Art. III.—*A Cycadophyte from the North American Coal Measures;* by Harvey Bassler.

Although the remains of fronds of indubitable cycadophytes have long been known from the European Paleozoic none have heretofore been known from the North American Paleozoic.

During the summer of 1915 the writer, while collecting from the so-called Four-foot Coal Seam opposite Barnum, W. Va., discovered a single characteristic specimen of the genus *Plagiozamites.*

The importance attached to the finding of this genus in the Paleozoic of North America and the possible significance of the occurrence of such a well-known Permian type as low in the coal-measures as the middle of the Conemaugh formation warrants the publication of the present announcement in advance of the publication of the detailed account of the flora which is now approaching completion.

The genus *Plagiozamites* was established in 1894 by Prof. René Zeiller* to include cycadean fronds with oval-lanceolate leaflets resembling in their general form those of *Zamites*, but inserted obliquely on the common rachis, the leaflets differing, further, from those of *Zamites* in that they do not display at the base the callous thickening that always or nearly always characterizes the latter. The Maryland specimen is not, however, specifically different from *Plagiozamites Planchardi* (Renault) Zeiller† of the Lower Permian of Trienbach in Alsace, and this makes the discovery of peculiar interest, for the American material comes from a horizon in the Middle Conemaugh 410′± below the Pittsburg seam of coal, which marks the base of the superjacent Monongahela Formation, and nearly 700′ beneath what has been considered to be the base of the Permian in this region. This fact, however, is in perfect accord with other evidence tending to show an interesting relationship between the middle Conemaugh of the Appalachian province and the Permian of other regions.

The appearance in the Conemaugh for the first time since the close of the Mississippian of inherently red sediments has for some years‡ been considered significant of some important geologic change such as might mark the passage from the true Coal Measures to the Permo-Carboniferous and this found confirmation in 1908 when in the Annals of the Carnegie Museum, vol. iv, pages 234–241, Prof. E. C. Case described a small collection of vertebrate fossils made by Dr. Percy E. Raymond in

*Zeiller, 1894, Bull. Soc. Geol. France, 3e Serie, xxii, pp. 174, 177.
†Zeiller, 1894, ibid., p. 174, pl. viii, figs. 1–5, pl. ix, fig. 1.
‡White, I. C., 1903, West Virginia Geol. Survey, vol. ii, pp. 165, 226, 227.

the middle Conemaugh at Pitcairn about fifteen miles east of Pittsburg, Pa. The determinable specimens of this collection, to the number of about twenty, are distributed among the reptilian genera *Naosaurs* and *Desmatodon* and the amphibian genus *Eryops*, and are declared to be distinctly of the same character as those from the Permian beds of northern Texas. These bones came from a horizon in the Pittsburg Red Shale about 35 feet beneath the Ames or Crinoidal Limestone which in turn lies 315 feet beneath the base of the Pittsburg Coal Seam and marks the last paleozoic marine invasion of this general region. Further, Dr. I. C. White, in Vol. II (A) of the West Virginia Geological Survey (1908), page 623, mentions the discovery near Salt Lick Bridge, Braxton Co., W. Va., a few feet above the horizon of the Ames Limestone, of what appears to be a perfect cast of the tibia of a large reptile allied to the Permo-Triassic *Pareiasauria*. In this connection it is interesting to recall that Scudder in 1896 (Bull. U. S. G. S., No. 124, p. 12), in discussing a collection of insect wings made near Steubenville, Ohio, from a horizon "a little above the Crinoidal" or Ames Limestone, states that this insect fauna closely resembles one from the Lower Permian of Weissig in Saxony.

The reference of each of the above faunal horizons to the Ames marine horizon raises the question of the relation of the "Four-foot Seam" at Barnum to this marine limestone. This coal-seam is the same as that at Barton, Md., 9 miles to the northeastward in the Georges Creek Valley which is known in the literature of the region as the *Bakerstown Coal* and which at Barton is about 135′ above the uppermost known marine fauna—*Brush Creek* of the literature—but this so-called Brush Creek horizon on the evidence of a considerable marine fauna is considered by Drs. C. K. Swartz and W. A. Price as probably that of the Ames Limestone.

In addition to the occurrence of *Plagiozamites Planchardi* at Teufelsbrunnen in Alsace it has been found also in France, in the Tranchée de Forêt, in shales associated with the Grand Couche of the Commentry Basin* and in shales associated with the upper seam of coal at the mines of Longpendu in the Blanzy Basin,† in both cases at practically the same horizon (slightly older than the one in the Vosges) which Zeiller‡ considers

* Renault, 1890, Flore Foss. terr. houill. de Commentry, 2e part, p. 615, Atlas, pl. lxvii, fig. 8.

† Zeiller, 1906, Flore foss. bass. houill. et Perm. de Blanzy et du Creusot, page 193, pl. xlvii, fig. 2.

‡ Zeiller, 1894, Sur l'age des depots houill. d. Commentry, Bull. Geol. Soc. France, 3e ser., t. **xxii**, p. 275 et seq., also Zeiller, 1906, loc. cit., pp. 237, 247.

uppermost Stephanian and which Sterzel* and Potonié† both consider referable to the lowermost Autunian or Rothliegenden (Permian). This horizon will be referred to as Permo-Carboniferous in the sense that it probably occurs in the narrow zone of passage from the Stephanian to the Autunian.

The material from Maryland falls well within the limits of this species as described by Zeiller, for, while the leaflets are rather less bluntly terminated than is the case with the Alsatian specimens or with the one from Longpendu, they are distally somewhat less attenuate than that from Commentry. The rachis of the Maryland specimen, unlike the rather poorly preserved rachises of the material figured by Zeiller, instead of being terete as these appear to have been, is flattened above, is rather coarsely but somewhat indistinctly lineate and is traversed longitudinally by a shallow median channel. The manner in which the base of the pinnules obliquely half encircles the rachis and the evidence near the base, of the torsion of these leaflets during fossilization, out of the plane they occupied during life, is well seen in the accompanying figures.

The better to show the nervation with its rather infrequent dichotomies and the spinulose denticles into which the nerves are produced, I have added a somewhat diagrammatic line drawing. The nerves occur to the number of 10 to 13 in each half centimeter.

Associated with *Plagiozamites Planchardi* in Europe are two species of Pteridosperms—*Linopteris Germari* (Geibel) Potonié and *Odontopteris genuina* Grand'Eury—which I believe do not anywhere range lower‡ and it is a matter of considerable interest to know that these three species are likewise found associated in Maryland.

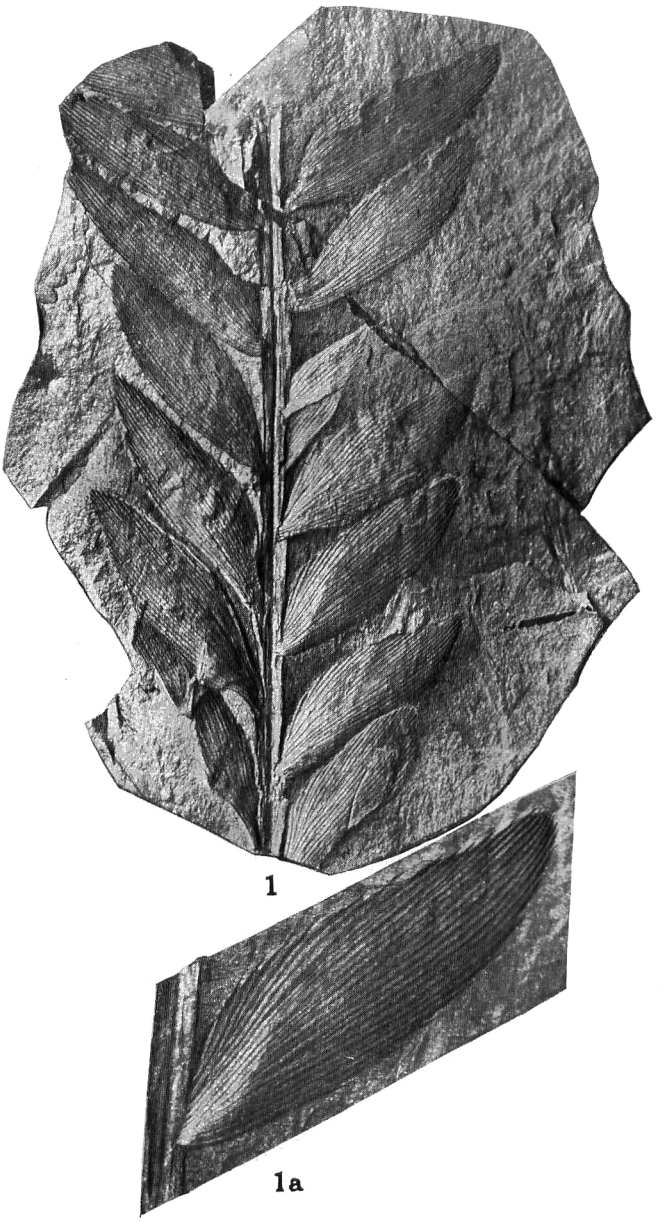
If we are not yet prepared to correlate the beds of the middle Conemaugh of the Appalachian basin with the Permo-Carboniferous of Europe, then the horizon which has yielded the plant here considered is lower than any other from which zamitoid cycadophytean fronds have yet been collected. The

* Sterzel, 1899, Flora des Rothl. von Oppenau, Mitth. d. grossherz. Badisch. Geol. Landesanst., Bd. 3, p. 340 et seq., also Sterzel, 1893, Flora d. Rothl. in Plauenschen Grunde bei Dresden; Abhandl. k. Sächs. Gesell. Wiss., vol. xix, pp. 157, 159.

† Potonié, 1893, Die Flora des Rothl. von Thüringen; Abh. kgl. Preuss. Geol. Landesanst., neue Folge, Heft 9, Theil ii, p. 224.

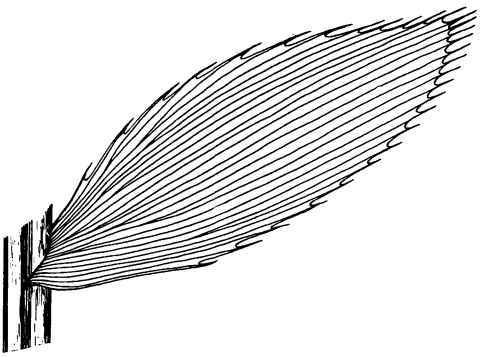
‡ To the species *Odontopteris genuina* Grand'Eury I would assign only material the pinnules of the more distal pinnae of which are obliquely ovate-triangular in shape with the upper margin straight or slightly concave, thus excluding the plant figured under this name by Kidston in 1901, in Flora Carb. Period. Proc. Yorksh. Geol. and Polytech. Soc., vol. xiv, pt. ii, pl. xxviii, fig. 1, from the Middle Coal Measures of England and that by Potonié in 1904 in Abbild. u. Beschreib., Lief. ii, No. 22, fig. 1, from the Westphalian of the basin of the Saar, forms which appear to have more in common with *Odontopterisbrittanica* Gutbier.

FIG. 1.



present known distribution of Paleozoic cycadophytean remains, the nature of which is reasonably above suspicion, may prove of interest in this connection. This material gives representation to three genera—the zamitoid genera *Plagiozamites*, confined to the Paleozoic, and *Sphenozamites* which ranges from the Permian to the top of the Jurassic, and the encephalartoid genus *Pterophyllum* which ranges from the Westphalian (Carboniferous) to the Wealden (Cretaceous), but is most extensively developed in the Keuper (Triassic).

FIG. 2.



In addition to *Plagiozamites Planchardi* there are five other described and figured species of this genus.* *Plagiozamites carbonarius* (Renault) Zeiller occurs in the Permo-Carboniferous, at the Tranchée de Forêt in the Commentry Basin and in the Lower Rothliegenden (Gehrener Schichten) at Stockheim in Thuringia,† while *P. minieri* Renault sp., *P. acicularis* Renault sp., *P. regularis* Renault sp., and *P. Saportanus* Renault sp. have not yet been reported outside of the Commentry Basin, where they also occur in the Permo-Carboniferous at Tranchée de Forêt.‡

The single Paleozoic representative of the genus *Sphenozamites* is *S. Rochei* Renault§ from the (Lower Permian) Autunian shales at Lally in the coal basin of Autun in France;

* In Erläut. z. geol. Specialkarte d. k. Sachs. Sect. Zwickau 1901, p. 135, in a list of the more important Middle Rothliegenden plants of Saxony, Sterzel gives *Plagiozamites Liebeanus* which in Pal. char. d. ober Steink. u. Rothl. im erzgeb. Beck (Ber. d. nat. Ges. z. Chemnitz) 1881, he had described, without figure, as *Cordaites Liebeanus* from the lower tuff in Helene-Schachte near Ölsnitz in Saxony.

† Potonie, 1893, loc. cit. p. 210, pl. xxix, fig. 5.

‡ Renault 1890, loc. cit., p. 614–618, pl. lxvii, figs. 7–19.

§ Renault, 1896, Flore foss. bass. houill et perm d'Autun et d'Epinac, p. 327, pl. 81, fig. 1.

Pterophyllum, on the other hand, is well represented, with *P. cottæanum* Gutbier from the Lebacher Schichten (Middle Rothliegenden) at Reinsdorf near Zwickau, Saxony,* from the lower Porphyrtuffe (Middle Rothliegenden) at Bernsdorf near Chemnitz, Saxony† and from the Lower Permian (Middle-Rothliegenden) at Zbeschau near Rossitz, Moravia,‡ *P. blechnoides* Sandberger, from the Middle Rothliegenden at Holzplatz near Oppenau in the Black Forest of Baden,§ and from the Middle Rothliegenden at Weissig near Pilnitz, Saxony;‖ *P. Fayoli* Renault, from the Permo-Carboniferous at the Tranchée de Pochin in the small coal basin of Montvicq a short distance northeast of Commentry, France;¶ *P. Grand Euryi* Saporta et Marion, from the 'upper zone' (Permo-Carboniferous) at the mines of Montchanin and Montmaillot in the Blanzy Basin, France;** *P. Cambrayi* Renault from the Upper Autunian shales immediately overlying the Boghead of Thèlot in the Basin of Autun;†† *P. inflexum* Eichwald, from the indurated red slate at Socolowa near Afonino in the coal basin of Kouznetzk which lies in the central part of the province of Tomsk, on the northern slope of the Altai Mts., Siberia,‡‡ and from the red slates in the valley of the Inia River in the same region§§—both Permian‖‖ of what has been called the northern type—and finally the unique occurrence of an unnamed species of *Pterophyllum* from the Transition Coal Measures (Westphalian) at Barfreston in the Kent Coal-field of Great Britain reported in 1912 by Prof. E. A. N. Arber,¶¶ which marks the earliest occurrence thus far recorded of the plant group here considered.

Geological Laboratory,
Johns Hopkins University,
March 31, 1916.

* Gutbier, 1849, Die Versteinerungen d. Rothlieg. in Sachs., p. 21, pl. vii, fig. 7.

† Sterzel, 1907, Mitth. d. grossherz. Bad. Geol. Landesanst., Bd. v, p. 380.

‡ Hofmann u. Ryba, 1899, Leitpflanzen, p. 103, pl. xx, fig. 3.

§ Sandberger, 1864, Flor. d. ober Steinkohl. im bad. Schwarzwald, p. 34, pl. ii, figs. 1–4.

‖ Geinitz, E., 1873, Brandschiefer von Weissig, p. 701, pl. iii, fig. 9, including *P. cottæanus* E. Geinitz (non Gutbier), p. 701, (excl. syn.) pl. iii, fig. 8.

¶ Renault, 1890, loc. cit., p. 619, pl. lxviii, fig. 1.

** Zeiller, 1906, loc. cit., p. 194, pl. xlvii, fig. 1.

†† Renault, 1896, loc. cit., p. 322, text fig. 64.

‡‡ Eichwald, 1860, Lethæa Rossica, vol. i, p. 215, pl. xv, figs. 5, 6.

§§ Geinitz, 1871, in Cotta's Der Altai, p. 172, pl. iii, fig. 7.

‖‖ Zeiller, 1902, Nouv. observ. sur la flore foss. d. bass. de Kousnetzk; Compt. rend., t. cxxxiv, p. 887.

¶¶ Arber, 1912, Geol. Mag., Dec. v, vol. ix, p. 98, pl. v, figs. 2, 4.