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OBSERVATIONS ON *ALETHOPTERIS*  
*GRANDIFOLIA* NEWBERRY  
AND ITS SEEDS

BY

CHESTER A. ARNOLD



UNIVERSITY OF MICHIGAN PRESS  
ANN ARBOR

# AIIM SCANNER TEST CHART # 2

## Spectra

4 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789  
 6 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789  
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## Times Roman

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## Century Schoolbook Bold

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## News Gothic Bold Reversed

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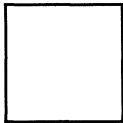
## Bodoni Italic

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## Greek and Math Symbols

4 PT ΑΒΓΔΕΞΘΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθικλμνοπφρστυωχψζ≧≦≠><≧≦≡  
 6 PT ΑΒΓΔΕΞΘΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθικλμνοπφρστυωχψζ≧≦≠><≧≦≡  
 8 PT ΑΒΓΔΕΞΘΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθικλμνοπφρστυωχψζ≧≦≠><≧≦≡  
 10 PT ΑΒΓΔΕΞΘΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθικλμνοπφρστυωχψζ≧≦≠><≧≦≡

White



Black



Isolated Characters

e	m	1	2	3	a
4	5	6	7	o	.
8	9	0	h	l	B

## MESH HALFTONE WEDGES

65

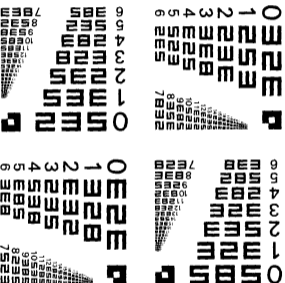
85

100

110

133

150



Resolution test chart containing two identical sets of patterns. Each set includes a vertical column of numbers 1 through 7, followed by a 5x5 grid of letters O, E, Z, E, B, and a triangular pattern of letters W, U, M, N. The letters are arranged in rows corresponding to the numbers: 7 (W U M N), 6 (W U M N), 5 (W U M N), 4 (W U M N), 3 (W U M N), 2 (W U M N), 1 (W U M N).



# CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

(Continuation of Contributions from the Museum of Geology)

## UNIVERSITY OF MICHIGAN

Editor: EUGENE S. McCARTNEY

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(Continued on inside of back cover)

OBSERVATIONS ON *ALETHOPTERIS*  
*GRANDIFOLIA* NEWBERRY  
AND ITS SEEDS

By CHESTER A. ARNOLD

IN 1873 Newberry<sup>1</sup> described *Alethopteris grandifolia* from the shale over Coal No. 1 at Tallmadge, Summit County, Ohio. This species, he says, is the most common plant fossil in the coal mines at Tallmadge, and he states that during his childhood and later he collected thousands of specimens representing all parts of its large fronds. Lesquereux cites this species in the *Coal Flora*<sup>2</sup> (p. 179) and says that, even after examining numerous specimens from the same locality, he is unable to find any character by which it may be definitely distinguished from *A. lonchitica*. Aside from this reference by Lesquereux, *A. grandifolia* is seldom mentioned in later literature. White<sup>3</sup> recognized it in the Pottsville formation of the southern anthracite coal field of Pennsylvania and he adds that it is characteristic of the roof of the Sharon coal (Coal No. 1 of Newberry) throughout the Appalachian province.

In the fossil plant collection in the Museum of Paleontology of the University of Michigan are several small shale slabs showing impressions of *Alethopteris* foliage and bearing labels indicating that they are from Newberry's locality. The history of this material and the way it came into the possession of the Museum are unknown, but, to judge from the appearance of the labels, it has

<sup>1</sup> Newberry, J. S., *Descriptions of Fossil Plants from the Coal Measures of Ohio, Report Geol. Surv. Ohio, Vol. 1, pt. 2, Palaeontology, 1873.*

<sup>2</sup> Lesquereux, L., *Description of the Coal Flora of Carboniferous Formation in Pennsylvania and throughout the United States, Vol. 1. Second Geol. Surv. Pennsylvania, Report of Progress P, 1880.*

<sup>3</sup> White, David, *The Stratigraphic Succession of the Fossil Floras of the Pottsville Formation in the Southern Anthracite Coal Field, Twentieth Ann. Report U. S. Geol. Surv., pt. 2, 1898-99.*

been in the Museum collection for many years. The *Alethopteris* foliage appears identical with Newberry's figures of *A. grandifolia*. "*A. lonchitica*" was written on some of the labels, but there is no doubt concerning its identity with Newberry's species. On some of the slabs are impressions and casts of seeds, and in a single instance a seed can be seen attached to the pinna rachis of a portion of a frond (Fig. 3).

Newberry mentions the great profusion of seeds in the roof shales of Coal No. 1, but says that they were never seen connected with the plants on which they grew. This, of course, was before the epoch-making discovery that many of these fernlike fossils of the Coal Measures bore seeds and were not true ferns. He says, further, that the fructifications of *Lepidodendron*, *Asterophyllites*, *Sphenophyllum*, and the ferns are known and are different from the seeds present at Tallmadge, so that the only alternative is that they belong to *Sigillaria*. He relies also upon Dawson's supposition that *Sigillaria* is a gymnosperm. One can only imagine his surprise had he chanced to observe for the first time these seeds and the supposed fern fronds in actual organic connection.

The seeds associated with *A. grandifolia* are fairly large and of the *Trigonocarpus* type. Two specimens of the nucellar casts are preserved and measure  $14 \times 25$  mm. (Fig. 1) and  $16 \times 25$  mm. (Fig. 5). Surrounding these casts are the carbonized remains of the testa. It appears that several testae had split open, with the consequent loss of the nucellar portion, and that the empty shells were then preserved as carbonaceous impressions (Figs. 2, 4, 6). From these the size and the shape of the complete seeds are determinable. They measure about  $18 \times 35$  mm. The testa appears to be thin, 1 mm. or so thick, and the shape of the seed conforms well with that of the nucellus, except for a short broad micropylar beak, which is about 5 mm. long (Figs. 2, 6). On the nucellar casts the three ridges characteristic of seeds of *Trigonocarpus* are visible. Longitudinal ridges are also present on the surface of the seeds, but their exact number is undeterminable. The seed connected with the frond is incomplete, only the basal portion being present (Fig. 3), but it appears identical with the others, all of which are certainly of the same kind.

The attachment of the seeds seems to be the same as in *Alethopteris Norinii*, described by Halle<sup>4</sup> from the Permian of China. In the Chinese species the seed is mentioned as attached to the rachis of an ultimate pinna bearing ordinary pinnules both above and below the seed. The seed seems to be placed on the upper side of the pinna, a feature which is undeterminable in our specimen. Owing to the state of preservation in the Tallmadge material no pinnules are present on the same side of the rachis with the seed, but on the opposite side they are arranged in the usual order (Fig. 3).

Regardless of difficulties that might exist in distinguishing between species of *Alethopteris* on foliar characters it is evident that the seeds of *A. grandifolia* and *A. lonchitica* indicate two species. The seed of *A. lonchitica* is supposed to be *Trigonocarpus Parkinsoni*, although actual connection between the two has never been observed. *Trig. Parkinsoni* has a long micropylar extension of the testa, or beak, which is nearly as long as the nucellar portion itself. In the seed of *A. grandifolia* the beak is short. The nucellar portions of both seeds may be comparable in size, but the total length of *Trig. Parkinsoni* is greater because of the prolonged micropylar beak. Also, to judge from most published figures of *Trig. Parkinsoni*, the nucellar portion is somewhat more broadly oval than that of *A. grandifolia*.

White, in referring to species present in the lower Pottsville, apparently was able to recognize both *A. grandifolia* and *A. lonchitica*, although he figures neither and makes no comments concerning their similarities and the differences between them. This, combined with the evidence produced by the seeds, appears to remove all reasonable doubt that these two forms are specifically distinct, although fragmentary vegetative portions such as are usually available for study might not show distinguishing features, as was the case with the material studied by Lesquereux.

On comparing the specimens of *A. grandifolia* with the numer-

<sup>4</sup> Halle, T. G., "Palaeozoic Plants from Central Shansi," *Palaeontol. Sinica*, Vol. 2, Fasc. 1, 1927; "Some Seed-bearing Pteridosperms from the Permian of China," *Kungl. Svenska Vetenskapskad. Handl.*, Vol. 6, No. 8, 1929.

ous figures of *A. lonchitica* by European authors it becomes evident that separation is difficult and often impossible when only small portions of the frond are at hand. There arise, therefore, the questions whether *A. grandifolia* might be more prevalent in the American Carboniferous than is commonly supposed and whether it might exist beyond the limits of the Sharon coal horizon. Another alternative is that the supposed connection between *A. lonchitica* and *Trig. Parkinsoni* does not exist, but this seems more improbable.

All figures shown in the plate are of natural size and are untouched, except that specimens 2, 3, 4, and 6 were whitened with ammonium chloride before being photographed. All specimens are in the Museum of Paleontology of the University of Michigan and bear the number 11126, except Figure 3, which is numbered 11309.



PLATE I

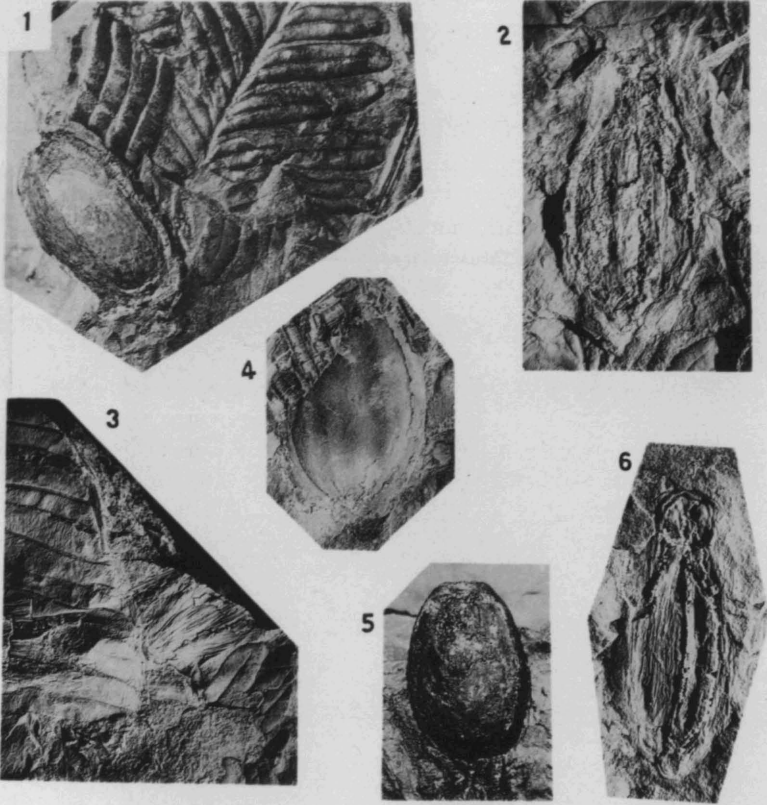


FIG. 1. Fragment of vegetative pinna, and a nucellar cast showing a portion of adjacent carbonized testa

FIG. 2. Flattened carbonized testa from which the nucellus had disappeared. The outline and the shape of the seed and the broad short micropylar beak are shown

FIG. 3. Portion of seed attached to pinna rachis

FIG. 4. Portion of flattened testa, which probably consisted of two layers

FIG. 5. Nucellar cast

FIG. 6. Carbonized testa showing some of the external ridges and the micropylar beak



(Continued from inside of front cover)

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