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Enigmatic Fossil Plants from the Early Pennsylvanian of Western Illinois

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ABSTRACT

Several limestone quarries in Rock Island County, Illinois, have exposed Early Pennsylvanian (Namurian B/C) strata filling a channel or channels eroded in Silurian and Devonian carbonates. The Early Pennsylvanian shale, siltstone, and sandstone contain abundant and well-preserved fossils, primarily plant fossils. These fossils represent plants which grew on a well-drained surface, and hence many are distinct from plants which grew in coal-forming swamps. These fossils are especially significant because it is thought that major evolutionary events took place on the "uplands" rather than in swamp or lowland environments. The most productive Illinois locality has produced many enigmatic fossils, representing plants not known or, at best, poorly known, from elsewhere. Among these fossils are (1) stout bilateral axes with alternate elongate spiny projections; (2) small lobed laminae; (3) a cluster of attached ovules morphologically identical to an "Antarcticoid capitulum" from the Permian of Antarctica; and (4) stout axes with opposite to subopposite lobes, possibly bearing ovules. A single specimen of the latter occurs at the base of a leaf, *Lesleya*. *Lesleya* has been suggested as an ancestor of the cycadales and possibly was an ancestor of glossopterids. These and several other unusual plant fossils provide glimpses into diverse Pennsylvanian "upland" floras which may have contained ancestors to extant plants.

INTRODUCTION

Most of the known Carboniferous fossil plants represent plants of lowlands, primarily swamp and deltaic environments. Floras of drier "uplands" are seldom represented in the fossil record. However, several sites in western Illinois contain fossils from upland environments (Leary and Pfefferkorn, 1977; Leary, 1981).

Intuitively, distinct compositional differences between swamp and non-swamp floras are anticipated. One expects plant communities of the geologic past in different environments to exhibit diversity similar to current communities.

In addition, it has been suggested that major evolutionary changes took place outside the swamps, specifically within the uplands. Thus, even though upland deposits are rare, they are important to our knowledge of plant diversity and evolution. The paleoenvironments are referred to as "upland" in contrast to lowland environments such as swamps, delta or alluvial plains. The paleorelief of these uplands in western Illinois ranged from only a few meters to 35 meters.

The fossils described here are from an "upland" setting. This locality is within the Allied Stone Company Quarry in Milan, Rock Island County, Illinois (Fig. 1). The fossils occur in shale which fills a river channel cut into Devonian limestone during the Late Mississippian to Early Pennsylvanian (Leary, 1981). The fossil-bearing shale has been dated as Namurian B/C on the basis of plant megafossils and spores (Russell Peppers, pers. comm.). The plants grew on a rolling surface underlain by fractured limestone. The surface had a relief of ca. 4 meters. Adjacent hills were up to 30 meters high.

DESCRIPTIONS

"*Aphlebia*"

This is an instance where nomenclature is clearly not the same as taxonomy. Although the specimens in question can, with some certainty, be identified to genus, higher taxonomic placement is impossible. It is not even known what part of a plant is represented. One possibility is that they are aquatic plants, another is that they are succulents. Still another possibility is that they are early coniferous or cordaitean fertile structures.

In appearance, they are very similar to *Aphlebia spinosa* from Mazon Creek, figured by Langford in his Coal Flora (1958). However, they do not closely resemble the type of *Aphlebia spinosa* described and figured by Lesquereux (1879). [Described as *Rhacophyllum spinosa* and transferred to *Aphlebia* by White (1899).] They more closely resemble the types of the genus, originally described by Gutbier in 1835. He named the specimens *Fucoides* and thought them a brown alga.

Among the specimens from western Illinois are several varieties. These may represent several species, even different genera. Possibly they are different stages in development or perhaps fertile and sterile forms of the same plant. Specimens are up to 13 cm long and 6.4 cm wide. They have a thick basal axis, expand rapidly, and taper to a point.

One group of these are stout axes with two rows of thick, branched or spiny appendages (Fig. 2). The organs are bilateral and the projections are opposite to subopposite. The major axes have coarse wrinkles which indicate that originally they were fleshy and shriveled upon drying prior to preservation (Fig. 3). The central portion is 1/6 to 1/3 of the total width.

The elongate projections are up to 28 mm long, with round or oval cross sections, 2 mm in diameter, and taper to a point. The appendages depart at steep angles at the base of the structure, the angle decreasing toward the apex. They curve gently upward along their length. Most specimens are open, the appendages widely separated. Some appear more foliar with the appendages touching or overlapping. No veins are visible in the projections. Some projections have downwardly curved "spines" near the base (Fig. 4). Those projections have radially arranged spines or leaf scars along their length.

Two specimens have what appear to be ovules attached just above the lateral arms (Fig. 5). Preservation of the specimens does not allow definite determination of the true nature of the ovule-like bodies.

A second group of similar structures appear to be radially symmetrical and covered with laminae (Fig. 6). Whether these belong to the same plant as the "*Aphlebia*" described above is not known.

Lobed lamina

Another fossil of unknown affinities consists of small laminae with lobate margins (Fig. 7). They range up to 47 mm in length and 24 mm in width. Overall, they are lanceolate in shape but the margins are deeply divided into lobes with rounded apices. The lobes usually occur in pairs, joined basally. The lamina taper to a narrow base.

Venation is faint. Apparently a single vein enters the base of the lamina. Side veins divide once dichotomously; a single vein enters each lobe.

One specimen consists of a small stem with a single leaf attached near the blunt tip. Several scars indicate leaves were attached in a spiral. Another specimen consists of a cluster of three lobed leaves (Fig. 8).

A total of 17 specimens have been collected. Three are nearly complete; other specimens are only fragments of various sizes.

"Antarcticoid capitulum with ovules"

Two specimens with identical ovules have been collected in the Allied Stone Company Quarry in western Illinois. One specimen preserves the ovules attached to a hand-shaped structure, the ovules at the end of the "fingers" (Fig. 9). The preserved organ is 9 mm long and 5 mm high. The ovules are pear-shaped, 3.2 mm long and 2.4 mm wide.

The second specimen contains a cluster of 9 ovules. Either they were detached prior to preservation or the organ was compressed vertically and the capitulum not preserved.

The specimen illustrated (Fig. 9) is very similar to a specimen described and illustrated by Schopf in 1976. His specimen, referred to as "Antarcticoid capitulum with ovules," is from the Permian of Antarctica and is associated with Glossopterids. It has been equated with *Rigbya* cf. *arberioides* (Lacey, 1977; Lacey et al., 1975).

Fertile axes of unknown identity

This fossil, somewhat resembling an over-grown graptolite or two-sided saw blade (Fig. 10), is probably a fertile structure. The projections are alternate to subopposite. The bases are broad and deccurent. These fossils have not been found attached to any other plant part.

The projections on each side of the thick axis appear to have an expanded tip which might have contained either seeds or, more likely, spores. The fossils are coalified and no detailed studies have been made yet to see whether spores or anatomy might be preserved.

CONCLUSION

There are a number of unusual plants in the Early Upper Carboniferous upland floras of western Illinois. Some may be significant as ancestors of extant plants. Most no doubt represent previously unknown plants, perhaps even groups of plants, now extinct. These fossils, and others yet undiscovered in upland floras elsewhere, provide exciting glimpses into the evolution of plants.

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Figure 1. Map of Illinois showing major tectonic features and location of collecting locality (arrow). (Base map courtesy Illinois State Geological Survey.)

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Figures 2 - 6

Fig. 2. *Aphlebia* sp. X 1
Fig. 3. *Aphlebia* sp. with wrinkled axis. X 2
Fig. 4. *Aphlebia* sp. X 1
Fig. 5. *Aphlebia* sp. with ovules? X 1
Fig. 6. *Aphlebia* sp.2. X 1

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Figures 7 - 10

Fig. 7. Lobed lamina. X 2

Fig. 8. Three lobed lamina on axis. X 2

Fig. 9. "Antarcticoid capitulum with ovules." X 5 Compare with Schopf (1976) and *Rigbya arberioides.*

Fig.10. Fertile axis. *Lesleya* in upper left. X 2

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