GENERIC SUMMARY OF THE SMALL SPORES OF THE VAN LEAR COAL FROM THE TYPE LOCALITY

(About 8,050' W. and 1,650' N. of SE corner of Paintsville quad., Johnson County, Kentucky. Rice samples RP.)

	176-A	176-B	176-C	176-D	176-E	176-F	176-G	176-H
AHRENSISPORITES	2.8	.8	4.0			?		
ALATISPORITES	2.0	+						+
CALAMOSPORA	.4		.4	.8	2.4	1.6	.4	2.0
CAMPTOTRILETES	?							
CIRRATRIRADITES	+					+		.4
CONVOLUTISPORA	+	.4	.4	+	.4	+	+	+
CRASSISPORA						+	+	+
DENSOSPORITES	1.6	.8	.8			+	20.4	6.4
DICTYOTRILETES		+	2.0	+		.4	+	+
ENDOSPORITES		+	.8	+	.8	6.0	.4	6.8
FLORINITES	1.6		+	.8	.4	1.2	1.6	2.0
GRANULATISPORITES	2.8	2.0	1.2	1.2	.4	.4	1.2	4.8
KNOXISPORITES	+	.4	.4	+		+	.4	+
LAEVIGATOSPORITES	78.4	88.4	66.4	34.0	10.0	6.8	10.8	2.8
LYCOSPORA	.4	2.0	16.4	61.6	84.0	80.0	60.0	70.8
PUNCTATISPORITES	2.8	4.0	1.2	.4	+	.8	.4	.4
RAISTRICKIA	+	+	.4		+		.8	+
REINSCHOSPORA			+					+
RETICULATISPORITES		+		+	+	+		.4
SAVITRISPORITES	+	+						.8
SIMOZONOTRILETES	.4	.4						
TRICUITRITES	+						+	
VESTISPORA	.4					+	+	.4
WILSONITES	+	+	2.4	.4		.4	+	.4
MONOSACCATE	6.4	.8	2.8	.8	1.6	2.4	3.6	1.6
ALL OTHER TAXA	+	+	.4	+				+
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

+ = not observed in statistical count. 2,000 specimens counted

Macerations 176 A-H = 39¼" sandstone, shale, coal, and underclay

176-A = 1" sandstone over 1" shaly coal
176-B = 7" coal, weathered
176-C = 7¼" coal
176-D = 5" coal
176-E = 5½" coal
176-F = 5" coal
176-G = 4¼" coal
176-H = ¼" shale, 1" coal, 2" underclay

TABLE 4

GENERIC SUMMARY OF THE SMALL SPORES FROM DDH #7 AT DEPTHS OF 324.6' AND 327.4'

(Elkhorn City, K87, 10,450' FEL, 4,400' FSL, just south of top of Beaver Knob, Elkhorn City quad., Pike County, Kentucky)

	177-U	177-V	177-W	177-X	177-Y	177-Z
CALAMOSPORA	+	.8		4.8	1.2	+
CIRRATRIRADITES				+		+
CRASSISPORA			+			
CRISTATISPORITES					+	+
DENSOSPORITES	1.2	.4		+	.4	.8
DICTYOTRILETES		+			+	
ENDOSPORITES	+	1.6		.8	.8	
FLORINITES	+	.4		.4		+
GRANULATISPORITES	5.2	2.4	+	26.0	3.6	1.2
KNOXISPORITES		?		+		+
LAEVIGATOSPORITES	12.8	4.4		9.2	6.8	4.4
LYCOSPORA	76.4	88.4	+	50.8	84.4	91.6
PUNCTATISPORITES	4.0	.8	+	2.0	1.2	.8
RAISTRICKIA	.4	+	+	.8	.4	+
RETICULATISPORITES		+		.8		
SAVITRISPORITES			+	1.2	+	.4
VESTISPORA	+	+	+		+	+
WILSONITES		+		.4	.8	
MONOSACCATE		.8		2.8	.4	.8
	100.0%	100.0%		100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 1,250 specimens counted

Macerations 177 U-W = 16" of coal and underclay with the coal top reported to be 324.6'. The top unit above the coal is $4\frac{1}{2}$" of cannel so the coal top should be adjusted accordingly.
177-U = $4\frac{1}{2}$" cannel coal
177-V = $8\frac{1}{2}$" coal
177-W = 3" underclay

Macerations 177 X-Z = 17" of shale, coal, and underclay with the coal top reported to be 327.4'.
177-X = 3" shale
177-Y = 11" coal
177-Z = 3" underclay

TABLE 5

GENERIC SUMMARY OF THE SMALL SPORES FROM DDH #7 FROM COAL AT 400.5-404.0'*

(Elkhorn City, K87, 10,450' FEL, 4,400' FSL, just south of top of Beaver Knob, Elkhorn City quad., Pike County, Kentucky)

	177-AA	177-BB	177-CC
AHRENSISPORITES	.8	1.2	
CALAMOSPORA	.8	+	+
CIRRATRIRADITES			+
CRASSISPORA			+
DENSOSPORITES	1.2	23.2	+
DICTYOTRILETES	.8	4.8	+
ENDOSPORITES	4.8	+	+
FLORINITES	.4		
GRANULATISPORITES	2.8	6.4	+
KNOXISPORITES	+		
LAEVIGATOSPORITES	2.4	10.8	
LYCOSPORA	82.4	52.8	+
PUNCTATISPORITES	+		
RAISTRICKIA		.4	+
REINSCHOSPORA		+	
SAVITRISPORITES	+		
WILSONITES		.4	
MONOSACCATE	3.6		
ALL OTHER TAXA		+	
	100.0%	100.0%	

+ = present but not observed in statistical count. 500 specimens counted

Macerations 177 AA-CC = 48" shale, coal, and underclay. * Log reports poor core recovery. The only available coal for maceration consisted of coal core pieces 5½" long plus some broken coal that probably did not represent more than 1½" of core.
177-AA = 3" shale
177-BB = 7" coal available of 3.5'
177-CC = 3" underclay

REPORT ON REFERRED FOSSILS

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

Stratigraphic range: Pennsylvanian

General locality: Kentucky

Referred by: Donald C. Alvord 7/21/64

Report prepared by: Robert M. Kosanke 1/17/68

Status of work: Incomplete

Kinds of fossils: Spores and pollen

Quad. or area: Jenkins West quad.

Shipment No.: KG-64-24D
Regional Geology in Kentucky

Date material received: 7/31/64

Macerations 82 F-K, samples of coal from U.S.G.S. D.D.H. #6, I83-13,625' FSL, 3,250' FWL, between head of Tom Biggs Branch and unnamed branch of Elkhorn Creek, Jenkins West quad., Letcher County, Kentucky.

82 F-G = samples from 443.8-445.3' interval
82-F = .7' coal
82-G = .8' coal

82 H-K samples from 484.8-488.4' interval
82-H = .9' coal
82-I = .9' coal
82-J = .9' coal
82-K = .9' coal

Macerations 82 F-K - 443.8-445.3'

Nineteen genera (table 1) and 53 species have been identified from these samples. Laevigatosporites is most abundant in 82-G with Densosporites next in numerical importance. Densosporites is dominant in 82-F with Laevigatosporites representing 17.2 percent of the assemblage. The composite average for 82 F-G (table 1) reveals that Densosporites is dominant and Laevigatosporites subdominant. The genera and, for the most part, the species identified are those common to this part of the Breathitt Formation. Seven species are new and have been assigned to Ahrensisporites, Cristatisporites, Densosporites, Granulatisporites, and Punctatisporites. Unfortunately, none of these new species are abundant.

Macerations 82 H-K - 484.8-488.4'

Twenty-three genera (table 2) and 67 species have been identified from these samples. Laevigatosporites is most abundant in 82 I-J and Lycospora is most abundant in 82-H and 82-K. The composite averages for the numerically significant genera (table 2) shows Laevigatosporites and Lycospora are of nearly equal dominance. Three new species have been assigned to Granulatisporites and Reticulatisporites. These species are not of numerical importance.

Comparison with the Williamson coal

Macerations 82 F-G representing the coal at 443.8-445.3' in DDH #6 do not compare favorably with the Williamson coal, macerations 99 A-I, report of 10/20/67. A comparison of the composite averages of the numerically significant genera shows Densosporites dominant in 82 F-G and Laevigatosporites dominant in the Williamson coal. The Williamson coal contains three shale and clay partings while 82 F-G is a solid coal unit. Some allowance for this should be made in these comparisons. Also, we are comparing 18" of coal from the diamond drill core with 43½" of coal from the Williamson coal. Based on generic abundance none of the individual coal samples from the Williamson coal compare with 82 F-G. Only 21 of 53 species identified from 82 F-G are present in the Williamson coal. I do not believe 82 F-G correlates with the Williamson coal.

Macerations 82 H-K representing the coal at 484.8-488.4' in DDH #6 compare more favorably with the Williamson coal. Twenty-one genera are common to both coals as well as 40 of 67 species. The first occurrence of Laevigatosporites 103 in the Breathitt Formation is in the Williamson coal. This species is present in 82 H-K. Comparison of numerically significant genera shows Laevigatosporites slightly more abundant than Lycospora in 82 H-K, but clearly Laevigatosporites is dominant in the Williamson coal. Lycospora is abundant in the Williamson coal samples, but for the most part this abundance is in the partings and underclay.

Robert M. Kosanke

Robert M. Kosanke

TABLE 1

GENERIC SUMMARY OF THE SMALL SPORES OF THE "WILLIAMSON COAL" FROM DDH #6

(Sample from 443.8-445.3' interval of U.S.G.S. DDH #6, I83-13,625' FSL, 3,250' FWL between head of Tom Biggs Branch and unnamed branch of Elkhorn Creek, Jenkins West quad., Letcher County, Kentucky)

	82-F	82-G
AHRENSISPORITES	.4	.8
CALAMOSPORA	.4	.4
CIRRATRIRADITES	+	+
CONVOLUTISPORA		.8
CRISTATISPORITES	1.2	+
DENSOSPORITES	74.8	27.6
ENDOSPORITES	+	+
FLORINITES		.4
GRANULATISPORITES	3.6	15.6
KNOXISPORITES		+
LAEVIGATOSPORITES	17.2	40.4
LYCOSPORA	.8	10.0
PUNCTATISPORITES	.4	1.2
RADIIZONATES		?
RAISTRICKIA	+	
RETICULATISPORITES		+
SAVITRISPORITES	.4	1.2
SIMOZONOTRILETES	+	
TRIQUITRITES	+	
WILSONITES	+	+
MONOSACCATE	.8	1.6
ALL OTHER TAXA	+	+
	100.0%	100.0%

COMPOSITE 82 F-G	
DENSOSPORITES	49.6%
GRANULATISPORITES	10.0
LAEVIGATOSPORITES	30.2
LYCOSPORA	5.7
	95.5%

+ = present but not observed in statistical count. 500 specimens counted

Macerations 82 F-G, samples of coal from 443.8-445.3'

82-F = .7' coal
82-G = .8' coal

TABLE 2

GENERIC SUMMARY OF THE SMALL SPORES OF THE "AMBURGY COAL" FROM DDH #6

(Sample from 484.8-488.4' interval of U.S.G.S. DDH #6, I83-13,625' FSL, 3,250 FWL between head of Tom Biggs Ranch and unnamed branch of Elkhorn Creek, Jenkins West quad., Letcher County, Kentucky)

	82-H	82-I	82-J	82-K
AHRENSISPORITES	1.2	.8	6.0	
ALATISPORITES			+	
CALAMOSPORA	2.4	.4	1.2	.4
CIRRATRIRADITES	+	+	.8	+
CONVOLUTISPORA			+	+
CRASSISPORA	+			+
CRISTATISPORITES			1.2	+
DENSOSPORITES	2.0	.8	29.2	.4
DICTYOTRILETES	.4			.4
ENDOSPORITES	2.0			.8
FLORINITES	.4	3.2	2.8	2.4
GRANULATISPORITES	6.4	14.0	8.0	.4
KNOXISPORITES	+	+	+	
LAEVIGATOSPORITES	37.2	54.4	35.6	14.4
LYCOSPORA	40.8	12.0	5.6	74.0
PUNCTATISPORITES	.8	.8	1.2	2.0
RAISTRICKIA	.4	.4	2.0	+
RETICULATISPORITES	+	+	2.0	
SAVITRISPORITES		3.2	.4	
SIMOZONOTRILETES	+		+	
TRIQUITRITES		.4	+	
VESTISPORA				+
WILSONITES	2.4	4.0	1.6	2.0
MONOSACCATE	3.2	5.6	2.0	2.8
ALL OTHER TAXA	.4		.4	+
	100.0%	100.0%	100.0%	100.0%

+ = present but not observed in statistical count. 1,000 specimens counted.

Macerations 82 H-K, samples of coal from 484.8-488.4'

82-H = .9' coal
82-I = .9' coal
82-J = .9' coal
82-K = .9' coal

COMPOSITE 82 H-K

DENSOSPORITES	8.1%
FLORINITES	2.2
GRANULATISPORITES	7.2
LAEVIGATOSPORITES	35.4
LYCOSPORA	33.1
	86.0%