

TWO EARLY PENNSYLVANIAN FLORAS OF WESTERN ILLINOIS

Richard Leary
Illinois State Museum

ABSTRACT

Two sites in western Illinois have yielded a large number of well-preserved early Pennsylvanian plant fossils and provide information concerning the environment. The fossils from Brown County represent an upland flora; those of Rock Island County are a mixture of upland and swamp plants. Both floras contain *Megalopteris*, *Lesleya*, and *Lacoea*. The high percentages of Pteridospermales and Noeggerathiales and the lower percentage of ferns and lycopsids in these floras contrast with the composition of the lowland or swamp floras.

LOCATIONS

In recent years two sites in western Illinois have yielded a large number of well-preserved plant fossils. The first is located in Brown County, on the La Moine River about 12 km north - northeast of Mt. Sterling (Fig. 1). The second locality is in the Allied Stone Company quarry on Vandruff Island, Milan, Rock Island County. Both exposures are located on the western margin of the Illinois Basin and the eastern flank of the Mississippi River Arch and near the western edge of the existing Pennsylvanian strata.

Major valleys are known to have drained east and southeastward across the pre-Pennsylvanian surface into the Illinois Basin (Smith, 1941; Horberg, 1950). Valleys up to 140 m deep and up to 32 km wide are known from other parts of the Illinois Basin (Bristol and Howard, 1971).

The deposits described below fill tributaries of major valleys. The exposure in Brown County reveals a ravine eroded into St. Louis - Salem (Mississippian) limestone and dolomite and filled with mud, silt and sand during early Pennsylvanian time. The ravine was steep-sided and at least 12 m deep (Fig. 2).

The deposits in Rock Island County occur in channels which were basically east-west with sharp "dog-legs," possibly controlled by joints in the limestone. The channels are about 4 m deep, 8 m wide, steep-sided, flat-bottomed (Fig. 3) and are filled with mud and quartz sand. They were eroded in an otherwise flat surface developed on Cedar Valley (Devonian) limestone.



Figure 1. Map showing locations in relation to major structural features. Base map courtesy Illinois State Geological Survey.

The fossils from these two localities represent plants which grew on the uplands between the major valleys. This environment was obviously better drained and probably drier than the swamp which existed in the deeper basin to the southeast.

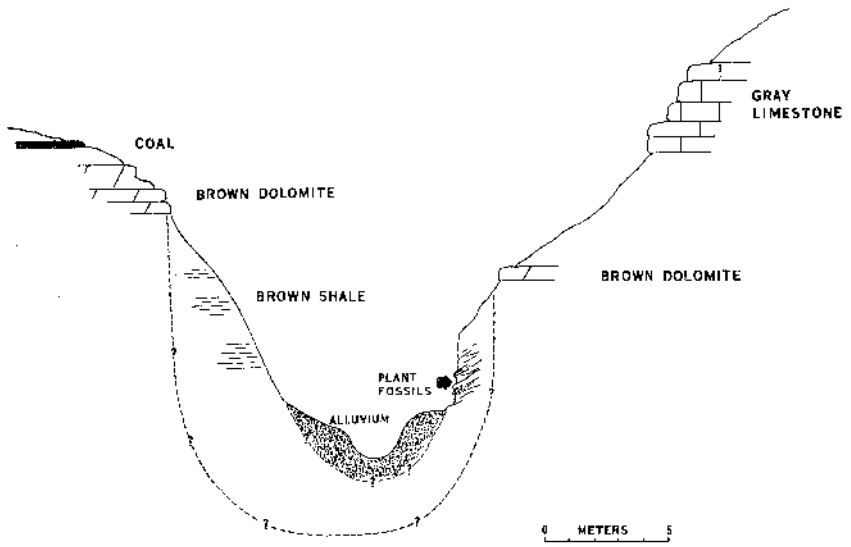


Figure 2. Cross section of the Brown County locality.

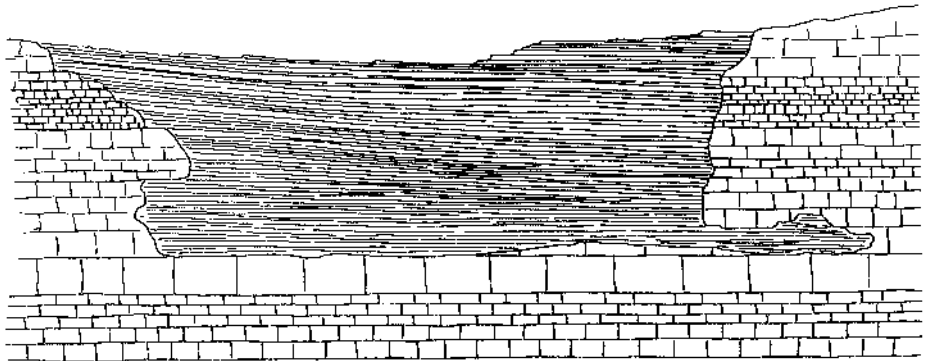


Figure 3. Cross section of a channel at the Rock Island site.

THE FLORAS

Twenty-five genera of foliage, fructifications and stems have been identified from the Allied Stone Company quarry (Table 1). The most abundant taxa are *Megalopteris*, *Cordaites*, *Lesleya*, *Samaropsis*, and *Cordaicarpus*. At the Brown County site twenty-one genera have been identified. Among the most common are *Lacoea*, *Sphenopteris*, *Cordaites*, and *Alethopteris*. *Megalopteris* and *Lesleya* are well represented.

As shown in Table 1, the two floras have many genera in common; the main differences are in the relative abundance of certain genera and the presence or absence of certain others. Lycopods are common in the Rock Island flora but very rare in the Brown County flora; only one determinable specimen and two fragmentary specimens of *Lepidodendron* have been found there; *Lepidophloios* is absent in both localities. Lycopods are the dominant plants in most lower and middle Pennsylvanian floras of the basin. Sphenopsids and *Cordaites* are more abundant in parts of the Rock Island flora than in the Brown County flora; ferns are more common in the Brown County flora.

Because several genera are unusual a few general statements follow. These and other taxa will be described in detailed reports on each locality (Leary and Pfefferkorn, in press; Leary, in preparation).

Megalopteris fronds are simple pinnate and near the tip appear pedate. The largest fronds, those of *M. dawsoni*, apparently consist of only three pedate lobes (Plate 1, Fig. 1); those of *M. ovata* bear numerous pinnules. The pinnules are generally large, straplike or lanceolate with a decurrent base. The midvein is thick with longitudinal striations often present; the lateral veins are dense and divide one to three times.

Lesleya foliage is similar to *Megalopteris* pinnules but consists of simple leaves (Plate 1, Fig. 2). These leaves are large, greater than 30 cm long and 10 cm wide. The midvein is broad, though not as broad as that of *Megalopteris*; the lateral veins are curved and divide once or twice. *Lesleya* and *Megalopteris* are also separated on the basis of epidermal structures (Florin, 1933). David White (1931, p. 275, 276) noted that *Megalopteris* and *Lesleya* are unique to uplands developed on carbonates.

Mesocalamites is distinguished from *Calamites* and *Archaeocalamites* on the basis of the continuity of ribs across the nodes. *Calamites* ribs alternate whereas some of the *Mesocalamites* ribs alternate and some are continuous. On the other hand *Archaeocalamites*, an older form, has all ribs continuous across the nodes.

Lacoea (Plate 2, Fig. 1) is a cone consisting of semicircular sporophylls which alternate on a thick axis. Although Read (1946) considered *Lacoea* a probable pteridosperm, specimens from Brown County, Illinois, permitted a reinterpretation and it is now considered a Noeggerathalian (Leary, 1973).

TABLE 1. Genera present at the localities in Brown and Rock Island counties, Illinois.

	<u>Brown County</u>	<u>Rock Island County</u>
<u>Lycophytina</u>		
<u>Lepidodendron</u>	vr	c
<u>Lepidophylloides</u>		c
<u>Lepidostrobos</u>		c
<u>Stigmaria</u>		vr
<u>Sphenophytina</u>		
<u>Mesocalamites</u>	c	c
<u>Asterophyllites</u>	c	c
<u>Annularia</u>	vr	
<u>Calamostachys</u>	c	c
<u>Sphenophyllum</u>		r
<u>Filicophytina (Ferns)</u>		
<u>Alloiopteris</u>	c	vr
<u>Dactylothea</u>	r	
<u>Pteridospermales</u>		
<u>Alethopteris</u>	c	r
<u>Sphenopteris</u>	a	c
<u>Lagenospermum</u>	vr	
<u>Telangium</u>	c	r
<u>Megalopteris</u>	c	a
<u>Lesleya</u>	c	a
<u>Samaropsis</u>	c	a
<u>Neuropteris?</u>		vr
<u>Mariopteris?</u>	vr	vr
<u>Whittleseyia/Aulacotheca</u>		vr
<u>Rhodea</u>	r	vr
<u>Noeggerathiales</u>		
<u>Lacoea</u>	a	c
<u>Palaeopteridium</u>	c	?
<u>Gulpenia</u>	r	vr
<u>Cordaitales</u>		
<u>Cordaites</u>	c	a
<u>Cordaicarpus</u>	r	c
<u>Cordaianthus</u>		r
<u>Artisia</u>		vr

Approximate abundance indicated by the following: vr - very rare (1, 2), r - rare (3 - 5), c - common (5 - 25), a - abundant (> 25). Based upon 350 specimens from each locality.

Gulpenia is characterized by small deeply lacerated pinnules attached spirally to a thin axis. In compression *Gulpenia* bears a superficial similarity to *Sphenophyllum* but the pinnules clearly alternate (Plate 2, Fig. 6,7).

Palaeopteridium has been often found associated with *Lacoea* (= *Discinites*, Nemjc, 1937) and perhaps the two belong to the same plant. The overall form of the *Palaeopteridium* pinnule is wedge-shaped, spatulate or diamond-shaped (Plate 2, Fig. 5). The pinnules have a stalklike base which is often not visible, giving the appearance that the pinnule is attached by a rather large part of the base. The upper margin bears numerous sharp-pointed teeth.

Although the differences in generic composition of the two floras might be in part due to a slight age difference (see section following), they are more likely to reflect slight environmental differences.

Several studies have been made of paleoecological differences in Pennsylvanian floras and several environments have been recognized (see Peppers and Pfefferkorn, 1970, p. 68, 69 for summary). Although the Colchester (No. 2) Coal member (Westphalian D) is considerably younger than the floras described here, more data is available for that period of time and the generalizations of major plant predominance are probably valid for earlier floras, with the exception of the tree ferns which were very rare or absent in the lower Pennsylvanian. The dominant groups for each environment are indicated below, but it must be kept in mind that all other groups were also present.

Swamp - lycopods or sphenopsids

Levees and floodplain - pteridosperms, ferns, sphenopsids

Upland - pteridosperms, *Cordaites*, Noeggerathiales (rare)

The flora preserved in the Allied quarry in Rock Island County combines features of several floras. The concentration of some genera, in particular the lycopods and sphenopsids, in certain areas and horizons indicates possible changes in climate and microenvironment. The sediments in the channels preserved at Rock Island show no signs of drying. Apparently the presence of a permanent body of water permitted the growth nearby of normally lowland or swamp plants on an otherwise dry upland.

The plants growing on the bluffs and well-drained uplands of northern Brown County were subject to more arid conditions. Thus the flora preserved at this site consists almost exclusively of genera characteristic of the uplands. The paucity of lycopods and ferns in the Brown County flora is in sharp contrast to their abundance in the swamp floras.

THE AGE OF THE FLORAS

Based upon stratigraphic evidence alone, the age of the Brown County flora can be determined only as post-Meramecian (post lower Visean) -- pre-Lampasas (pre-Westphalian B). On the basis of limited spore analysis the age is Morrowan (Namurian B-Westphalian A) (R. Peppers, personal communication). The age determination based upon the macrofossils agrees with this conclusion although the previously recognized ranges of some species could indicate ages both older and younger. The age is probably Namurian B (Leary and Pfefferkorn, in press).

The age of the Rock Island County flora is even less well established. The stratigraphic evidence places the age as post-Devonian -- pre-Pleistocene or perhaps pre-DesMoinesian (Westphalian C) (Edmund and Anderson, 1967, p. 13). Both spore and plant macrofossil studies are incomplete but at least one species (*Sphenophyllum tenerrimum*, Plate 2, Fig. 8) indicates a late Mississippian (Namurian A) age for the flora. Because of the strong environmental/facies control of the flora composition, age determinations based solely on a few plant species are approximate.

SUMMARY

Although the sites in Rock Island and Brown counties will continue to be studied and other sites sought, several conclusions can already be drawn:

1) The exposures in Rock Island and Brown counties provide glimpses of the landscape which existed on the western margin of the Illinois Basin at the beginning of Pennsylvanian sedimentation. These localities, in addition to drilling records, indicate the presence of steep-sided channels and valleys separated by relatively flat uplands.

2) The plant fossils preserved in sediments filling channels, valleys and sink holes illustrate the early Pennsylvanian upland floras. These floras were dominated by *Megalopteris*, *Lesleya*, and *Cordaites*.

3) By examining these upland floras we can better realize the diversity of plant life during the early Pennsylvanian. The composition of the upland floras differs from that of the lowland and swamp floras in the high proportion of Pteridospermales, *Cordaites* and Noeggerthiales and the low percentages of lycopsids and ferns.

4) Several fossil plant species found in these localities indicate that Pennsylvanian sedimentation in western Illinois began earlier than previously known. The Brown County deposit is Namurian B (lower Morrowan) and the Rock Island County sediments are perhaps as old as Namurian A (normally considered uppermost Mississippian).

ACKNOWLEDGMENTS

The author wishes to acknowledge the cooperation and assistance of Jerry Morris, Supervisor of the Allied Stone Co. quarry in Milan, Illinois, and the Mark Spencer family of Brown County. Without their active assistance, neither of these localities would have been studied. The comments and suggestions of Dr. Tom L. Phillips, University of Illinois, and Dr. Herman W. Pfefferkorn, University of Pennsylvania, are also greatly appreciated.

DESCRIPTION OF PLATES

Plate 1

- Fig. 1 - *Megalopteris dawsoni* X $\frac{1}{2}$
Fig. 2 - *Lesleya* sp. X $\frac{1}{2}$

Plate 2

- Fig. 1, 2 - *Lacoea seriata* X1
Fig. 3, 4 - *Samaropsis newberryi* X1
Fig. 5 - *Palaeopteridium reussi* X2
Fig. 6, 7 - *Gulpenia limburgensis* X2
Fig. 8 - *Sphenophyllum tenerrimum* X1

PLATE 1

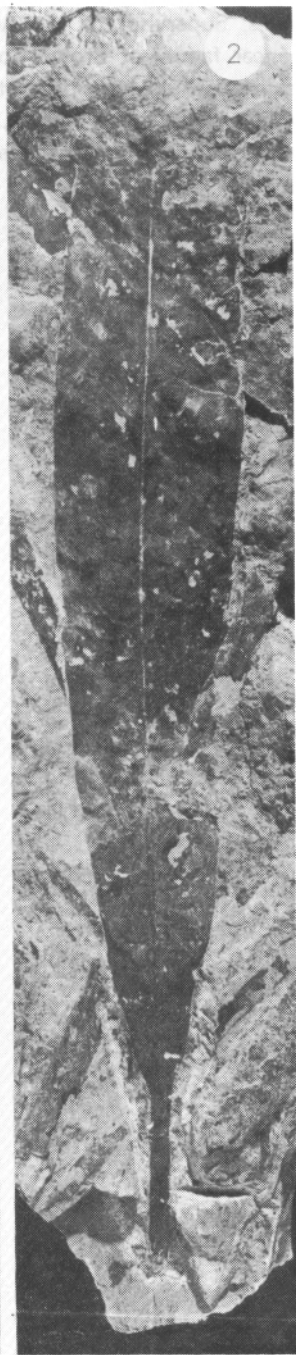
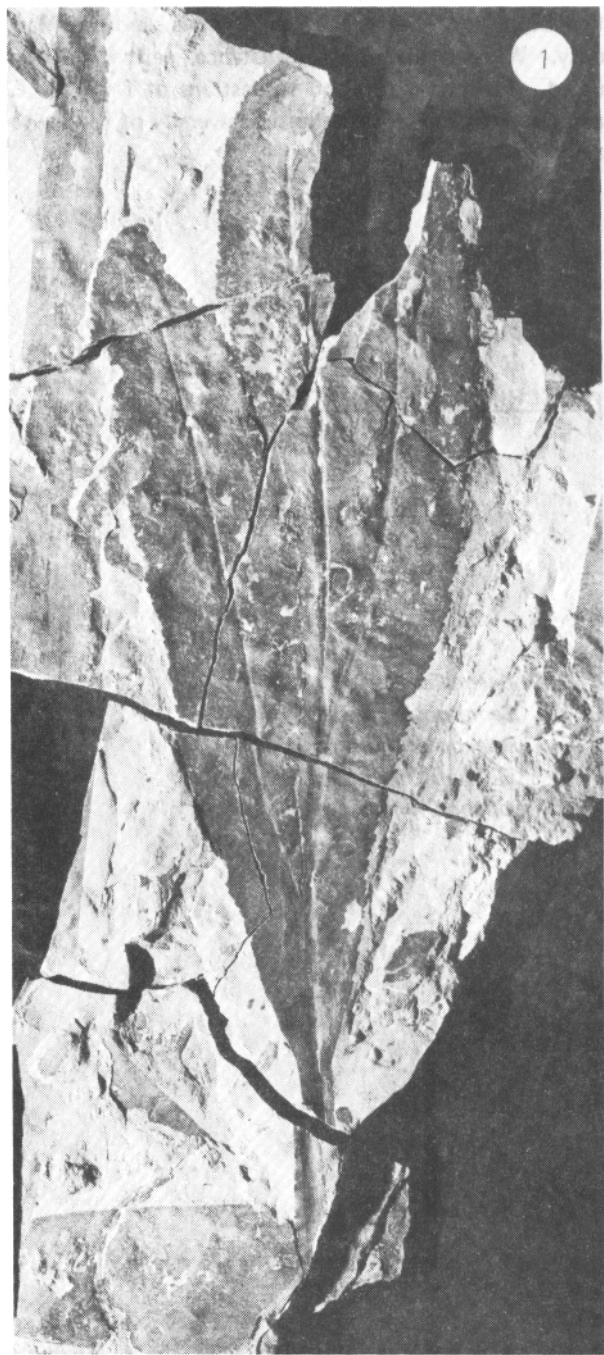
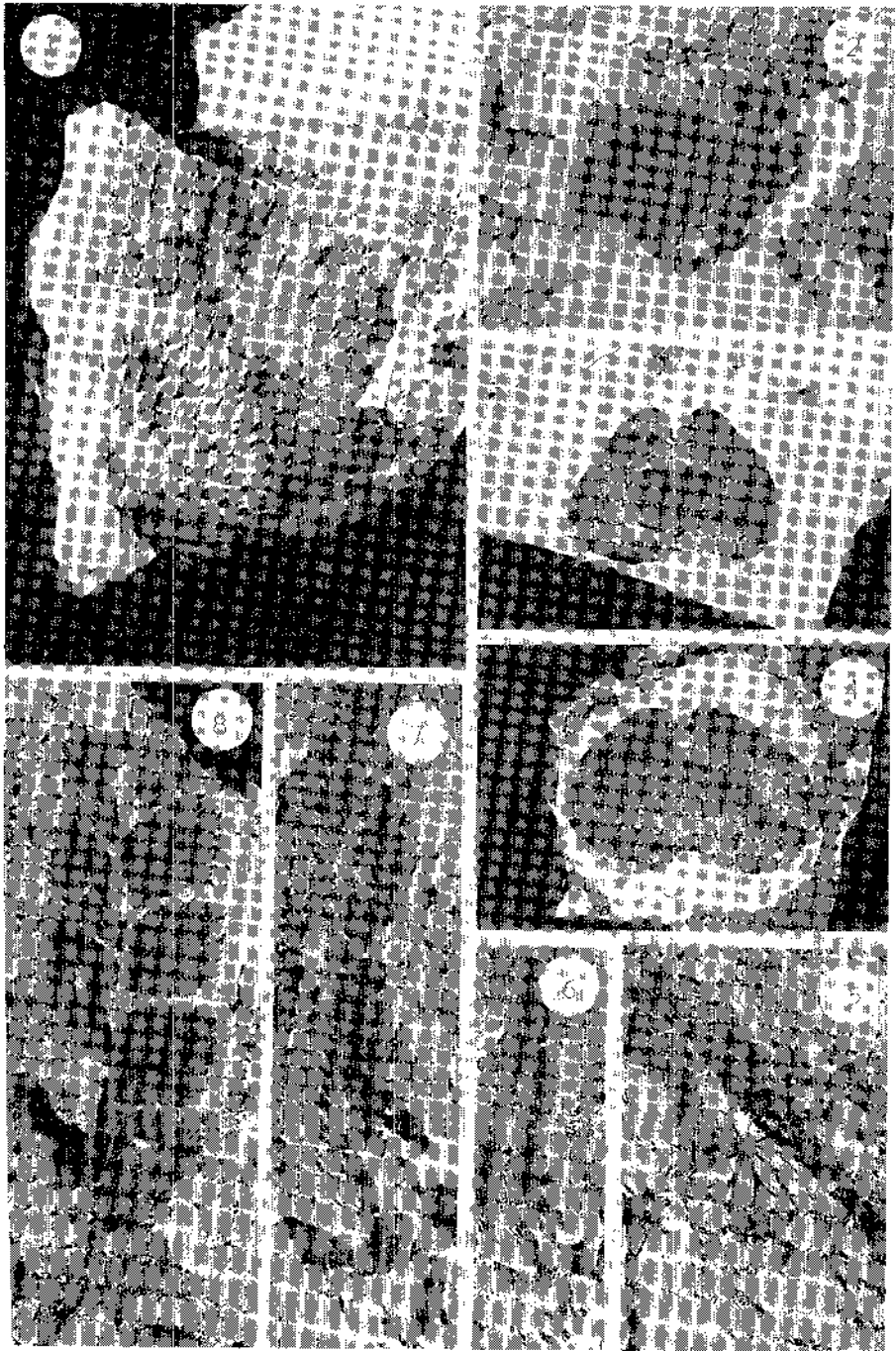


PLATE 2



LITERATURE CITED

- Bristol, H. M. and Howard, R. H., 1971. Paleogeologic map of the sub-Pennsylvanian Chesterian (U. Miss.) surface in the Illinois Basin. Ill. State Geol. Survey 458, 14 pp.
- Edmund, R. W. and Anderson, R. C., 1967. The Mississippi River Arch, 31st Annual Tri-State Geological Guidebook. Augustana College. 64 pp.
- Florin, Rudolf, 1933. Zur Kenntnis der palaozoischen Pflanzengattung *Lesleya* Lesquereux and *Megalopteris* Dawson. Arkiv for Botanik, (K. Svenska Vetensk. Akad.), 25A(19), 23 pp.
- Horberg, Leland, 1950. Bedrock Topography of Illinois. Ill. State Geol. Survey Bulletin 73, 111 pp.
- Leary, R. L., 1973. *Lacoea*, a lower Pennsylvanian Noeggerathialian cone from Illinois. Rev. Paleob. and Paly. 15(1), p. 43-50.
- Leary, R. L., in preparation. An early Pennsylvanian upland flora from Rock Island County, Illinois.
- Leary, R. L. and Pfefferkorn, H. W. A lower Pennsylvanian Flora with *Megalopteris* and Noeggerathiales from west-central Illinois. Ill. State Geol. Survey (in press).
- Nemjc, F., 1937. On *Discinites* K. Feistm. Inter. Acad. Sci. Boheme. Bulletin 38, p. 3-10.
- Peppers, R. A. and Pfefferkorn, H. W., 1970. A comparison of the floras of the Colchester (No. 2) Coal and the Francis Creek Shale in Despositional Environments in parts of the Carbondale Formation, western and northern Illinois. Ill. State Geol. Surv. Guidebook Series No. 8, p. 61-74.
- Smith, M. H., 1941. Structure contour map of the pre-Pennsylvanian surface of Illinois. Ill. State Acad. Sci. Trans. 34(2), p. 160-163.
- White, David, 1931. Climatic implications of Pennsylvanian Flora. Ill. State Geol. Survey Bulletin 60, p. 271-281.