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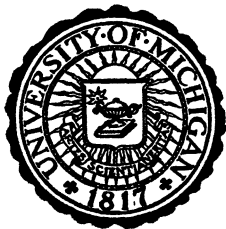
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OBSERVATIONS ON FOSSIL PLANTS FROM  
THE DEVONIAN OF EASTERN  
NORTH AMERICA

II. *ARCHAEOPTERIS MACILENTA* AND  
A. *SPHENOPHYLLIFOLIA* OF LESQUEREUX

BY  
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II. *ARCHAEOPTERIS MACILENTA* AND  
*A. SPHENOPHYLLIFOLIA* OF LESQUEREUX

By CHESTER A. ARNOLD

TWO species of *Archaeopteris*, *A. macilenta* and *A. sphenophyllifolia*, were described by Lesquereux in Volume III of the *Coal Flora*,<sup>1</sup> but not figured. A statement is made that plates illustrating these species had been prepared, but too late for publication and, so far as the present author is aware, neither these plates nor any other figures showing these species have ever been published. It seems desirable, therefore, to publish figures of specimens of these species recently observed among the collections in the United States National Museum. For the privilege of examining this material the author wishes to express his appreciation to Drs. R. S. Bassler and C. B. Read of that institution.

Besides publishing figures of *A. macilenta* and *A. sphenophyllifolia* an attempt will be made to enlarge somewhat upon Lesquereux's description. Brief comments will also be made concerning similarities between them and more recently described species, but questions concerning their status as valid species will not be considered here. Though the material is well preserved and adequate for description, it is rather limited in amount. The motive at present is primarily to figure and to describe more completely than has been done heretofore certain specimens to which

<sup>1</sup> Lesquereux, L., *Description of the Coal Flora of the Carboniferous Formation in Pennsylvania and throughout the United States. Second Geol. Surv. Pennsylvania*, Vol. III, Report of Progress P. Harrisburg, 1884.

Lesquereux assigned the names mentioned above. Another unfigured form, designated as *A. denticulata* (*Coal Flora*, p. 774), is probably not an *Archaeopteris* and will not be considered further here.

1. *Archaeopteris macilenta* Lesq.

(Pl. I, Fig. 1)

*Coal Flora*, Vol. III, pp. 773, 775, 776. 1884.

One slab bears portions of two fronds representing this species. The attached label states that it was collected by R. D. Lacoé at Factoryville tunnel (Pennsylvania) and was determined by Leo Lesquereux. It bears the collection number 830; which is that given in the *Coal Flora* (p. 776) for members of that species. Since the statement is made in the *Coal Flora* that *A. macilenta* came from Meshoppen (no mention is made of Factoryville), there is some slight uncertainty whether this specimen was one of the original ones used by Lesquereux when he described the species. Either there is an error in locality designation in the *Coal Flora* or material was derived from two localities and only one was mentioned. However, the specific identity of the specimen is positive, and it is considered suitable for illustrating the species.

The largest frond on the slab measures 14 inches in length, and 13 pairs of opposite pinnae depart from the rachis. Midway between adjacent pairs of pinnae on the lower part of the frond is a pair of oppositely placed interpinnae. Whether or not these extend to the tip of the frond is undeterminable. As stated by Lesquereux (p. 773), the rachis shows distinct lengthwise striations, which are probably exposures of the vascular elements due to partial removal of the outermost tissues. Also, a few fine cross striations can be observed at places on the rachis. These are cited as specific characters for certain species, but they are probably shrinkage cracks having no diagnostic value.

The other frond (Pl. I, Fig. 1) is shorter, but shows the pinnae to better advantage. The largest pinnae are about five inches long, but the lowermost ones, which are incomplete, were probably longer. They are spaced approximately one inch apart and leave the rachis at an angle of about 35 or 40 degrees. They are straight,

parallel to each other, and not flexuous. The pinnules are evenly spaced along the pinna rachis, and adjacent ones may touch slightly without appreciable overlapping. They are symmetrically obovate and oblique to the rachis, but not decurrent upon it or outwardly curved. In length (approximately one half inch) they slightly exceed their greatest breadth, which is at about the middle portion. The terminal portion is rounded, while the basal portion converges to a narrow point of attachment. The margins of the basal portions are either straight or slightly concave. The terminal portion is deeply marked by indentations, some of which reach below the middle. Three or four very deep indentations divide the lamina more or less into lobes. Each lobe is in turn divided by shallower indentations into distinct teeth, of which there may be a dozen or more on each pinnule. Lesquereux states in his description that the teeth are not produced by a prolongation of the veins, but by lateral expansions of the substance of the leaf. Careful examination, however, of the best preserved teeth with a binocular microscope indicates that a single vein passes to the apex of each tooth, even though the notches on either side may be of unequal depth. The extreme tips of many of the teeth are broken, so that the terminations of the veins are often obscured. The veins are very small, as Lesquereux states. No fructifications are present on the specimen at hand.

This species is certainly distinct from any other American species of *Archaeopteris*, but there are some close resemblances between it and *A. fimbriata* from Bear Island. The most striking one is the dentation of the pinnules. Nathorst<sup>2</sup> states that a pinnule may have from a few to twenty terminal teeth and that the indentations do not reach the base. Size and shape of the pinnules are very similar in both species, and the opposite arrangement of the pinnae and the occurrence of opposite interpinnae pinnules on the main rachis are points of resemblance. Lengthwise striations on the rachis of *A. fimbriata* are also mentioned. The pinnules may be assumed to be very slightly longer in proportion to their width than those of *A. macilenta*, and some of the

<sup>2</sup> Nathorst, A. G., "Zur oberdevonischen Flora der Bäreninsel," *Kungl. Svenska Vetenskapsakad. Handl.*, Vol. 36, No. 3. 1902.

figures suggest that the teeth are longer and more slender. In *A. macilenta* only three or four indentations extend deeply into the lamina, while in the Bear Island species it appears that many more or in some instances all of the indentations extend one third or more of the way down. On the whole, however, the general resemblances between the two forms are close, and whatever differences there are might well be within the limits of a single species.

There are no spore-bearing structures in the present collection referable to *A. macilenta*, although Lesquereux states (p. 775) that they occupy the base of the fronds, taking the place of the lower branches. According to his description, they are  $3\frac{1}{2}$  to 4 inches long and somewhat flexuous. Fertile branches similar in character and occupying a similar position on the frond are figured by Nathorst (*op. cit.*, Pl. 3, Fig. 3) for *A. fimbriata*.

*Archaeopteris fissilis* from the Donetz Basin<sup>3</sup> is another type with deeply cleft leaves. However, in this species the divisions extend nearly to the bases of the pinnules, which produce an appearance quite different from that of either of the other two forms.

## 2. *Archaeopteris sphenophyllifolia* Lesq.

(Pl. I, Figs. 2-6)

*Coal Flora*, Vol. III, pp. 773, 775. 1884.

The material in the collection assigned to *Archaeopteris sphenophyllifolia* consists of nine specimens from Meshoppen, Pennsylvania (No. 829 of the Lacoë collection), and four collected by Prosser from the bluffs of the Delaware River four miles above Port Jervis, New York, at a locality known as "Hawk's Nest." Of the material from Meshoppen all was determined by Lesquereux, and two specimens are labeled as types (Pl. I, Figs. 2-3). Prosser's material from the bluffs of the Delaware River has no labels other than a collection number (409), but the records in the National Museum show that material bearing this number was collected in 1901 from the Starrucca sandstone (of White), which at that

<sup>3</sup> Schmalhausen, J., "Über devonische Pflanzen aus dem Donetz-Becken," *Mem. du Comité Géol. de Russe*, Vol. 8, pp. 27-29. 1894.

time was assigned to the lower Catskill. Prosser describes this locality <sup>4</sup> and states (p. 44) that material referable to *A. sphenophyllifolia* was identified by Lacoë and compared with the types from Meshoppen. From all available data it appears certain that the material at hand was at least a part of that collected by Prosser and submitted to Lacoë, and also mentioned in Prosser's report.

A large type specimen (No. 829 a) from Meshoppen appears to be the one from which the diagnosis was made. It shows the "strong primary rugose rachis" to which Lesquereux refers, with very long rigid secondary pinnae, on which the rachis is striate lengthwise. It also has oblique tertiary pinnae bearing wedge-shaped, deeply split pinnules. The entire specimen is slightly more than 15 inches long. In the lower portion is the large rachis, one half of an inch in diameter, and departing from it are a pair of secondary pinnae, which are almost opposite each other. These secondary pinnae are at least 12 inches long, and they depart from the central rachis at an angle of about 15 degrees. As they pass upward they bend outward slightly, probably because of the weight of the large pinnules. The tertiary pinnae are from 4 to 6 inches long, or slightly more, but none are complete. The pinnules are narrowly wedge-shaped, about one inch long, are distantly spaced, and do not overlap (Pl. I, Fig. 2). The apical splitting of the pinnules is visible, but is not quite so pronounced as in the material from the Delaware River.

The second type specimen is much smaller and presents an appearance somewhat different from that of the other (Pl. I, Fig. 3). Careful comparison, however, reveals several points in common. The pinnules are less than one half as long as those of the other type specimen, but are distantly placed, so that they do not overlap, and the pinnae are oppositely arranged on the main rachis in a similar manner. Also, the apical splitting of the rather narrow pinnules is visible, but not so conspicuous except after careful examination. This specimen probably represents the foliage borne on the less rapidly growing portions of the plants.

<sup>4</sup> Prosser, C. S., *The Devonian System of Eastern Pennsylvania and New York*, U. S. Geol. Surv., Bull. 120. 1894.

Fructifications are not mentioned in the original description of this species, but in the collection there is a single fertile branch which Lesquereux had designated as *A. sphenophyllifolia*. This specimen (Pl. I, Fig. 4) bears the number 16985. It agrees well with the fructification described (but not seen during the course of the present study) for *A. macilenta*. Why it was referred to *A. sphenophyllifolia* is not known. It is a portion of a fertile frond bearing lateral branches (pinnae) about one half of an inch apart. They appear to be nearly opposite. Each fertile pinnule consists of a peduncle, one fourth of an inch or more long, which bears upon its adaxial surface a row of four or five oval sporangia. These sporangia are borne singly upon short pedicels. The peduncle which bears the pediceled sporangia is expanded distally into a narrow lamina, which extends some distance beyond the portion bearing the sporangia.

The material of this species collected by Prosser from the bluffs of the Delaware River is preserved in a fine-grained reddish or buff sandstone. The pinnules present the appearance of having been stiff and rigid, since the imprints are rather deep and clear cut (Pl. I, Fig. 5). The main rachis seems to have been covered with pinnules, to judge from the appearance in some specimens. The individual pinnae are long and slender, with narrow cuneate bases and rounded apices. The apex is slightly cut into four or five lobes. The veins apparently were strong and fibrous, so that the blade split readily between them (Pl. I, Fig. 6). The pinnules leave the rachis at a steep angle and curve very slightly outward, and since they are distantly spaced there is very little actual overlapping.

This material seems to agree with Lesquereux's description of the species in practically all respects, especially in the long, narrow, distant pinnules, which are cut apically and have strong veins. The surface features of the main rachis, whether smooth, punctate, or striate lengthwise, are probably due to preservation and are not of importance for diagnosis, as Lesquereux claimed. Whether more than one species is represented in the material assigned to *A. sphenophyllifolia* is uncertain, although the specimen with the small pinnules (Pl. I, Fig. 3) impresses one as different from the

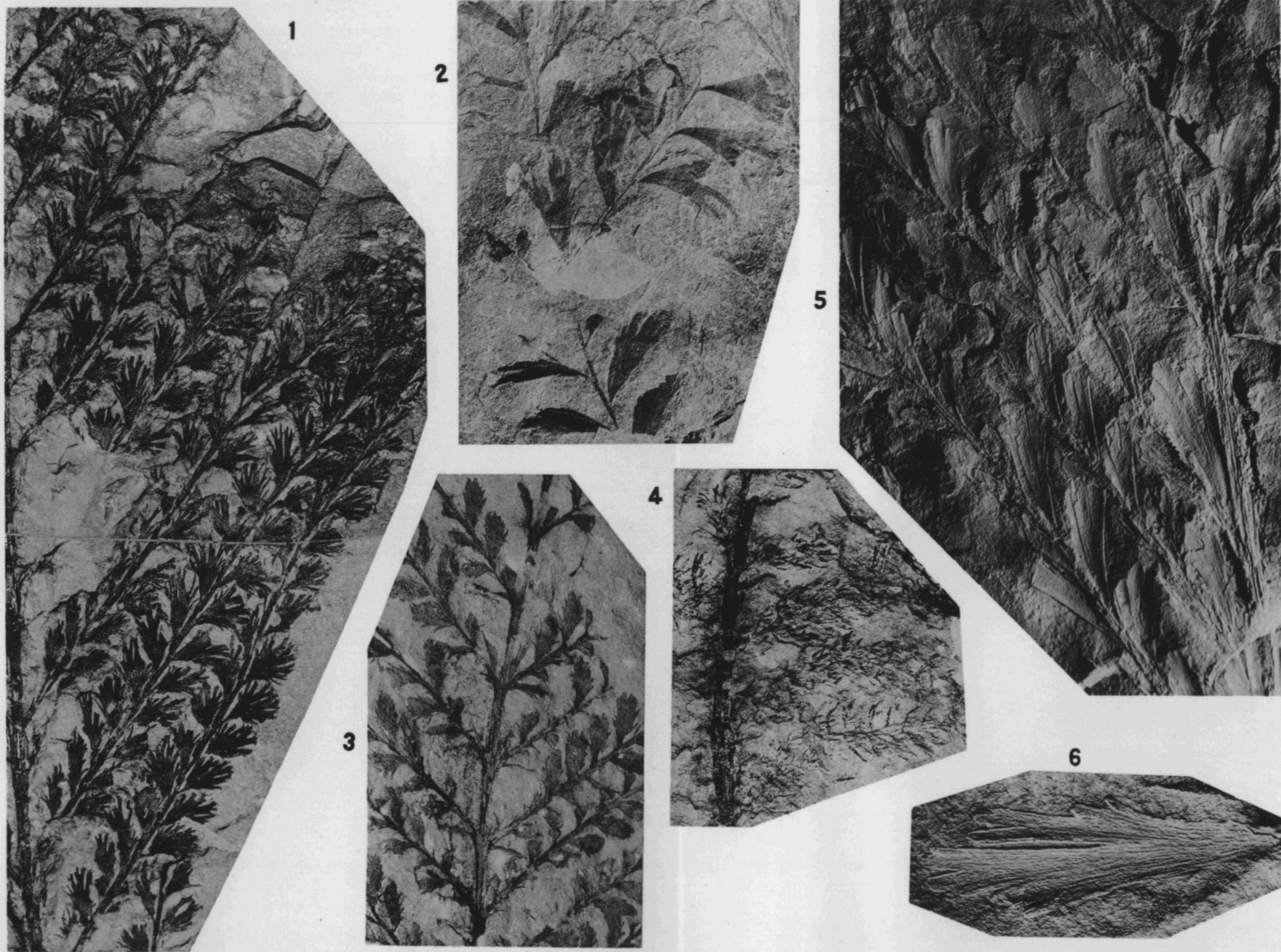


others. However, a careful comparison indicates that the only important difference is that of size. The pinnules of the small form are slightly broader in proportion to their width, and they tend to stand out from the rachis at a greater angle. On the other hand, the distant spacing and the noticeable lack of overlapping agree well with other specimens assigned to this species.

## EXPLANATION OF PLATE I

- FIG. 1. *Archaeopteris macilenta* Lesq. No. 830 of Lacoë collection. From Factoryville tunnel. Probable cotype
- FIG. 2. *Archaeopteris sphenophyllifolia* Lesq. No. 829 a of Lacoë collection. From Meshoppen. Cotype
- FIG. 3. *A. sphenophyllifolia* Lesq. No. 829 v of Lacoë collection. From Meshoppen. Cotype. Small form
- FIG. 4. *A. sphenophyllifolia* Lesq. No. 829 f of Lacoë collection. From Meshoppen. Cotype. Fructification
- FIG. 5. *A. sphenophyllifolia* Lesq. No. 409 U. S. Nat. Mus. Coll. Specimen collected by Prosser from the "Hawk's Nest," on the New York side of the Delaware River above Mill Riff, about four miles north of Port Jervis, New York
- FIG. 6. *A. sphenophyllifolia* Lesq. Data as for Figure 5. Single pinnule enlarged 3 times

PLATE I



*Archaeopteris macilenta* and *A. sphenophyllifolia*





