The Description and Stratigraphic Relationships of Fossil Plants From the Lower Pennsylvanian Rocks of Indiana.

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The outcrop of the Lower Pennsylvanian rocks in Indiana extends in a belt of varying width in an east-of-south direction from Warren County on the north to the Ohio river in Perry and Crawford counties on the south. The outcrop in a few places is almost twenty miles in width although the usual width is very much less. For the most part the rocks of this area are made up of a series that vary greatly in lithologic characteristics both horizontally and vertically. In places the formation consists of a massive sandstone ranging in texture from rather coarse conglomerate to the fine-grained Hindostan whetrock of Orange county. In other localities interbedded sandstones and shales make up the formation. Locally coal beds occur and in a few places iron ore is found at or near the base of the series. The series lies unconformably on Mississippian limestone, shale or sandstone. The great similarity of the Upper Mississippian (Chester) shales and sandstones to the shales and sandstones of the Lower Pennsylvanian has made the separation of those two systems a difficult matter, especially when stratigraphic evidence alone has been employed. This series of rocks is overlain by the shales, sandstones or limestones of the Allegheny formation. Ashley[1] considered that the boundary between the Pottsville and Allegheny series in Parke county is found to come between the two Minshall coals, apparently about the top of the limestones between the two coals.

The series of rocks briefly described in the foregoing paragraph is the "Millstone grit" of the early geologists and the "Conglomerate" and "Conglomorate sandstones" referred to in the earlier State Reports. Hopkins in his report on "The Carboniferous Sandstones of Western Indiana,"[2] proposed the term "Mansfield Sandstone" for the series. Later Ashley placed the series in what he designated "Division I." He retained the term "Mansfield sandstone" for the massive bed or beds of sandstone that occur locally in the series.[3] As the fossils obtained from these rocks show that the rocks are of the Pottsville age there is no good reason why that name should not be applied as suggested by Ashley.[4]

The Pennsylvanian rocks that occur within the area included in the Bloomington Quadrangle represent in part the Pottsville or Ashley's "Division

[1] 33rd An. Rep. Ind. Dept. Geol. and Nat. Res. p. 58, 1908.
[2] 20th An. Rep. Ind. Dep. Geol. and Nat. Res. 1895.
[3] 23rd An. Rep. Ind. Dep. Geol. and Nat. Res. p. 95, 1896.
[4] 33rd An. Rep. Ind. Dep. Geol. and Nat. Res. p. 58, 1908.

I." Geographically they occupy a position somewhat south of the center of the eastern outcrop of the Pennsylvanian in Indiana. The stratigraphy of these rocks within the Quadrangle has already been published.[5]

The fossil plants collected in the Bloomington Quadrangle were obtained principally from two localities: (1) From a shale bed about one fourth mile southeast of the Yoho School, in the northwest quarter of section 8, T. 7 N, R 2 W; and (2) From a ferruginous sandstone layer along the east side of the road, about one fourth of a mile southeast of Cincinnati, in section 27, T 7 N, R 3 W. A provisional list of fossils from those localities has previously been published.[6] A more critical study of a better collection from the former locality has slightly modified and increased the number of species of the provisional list.

The fossil plants found at the Yoho school locality are as follows:

Sphenophyllum cuneifolium (Stb.) Zeiller.
Sphenophyllum tenue D. W.
Lepidodendron yohoense n. sp.
Lepidodendron obovatum Sternb.
Lepidodendron clypeatum Lx.
Sphenopteris inequilateralis Lx.
Sphenopteris communis Lx.
Mariopteris decipiens Lx.
Mariopteris muricata Schloth.
Pecopteris plumosa Artis.
Pecopteris sp. indet.
Pseudopecopteris cf. macilenta L. and H.
Pseudopecopteris dimorpha Lesq.
Neuropteris cf. Elrodi Lx.
Neuropteris Jenneyi D. W.
Alethopteris grandifolia Newb.
Alethopteris Evansi Lx.
Alethopteris sp. indet.
Callipteridium cf. traeyanum Lx. MMS.
Callipteridium sp. indet.
Odontopteris Newberryi Lx.
Cordaites Robbii Dn.
Cardiocarpon annulatum Newb.
Cardiocarpon pachytestum Lx.
Cardiocarpon rugosum n. sp.
Cardiocarpon ovoideum n. sp.
Cardiocarpon sp. indet.
Trigonocarpum cf. Schultzianum Goepp. and Berg.
Rhabdocarpon sp. indet.

[5] 39th An. Rep. Ind. Dep. Geol. and Nat. Res. pp. 223–229, 1914. The Geologic map of the Quadrangle is given in the same volume.
[6] Proc. Ind. Acad. Sci. pp. 395–398. 1914.

While a few of those plants have a rather extensive vertical range, by far the greater number of them are plants that are confined to the Pottsville, among which may be mentioned *Sphenophyllum cuneifolium*, *S. tenue*, *Sphenenopteris inequilateralis*, *S. communis*, *Mariopteris decipiens*, *M. muricata*, *Neuropteris Elrodi*, *Alethopteris Evansii*, *A. grandifolia*, *Odontopteris Newberryi*, *Cardiocarpon annulatum*, *and C. pachytestum*, forms that are characteristic of the upper part of the Middle Pottsville of the type section or of horizons in Ohio (Sharon coal?), Tennessee (Sewanee coal), Arkansas ("the coal bearing shales"), and West Virginia (Sewell) that are approximately of the same age.[7] From the evidence of the fossils it would appear that the Pennsylvanian as represented in the Yoho School locality would fall somewhere in the upper part of the middle Pottsville.

Plants found at the Cincinnati locality are as follows:

Calamites Suckowi Brongn.
Lepidodendron clypeatum Lx.
Cardiocarpon bicuspidatum? (Sternb.) Newb.
Trigonicarpum ovatum n. sp.
Trigonocarpum hexagonale n. sp.
Trigonocarpum hexacostatum n. sp.

Definite correlation cannot be drawn from the meager flora from this locality. *C. Suckowi* and *L. clypeatum* have an extensive vertical range and the range of the three new species of Trigonocarpum is not known. *G. bicuspidatum* would indicate an age somewhat near that of the Yoho School locality.

The Clay City Quadrangle includes parts of Owen, Clay and Putnam counties. The fossil plants obtained from this Quadrangle were all found in the northeastern quarter of the Quadrangle and immediate vicinity. Plants were obtained from the following localities: (1) From a "black jack" layer over a thin coal in the creek bank, near the section line between sections 18 and 19, T 11 N, R 5 W, about one half mile east of Bowling Green; (2) From shales overlying the Lower Block Coal in a drift mine in a ravine, on the east side of the road, two miles north of the Roadman School, in the southwest corner of section 1, T 12 N, R 6 W; (3) From a sandstone overlying the horizon of the Lower Block Coal, in the creek about one fourth mile north of Liberty School, in the north central part of section 31, T 12 N, R 5 W; (4) From the fire clay under the Upper Block Coal, in the creek bank, about one fourth mile northwest of Asherville, in section 15, T 12 N, R 6 W; (5) From hard sandy shales over the Lower Block Coal at Schroepferman's mine, in the east part of section 4, T 12 N, R 6 W; (6) From shales over the Upper Block Coal at Baird's mine, in the east part of section 5, T 12 N, R 6 W; (7) From a plant-bearing sandstone in the Pennsylvanian, about one

[7] 20th An. Rep. U. S. G. S. Part II, pp. 816–817, 1900.

and one-half miles southwest of Reelsville. The fossils from the three last mentioned localities are too fragmentary to be of much value.

The following species of plants were found at the Bowling Green locality:

Lepidodendron obovatum? Sternb.
Lepidodendon aculeatum Sternb.
Alethopteris Serlii (Brongn.) Goepp.
Sigillaria elegans? Sternb.
Cordiates Robbii Dn. Daws.
Cardiocarpon bicuspidatum? (Sternb.) Newb.
Cardiocarpon cf. circulare Lx.

These fossils were obtained from "Coal A" of Cox. This coal rises rapidly to the eastward and unites with "Coal B" of Cox[8] about fifty yards up the creek. Both coals are overlain by massive sandstones. Detailed stratigraphic work has not yet been completed in that part of the Quadrangle so that the relation of those two coals to the two Block Coals farther west is not definitely known. It is interesting, however, that the fossils from the Lower Block Coal at the Roadman School locality represent almost exactly the same flora, which is given below:

Lepidodendron obovatum Sternb.
Lepidodendron aculeatum Sternb.
Althopteris Serlii (Brongn.) Goepp.
Sigillaria elegans? Sternb.
Cordaites Robii Dn.
Cardiocarpon bicuspidatum (Sternb.) Newb.
Cardiocarpon subcirculare n. sp.

The following species were found in the Liberty School locality.

Calamites Suckowi Brongn.
Sphenophyllum cuneifolium (Sternb.) Zeiller.
Pseudopecopteris obtusiloba (Brongn.) Lx.
Cardiocarpon annulatum Newb.
Pecopteris sp. indet.

The above named plants are also from a horizon representing Ashley's[9] Coal I and "Coal A" (or "Coal B") of Cox.[10] From somewhat detailed field work this horizon is believed to be the same, or very nearly the same, as that of the Lower Block Coal.

The plants from the shales overlying the Lower Block Coal at Schroepferman's mine were insufficient to cast much light on the age of that horizon.

[8] Cox, E. T., 1st. Rep. Geol. Surv. Ind. p. 24, 1869.
[9] Ashley, Geo. H., 23rd An. Rep. Ind. Dep. Geol. and Nat. Res., 1898.
[10] Cox, E. T., 1st. Geol. Surv. Ind., 1869. See also the map accompanying the 7th Am. Rep. Geol. Sur. Ind., 1876.

The fossils from the horizon of the Lower Block Coal at Bowling Green, Roadman School and Liberty School localities, although insufficient for definite correlation with the Pottsville in the type locality, very likely represent a horizon somewhere in the lower half of the Upper Pottsville.

The plants from the Asherville locality, with a single exception, are from the fire clay under the Upper Block Coal, and are as follows:

Sphenophyllum cuneifolium (Sternb.) Zeiller.
Lepidodendron obovatum Sternb.
Lepidodendron aculeatum Sternb.
Pecopteris cf. abbreviata Brongn.
Cardiocarpon obtusum n. sp.
Cardiocarpon cordatum n. sp.
Cardiocarpon communis n. sp.
Cardiocarpon irregulare n. sp.
Cardiocarpon cuneatum n. sp.
Cardiocarpon gracile n. sp.

Of the above species *Sphenophyllum cuneifolium* is the only plant that has much value as a horizon marker. This species was represented by the rigid, coarse veined variety, characteristic of the upper Pottsville[11] and was obtained from a thin layer of ferrugineous concretions just above the Upper Block Coal.

Only three species of plants were found in the shales overlying the Upper Block Coal at Baird's mine, the following forms being represented:

Cordaites Robbii? Dn.
Cordaianthus sp. indet.
Cardiocarpon acuminatum n. sp.

These forms are of very little value in determining the age of the horizon from which they were obtained.

The few fragments of plants from the Reelsville locality are insufficient for correlating that horizon with the Pottsville of other localities.

[11] White, D., 20th An. Rep. U. S. G. S. Part II. p. 899, 1900.

Notes on the Previously Known Species and Descriptions of New Species from the Lower Pennsylvanian Rocks of Indiana.

EQUISETALES.

Genus *Calamites* Suckow.
Calamites Suckowi Brongn

Plate VIII, fig. 8.

1828. *Calamites Suckowi*, Brongniart, Hist. veg. foss., p. 124, pl. XIV, fig. 6; pl. XV, figs. 1–6; pl. XVI.

1886. *Calamites Suckowi* Brongn. Zeiller, Bassin houil. de Valenc., Atlas, Pl. LV, fig. 1. Text (1888), pp. 333–338.

1914. *Calamites Suckowi* Brongn. Stopes, M. C., The "Fern Ledges" Carboniferous Flora of St. John, New Brunswick. Memoir 41, Canadian Geol. Survey, Pl. 11, pp. 15–16.

The specimens in hand seem to agree closely with forms previously assigned to this species. The form figured is from the Liberty School locality and seems to have ribs a little less in width than the forms from New Brunswick[1] and Europe.[2] Representatives of this species were also found at the Cincinnati locality.

SPHENOPHYLLALES

Genus *Sphenophyllum* Brongniart
Sphenophyllum tenue D. W.

Plate I, Fig. 1

1900. *Spenophyllum tenue* White, David, The Stratigraphic Succession of the Fossil Flora of the Southern Anthracite Coal Field, Pennsylvania, U. S. G. S., 20th Ann. Rep. Part II, pp. 900–901, Pl. CXCI, Figs. 6–7.

The stems, so far as could be determined, were rather slender and moderately well ribbed. The leaves were eight millimeters to one centimeter in width and about one and one-half centimeters in length, crenulate-denticulate, broadly cuneate, usually slightly rounded at the apex, semi-translucent, with slender, elongated bases. The single primary nerve is prominent for some distance upwards from the base, forks four to six times at a narrow angle, thus providing a nervule for each tooth.

The specimens in hand seem to agree rather closely with the forms described from the type locality.[3] They appear to differ somewhat in that the leaves are a little shorter in the narrow basal part, are slightly more cuneate, and have heavier lamina. The latter difference can well be due to the large

[1] Stopes' paper above cited.
[2] Zeiller's works above cited.
[3] White, cited above.

amount of iron present and not to a difference in structure. This species was not abundant, single, detached leaves usually being found. A whorl of five leaves is shown in Plate I, Fig. 1. Locality: Yoho School.

Sphenophyllum cuneifolium (Sternb.) Zeiller.
Pl. I, figs, 2, 3, 6; Pl. II, fig. 3.

1823. *Rotularia cunefolium* (Sternb.) Versuch, Fasc. 2, p. 33, Pl. XXVI, Figs. 4a, 4b.

1886. *Sphenophyllum cuneifolium* (Sternb.) Zeiller, Fl. foss. Bas. houill. Valencienne, Atlas, Pl. LXIII, Figs. 1, 3, 6, 7, 9, Text, (1888), p. 414.

1899. *Sphenophyllum cuneifolium* (Sternb.) Zeill. White, David, Fossil Flora of the Lower Coal Measures of Missouri. U. S. G. S. Mon. 37, pp. 174–177.

1900. *Sphenophyllum cuneifolium* (Sternb.) White, David, The Strat. Succ. Foss. Flora S. Anthracite Coal Field, Pa. U. S. G. S. 20th Ann. Rep. Part 2, pp. 889–890.

1908. *Sphenophyllum cuneifolium* (Sternb.) Zeill. Sellards, E. H. Foss. Plants Upper Pal. of Kans. Univ. Geol. Surv. Kans., Vol. IX, p. 426, Pl. LII, Fig. 4,

This species was represented by two forms: (1) a form in which the leaves are deeply dissected and (2) a form in which the leaves are not dissected. The former type of leaf is narrow, with elongated, sharp teeth. The bifurcation of the nerves occurs near the base. In pl. I, fig. 3 and in pl. II, fig. 3, are shown leaves of this type. In the latter figure the dissection extends almost to the base of the leaf. The other type of leaf is seven to ten mm. in length and two mm. in width, slender, elongated and a little less cuneate than the European form. The nervation arises from two nerves which fork once near the base, either or both again dividing near the middle of the leaf and sending veins to the four elongated, sharply-pointed teeth.

Localities: Both types of leaf are common in the Yoho School locality. The dissected variety only was found in the Liberty School locality. The form with the leaves not dissected was found in concretions above the Upper Block Coal at Asherville.

LYCOPODALES

Genus *Lepidodendron* Sternburg.
Lepidodendron Yohoense n. sp.

Pl. V. Fig. 6

Bolsters comparatively large, broadly lanceolate in shape, marked by fine transerse wrinkles throughout their entire length; elongated and acuminate in opposite directions at the ends; separated by a prominent ridge marked by fine transerse wrinkles; inside scar a little above the center, rhomboidal, transersely elongated and slightly rounded above; vascular

scar and parichnos prominent in lower part of scar; ligular pit obsure; appendages rather large and prominent.

This tree appears to belong to a group of *Lepidodendra* with nominally transersely wrinkled bolsters to which belong *L. Brittsii* and *L. Wortheni* and possibly *L. Choctawense*. It differs from those species in that the wrinkles appear to be more pronounced, the subjacent lateral appendages are present, the bolsters are more sharply pointed and the leaf scars are proportionaally smaller.

Locality: Yoho School. Rather common.

Lepidodendron oboratum Sternb.

Plate VII. fig. 7; Pl. VIII, figs. 1, 6; Pl. IX, fig. 15.

1820. *Lepidodendron oboratum* Sternburg, Ess. Fl. monde prim., I. fasc. 1, pp. 21–25, pl. VI, fig. 1; Pl. VIII, fig. 1a, 1b; fasc. 4, p. x. Renault, Cours. bot. foss., II, p. 13, pl. VI, fig. 5.

1879. *Lepidodendron dichotomum*. Lx. (non Sternb.), Coal Flora, Atlas, pl. LXIV, fig. 3, text, pp. 384–385.

1886. *Lepidodendron obovatum* Sternburg. Zeiller, Bassin houiller de Valencien. Atlas, pl. LXVI, figs. 1a. 8, text (1888), pp. 442–446.

The majority of the forms assigned to this species were in a poor state of preservation, being in most instances considerably distorted or decorticated. The plant shown in pl. VI, fig. 17, is possibly a better representation of the species than those from other localities.

Localities: Yoho School, Bowling Green, Roadman School and Asherville.

Lepidodendron clypeatum Lx.

Pl. V, fig. 7; pl. VI, fig. 15.

1854. *Lepidodendron clypeatum* Lesquereux. Jour. Bost. Soc. Nat. Hist., Vol. VI, p. 429.

1879. *Lepidodendron clypeatum* Lx., Coal Flora, Atlas, p. 12, pl. LXIV, figs. 16, 16a, 16b; text, Vol. II (1880), p. 380.

1899. *Lepidodendron clypeatum* Lx., White, D., Fossil Flora of the Lower Coal Measures of Missouri, U. S. G. S. Monograph Vol. 37, p. 201.

This species was common in both the Yoho School and Cincinnati localities. The form figured from the former locality has bolsters with sides more nearly equilateral than the Pennsylvania plants described and figured by Lesquereux. The appendages are also a little larger than in the Pennsylvania forms. The form of the bolsters of the plant shown in Pl. VI, fig. 15, more closely resembles the Pennsylvania forms. The latter specimen is a sandstone mold; consequently the characteristic markings of the species are more or less obliterated.

Localities: Yoho School, Cincinnati.

Lepidodendron aculeatum Sternb.

Plate VIII, Fig. 2; Pl. IX, fig. 14.

1820. *Lepidodendron aculeatum* Sternburg, Ess. fl. Monde Prim., I, Fasc. 1, pp. 21–25; pl. VI, fig. 2.

1880. *Lepidodendron aculeatum* Sternburg, Lesquereux, Coal Flora, Atlas (1879), Plate LXIV, Fig. 1. Text, pp. 371–372.

1886. *Lepidodendron aculeatum* Sternburg, Zeiller, Bassin houiller de Valenciennes. Atlas, Plate LXV, Figs. 1–7. Text (1888) pp. 435–441.

This species closely agrees with the European forms figured and described by Zeiller. The fine, longitudinal wrinkles on the ridges separating the bolsters are however not figured as appearing on the European forms. The bolsters are a little wider than those figured by Lesquereux from Pennsylvania.[4]

Locality: Lower Block Coal east of Bowling Green, Asherville and north of the Roadman school. A form doubtfully referred to this species was also found in the Yoho School locality.

Genus *Sigillaria* Sternburg

Sigillaria elegans? Sternburg

Pl. VII, Fig. 8; Pl. VIII, Fig. 7.

The extremely poor state of preservation of these plants makes their determination uncertain. The form shown in pl. VII, fig. 8, appears to possess some of the characteristics of *S. tassellata*. The unusual length of the parichnos in the form shown in pl. VIII, fig. 7, may be due to the conditions of fossilization.

Localities: The species figured in pl. VIII, fig. 7, is from the Roadman school; the form shown in pl. VII, fig. 8, is from Bowling Green.

[4] Coal Flora, Atlas, pl. LXIV, fig. 1.

FILICALES AND PTERIDOSPERMALES

Genus *Sphenopteris* Brongniart

Sphenopteris communis Lx.

Pl. I, Figs. 4, 5 and 7.

1884. *Sphenopteris communis* Lesquereux, Coal Flora, Vol. III, p. 762, pl. CIV, figs. 1, 1a.

The fossils referred to this species agree closely with the forms described by Lesquereux as *S. communis*. This specimen is interesting in that it is fertile. Figs. 5 and 7 show the reduced lamina and small, quadrivalvate, cupular fructifications, probably belonging to the genus *Zeilleria*, attached to the ends of the principal nerves. Those details are better indicated in the enlarged text figure.

Fig 1. Part of fruiting frond of Sphenopteris communis (x3½)

Sphenopteris cf. *inequilateralis* Lx.

Pl. II, figs. 6, 7.

A few fragments of a plant comparable with *S. inequilateralis* were found in the Yoho School district. Those fragments agree rather closely with

Arkansas fossils described and figured by Lesquereux. A slight difference is noted, however, in that the pinnules are a little more deeply lobed and more blunt than in Lesquereux's figures.[5]

Locality: Yoho School.

Genus *Mariopteris* Zeiller

Mariopteris muricata Schlotheim

Pl. II. Fig. 2.

1880. *Pseudopecopteris muricata* Brongn. Lesquereux, Coal Flora, Vol. I, p. 203, pl. XXXVII, fig. 2.

1886. *Mariopteris muricata* (Schlotheim). Zeiller, Bassin houiller de Valenciennes. Description de la Flora Fossile. Atlas, pl. XX, fig. 1–4; pl. XXI, fig. 1; pl. XXII, figs. 1, 2; pl. XXIII, fig. 1; Text, (1888) p. 173.

The plant shown in pl. II, fig. 2, agrees very closely with the European form figured by Zeiller[6] as *M. muricata* Sch. var. *hirta* Stur.

Locality: Yoho School.

Mariopteris decipiens Lx.

Pl. IV, fig. 7; Pl. V, fig. 4.

1860. *Sphenopteris dilatata* Lesquereux, 2nd. Rept. Geol. Surv. Ark. pp. 310–315, pl. II, figs. 3, 3a.

1879. *Pseudopecopteris decipiens* Lesquereux, Coal Flora, Atlas, Pl. LII, figs. 9?, 10, 10a, text (1880), p. 214.

1895. *Mariopteris* (*Pseudopecopteris*) *decipiens* Lx. White, David, Flora of the Outlying Carboniferous Coal Basins of Southwestern Missouri, Bul. 98, U. S. G. S., p. 47, pl. I, figs. 5-8, 5a; pl. II, figs. 1-3, 3a.

This species was represented principally by detached pinules. Those fragmentary specimens have pinules that differ slightly in shape from the Missouri forms in that they are more restricted at the base and have a greater number of lobes. They closely resemble the Arkansas[7] forms figured by Lesquereux. The form shown in Pl. IV, fig. 7, is close to the Pennsylvania forms.[8]

Locality: Yoho School.

Coal Flora, Vol. III, Pl. 765, p. C111, figs. 4–5a.

[6] Basin Houiller de Valenciennes, Flore Fossile, Atlas, pl. XX, fig. 4.

[7] 2nd Geol. Surv. Ark., Pl. II, figs. 3, 3a.

[8] Coal Flora, p. 214, Atlas, pl. LII, figs. 9? 10, 10a.

Genus *Pseudopecopteris* Lesquereux

Pseudopecopteris obtusiloba (Brongn.) Lx.

Plate IX, figs. 2 and 7.

1829. *Sphenopteris obtusiloba* Brongniart, Hist. Veg. Foss., p. 201, pl. LIII, fig. 2.
1884. *Pseudopecopteris obtusiloba* (Brongn.) Lesquereux, Coal Flora, Vol. III. p. 753.
1886. *Sphenopteris obtusiloba* Brongn. Zeiller, Fl. Foss. houill. Valenc. Atlas, pl. III, figs. 1–4; pl. IV, fig. 1; pl. V, figs. 1–2, text (1888), p. 65.
1893. *Sphenopteris* (*Pseudopecopteris*) *obtusiloba* Brongn. D. White, Bull. U. S. G. S., No. 98, p. 52.
1899. *Sphenopteris obtusiloba* (Brongn). Lx. D. White, Mon. U. S. G. S., Vol. 37, p. 24, pl. VII, Figs, 1–3; Pl. VIII.

This plant occurred in a hard, porous sandstone, the cementing material of which was principally silica, with a very small per cent of iron; consequently the diagnostic details of the fossils were not well preserved. The plants shown in figs. 2 and 7 agree closely with *P. obtusiloba* from Missouri.[9]

Locality: Liberty School.

Pseudopecopteris cf. *dimorpha* Lx.

Pl. II, figs. 1b?, 4? and 5.

The plant shown in fig. 5, pl. II, is very close to the plant described by Lesquereux as *Pseudopecopteris dimorpha*. Figs. 1b and 4 may represent *P. macilenta*,[10] the material being so fragmentary that determination is uncertain.

Locality: Yoho School.

Genus *Pecopteris* Brongniart

Pecopteris plumosa Artis

Pl. IV, figs. 3, 5 and 6.

1825. *Filicites plumosa*. Artis, Antediluvian Phytology, p. 17, pl. XVII.
1828. *Pecopteris plumosa* Brongniart, Hist. veg. foss., p. 348., pl. CXXI, CXXII.
1871. *Pecopteris* (*Aspidites?*) *serrulata* Hartt in Dawson, Foss. Devon. Upp. Silur, Canada, Geol. Surv. Rep., p. 55, pl. XVIII, figs. 207–209.
1888. *Pecopteris* (*Dactylotheca*) *dentata* Brongn. Zeiller, Flor. Foss. houill. Valenc., p. 6, Atlas, (1886) pl. XXVI-XXVIII.
1914. *Pecopteris plumosa* Artis. Stopes, M. C., Memoir 41, Geol. Surv. Canada, p. 44, pl. XII, figs. 27, 28, 29, and text fig. 7.

[9] U. S. G. S. Mon. Vol. 37, p. 24; Bull. U. S. G. S. No. 98, p. 52.
[10] Coal Flora, Vol. III, p. 750, pl. CXVIII, figs. 4, 4a.

The specimens representing this species appear to be the same as the Canadian form, *P. serrulata* of Hartt,[11] and Zeiller's European form, *P. dantata*. There seems also to be no essential difference between the plants studied and the forms described and figured by Brongniart as P. plumosa.

Locality: Yoho School.

Pecopteris sp.

Pl. II, fig. 8.

Detached pinnae of a rather delicate Pecopterid plant comparable with *P. Miltoni* were found at the Yoho School locality. The diagnostic features of those fossils are too obscure for definite determination.

Pecopteris cf. *abbreviata* Brongn.

Pl. IX, figs. 11, 12 and 13?.

A few poorly preserved fragmentary plants are doubtfully referred to this species. The shape and size of the pinnules agree rather closely with forms figured by Zeiller.[12]

Locality: Fire clay under the Upper Block Coal, Asherville.

Undermined *Pecopteris* Species

A few imperfectly preserved, fragmentary Pecopterid forms are figured in plates VI, IX and X. Fig. 13, pl. VI, represents a plant from the Reelsville locality; fig. 1, pl. IX, a plant from the Liberty school locality; figs. 5 and 6, pl. IX, are of fossils from Schroepferman's mine; fig. 2, pl. X, is a plant from the fire clay under the Upper Block Coal, Asherville.

Genus *Neuropteris* Brongniart.

Neuropteris Elrodi Lx.

Pl. V, fig. 2.

1879. *Neuropteris Elrodi* Lesquereux, Coal Flora, Atlas, pl. XII, fig. 4' text (1880), p. 107.

1883. *Neuropteris Elrodi* Lx. 13th, Ann. Rep. Geol. and Nat. Hist. Ind., p. 52, pl. X, fig. 3.

1900. *Neuropteris Elrodi* Lx. White, David, U. S. G. S., 20th Ann. Rept. Part II, p. 782.

The fossils referred to this species closely agree in all essential characteristics with plants from the shales of the Whetstone beds of Indiana.

Locality: Yoho School.

[11] See Stropes' discussion of this species in Memoir 41, Geol. Surv. Canada, pp. 45–46.
[12] Flore Fossile, Atlas, pl. XXIV.

Neuropteris sp.

Pl. III, fig. 4; pl. IV, fig. 1; pl. V, figs. 1 and 3.

Numerous detached cyclopterid pinnules of *Neuropteris Sp.* were found at the Yoho School locality. As none of these pinnules were found in actual connections with the parent plant their determination is uncertain. The form shown in pl. V, figs. 1 and 3, bears a rather close resemblance to the cyclopterid pinnules of *N. Jenneyi* D. W.[13]

Detached pinnules of two other undetermined species of *Pecopteris* are shown in plate IX, fig. 4, and pl. X, fig. 1. The former is from the Asherville locality and the latter is from Schroepferman's mine.

Genus *Alethopteris* Sternburg

Alethopteris grandifolia Newb.

Pl. II, fig. 9, pl. III, fig. 6, Pl. V. fig. 5.

1873. *Alethopteris grandifolia.* Newberry, Geol. Surv. Ohio. Vol. I, Part II, p. 384, pl. XLVIII, figs. 1, 1a and 2.

1900. *Alethopteris grandifolia* Newb. White, D., U. S. G. S., 20th. Ann. Rep. Pt. II, p. 886.

The fragmentary forms in hand representing this species seem to differ in no essential characteristic from the forms described from Ohio except that they are much smaller.

Locality: Yoho School.

Alethopteris sp.

Plate III, figs. 1, 2.

Only two fragments of this form were found. It is very probable that this is an undescribed species but the material is insufficient for determination and description.

Locality: Yoho School.

Alethopteris Evansii Lx.

Plate III, fig. 3.

1884. *Alethopteris Evansii.* Lx., Coal Flora, Vol. III, p. 834.

1900. *Alethopteris Evansii* Lx. White, D., U. S. G. S., 20th Ann. Rep. Part II, p. 887, pl. CXCII, figs. 7, 7a, 8, 8a.

The forms representing this species agreed closely with the forms from the Pottsville region of Pennsylvania. The finely punctuate and rugose nature of the lamina is not well shown in the figure.

Locality: This species was abundant at the Yoho School locality.

[13] Bul. 98, U. S. G. S., Pl. II, fig. 10.

Alethopteris Serlii (Brongn). Goepp.

Pl. VII, figs. 1, 2 and 3

1828. *Pecopteris Serlii.* Brongniart, Histoire des Vegetaux Fossilis, p. 292, pl. LXXXV.
1880. *Alethopteris Serlii.* Brongn. Lx., Coal Flora, Vol. I, p. 176; Atlas (1879) pl. XXIX, figs. 1–5.
1900. *Alethopteris Serlii* (Brongn.) Goepp. White, D., U. S. G. S., 20th Ann. Rep. pl. II, p. 782.

The few fragmentary representatives of this species seem to differ slightly from the normal type in that the pinules are somewhat closer together. There is a very close agreement in the shape of the pinules and in the nervation with the Pennsylvania form described by Lesquereux.

Localities: Bowling Green, and Roadman School.

Genus *Callipteridium* Weiss

Callipteridium sp.

Pl. III, fig. 5; pl. IV, figs. 2, 4.

The plants shown in pl. III, fig. 5, and in pl. IV, figs. 2 and 4 are close to a form described by Lesquereux in MMS. as *C. Tracyanum.*[14]

Locality: Yoho School.

Callipteridium sp.

Pl. III, fig. 7.

This species is closely related to *Callipteridium* cf. *Tracyanum* but has more fleshy pinnules, a less prominent midrib and a greater number of nerves. The material at hand is not sufficient for definite determination.

Locality: Yoho School.

Genus *Odontopteris* Brongniart

Odontopteris Newberri Lx.

Pl. I, fig. 8; Pl. II, fig. 1a.

1873. *Odontopteris neuropteroides* Newberry, Geol. Surv. Ohio, Paleontology, Vol. I, p. 381, pl. 47, figs. 1–3.
1880. *Odontopteris Newberryi* Lesquereux, Coal Flora, Vol. I., p. 127.

The plant shown in plate I, fig. 8, agrees closely in all essential characteristics with the Ohio forms described by Newberry. The form shown in pl. II, fig. 1a, is doubtfully referred to *O. Newberryi.* It may represent a closely related species.

Locality: Yoho School.

[14] Private communication from David White.

Genus *Trigonocarpum* Brongniart

Trigonocarpum ovatum n. sp.

Pl. VI, figs. 6a, 6b.

Nutlet oval, slightly truncate at base, pointed at apex, broadly oval to nearly round in cross section, 6–7 mm. in diameter, 12–13 mm. long, marked from base to apex by three prominent ribs at an equal distance apart, base marked by a round depression 3 mm. in diameter.

Locality: Cincinnati.

Trigonocarpum sp.

Four other Trigonocarpum forms are shown in Pl. VI, figs. 9a–9b, 10, 11 and 12. Those forms were so imperfectly preserved that their determination was too doubtful to be of value. The forms shown in figs. 9a-9b and 10 have three ribs; and the forms shown in figs. 11 and 12 are hexagonal in cross section.

Locality: Cincinnati.

Trigonocarpum cf. *Schultzianum* Goep. and Berg.

Plate VI, fig. 7.

This species, although somewhat smaller, appears to agree closely with Kansas forms described by Sellards.[15]

Locality: Yoho School.

Trigonocarpum hexagonale n. sp.

Plate VI, figs. 5a, 5b.

Nut ovoid in outline, pointed at apex, much truncated at base, about 1.5 centimeters long, 8 mm. in diameter, hexagonal in cross section, with six prominent ridges from base to summit; base marked by round depression 3 mm. in diameter and by 6 faint lines extending from the depression to the six angles formed by the six sides.

Locality: Cincinnati.

Trigonocarpum hexacostatum n. sp.

Plate VI, figs. 4a–4b.

Nutlet broadly oval in outline, wedge shaped at apex, truncated at base, hexagonal in cross section, 5 mm. in diameter, 7 mm. long, marked by six rather prominent ridges from base to summit; base 3 mm. in diameter, marked by a small depression and six rather faint lines from the depression to angles of the hexagonal base.

Locality: Cincinnati.

[15] Sellards, E. H., Univ. Geol. Surve. Ks., Vol. IX, p. 428, Pl. LII, fig. 1; Pl. LVIII, fig. 3, 1908.

Cordaianthus sp.

Pl. IX, fig. 8.

A plant probably belonging to the genus *Cordaianthus* was found in the shales overlying the Upper Block Coal at Baird's mine. The specimen was so poorly preserved that specific determination was uncertain.

GYMNOSPERMS

Cordaitales

Genus *Cordaites* Unger

Cordaites Robbii Daw

Pl. VII, fig. 9.

1861. *Cordaites Robbii.* Dawson, Canad. Nat., Vol. 6, p. 168.

1886–1888. *Cordaites brassifolius* Sternb. Zeiller, Bassin Houiller de Valenciennes, p. 625, pl. XCII, figs. 1–6.

1900. *Cordaites Robbii* Daw. White, Foss. Flora Pottsville Form., p. 903.

1914. *Cordaites Robbii* Daw. Stopes, The "Fern Ledges" Carb. Flora of St. John, New Brunswick, p. 82, pl. XIX, fig. 50, and text fig. 16.

The specimen illustrated in pl. VII, fig. 9, is from Bowling Green. It seems to agree closely with forms previously described as *C. brassifolius.*[16] It is also close to, if not the same as *C. communis* although the nervation is more regular than in the Missouri[17] forms of that species. It is very likely the same form described by Stopes as occuring in the Pennsylvanian of New Brunswick.[18] The very fine veins alternating with the coarser ones are not well shown in the figure. They are apparent, however, in a small area near the end of the arrow.

Localities: Yoho School, Bowling Green, Roadman School and Bird's mine (?). The species was common in the two first named locaiitles.

Genus *Cardiocarpon* Brongniart

Cardiocarpon annulatum Newb.

Plate V, fig. 10; Plate VIII, fig. 4.

——.? *Cardiocarpon annulatum.* Newberry. Ann. Sc. of Clevel., l. c.

1873. *Cardiocarpon annulatum* Newb. Geol. Surv. Ohio, Vol. 1, p. 374, pl. 43, Figs. 8–8a.

1879. *Cardiocarpus annulatus.* Lesquereux, Coal Flora, Atlas, Pl. LXXXV, Figs. 36, 37, text (1880), p. 564.

Examples of this species from the Yoko School locality seem to agree in all respects with the forms described by Newberry from the shale over Coal

[16] Compare figures in Zeiller's works listed in above Synonomy.
[17] See discussion of this species in White's paper above cited.
[18] See Memoir of Stopes above cited.

No. 1 at Youngstown, Ohio.[19] A form shown in Pl. VIII, fig. 4, from the Liberty School locality is doubtfully referred to this species.

Locality: A few specimens were found at the Yoho School and Liberty School localities.

Cardiocarpon pachytestum. Lx.

Plate V, fig. 9.

1879. *Cardiocarpus pachytesta.* Lx. Coal Flora, Part II, p. 565.
1884. *Cardiocarpus pachytesta.* Lx. Coal Flora, Part III, p. 809, pl. CIX, figs. 13, 15.

The examples of this species agree closely with the type forms included by Lesquereux in his later description of the species.[20] A slight difference is noted in that the base of the nucleous does not appear to "continue downward in a narrowly lanceolate acuminate appendage or axis of a pedicel." This, however, may be due to the imperfect preservation of the specimens in hand rather than a difference in structure.

Locality: Yoho School.

Cardiocarpon acuminatum n. sp.

Plate IX, fig. 9.

Fruit about 7 mm. wide, 9 mm. long, oval in outline; nucleus 4 mm. wide, 5 mm. long, truncate at base and acutely pointed at apex; wings of uniform width of about 1.5 mm., conforming to the shape of the nucleus, prolonged, narrowed and close together at the apex.

This form very likely belongs to a group of small, wide-winged Cardiocarpon forms represented by *C. late-alatum.*[21]

Locality: Baird's Coal Mine.

Cardiocarpon irregulare n. sp.

Plate X, figs. 7, 8a, 9 and 12.

Fruit cordate to broadly oval in outline, about 5 mm. wide and 6.5 mm. long; nucleus ovate, acutely pointed above, truncate with small depression at base; wings about .5 mm. in width at base and increasing to about 1 mm. in width at the apex and there emarginate.

This species varies somewhat in shape, in size and in the width of the wings at the base. The cordate shape is shown in figs. 7 and 9, pl. X, and the more rounded form in figs. 8a and 12, pl. X.

Locality: Very numerous in the fire clay under the Upper Block Coal at Asherville.

[19] Geol. Sur. Ohio, Pal., vol. 1, p. 374, 1873.
[20] Coal. Flora, III, p. 809, 1884.
[21] Coal Flora, Vol. II, p. 568, Pl. LXXXV, figs. 46, 47.

Cardiocarpon cuneatum n. sp.

Plate X, figs. 4, 6.

Fruit about 1.2 centimeters long and 1 centimeter wide, the greatest width a little below the middle, narrowly cordate; nucleous ovate to nearly round, elongated and pointed above, slightly flattened or depressed at base and marked by a line extending downward from the micropyle nearly to the base; wings about 1 mm. in width at base and increasing to about 2 mm. in width at apex, slightly marginate.

The smaller size, more acute nucleus, and emarginate wings distinguish this species from *C. minus*,[22] a form which it closely resembles.

Locality: Fire clay under the Upper Block Coal, Asherville.

Cardiocarpon gracile n. sp.

Plate X, fig. 5.

Seed broadly oval in outline, slightly truncate at base, about 9 mm. long and 7 mm. in width, the greatest width a little below the center; nucleus oval, slightly truncate at base, wedge shaped at apex; with line extending downward from micropyle to near the center; wings less than 1 mm. wide at base, increasing to about 1.5 mm. at apex; very slightly emarginate.

This species is doubtless closely related to *C. cuneatum*. It differs from it principally in being smaller in size and in having a less sharply pointed nucleus.

Locality: Same as *C. cuneatum*.

Cardiocarpon cordatum n. sp.

Plate X, fig. 10.

Fruit ovate in outline, about 7.5 mm. long, 6 mm. wide, the greatest width a little below the center; nucleus cordate in outline, pointed above, marked by line extending from apex to depression in truncated base; wings about .5 mm. wide at base and about 1.5 mm. wide near the apex; very faintly emarginate.

This species differs from *C. gracile* in its smaller size and in that its nucleus is more sharply pointed at the apex and more truncate at the base. It may be distinguished brom *C. irregulare* by its larger size, wider wings and nucleus not marked by a vertical line. A poorly preserved specimen shown in Pl. IX, fig. 10, is doubtfully referred to this species.

Locality: Fire clay under the Upper Block Coal, Asherville.

Cardiocarpon commune n. sp.

Plate X, figs. 11 and 15

Fruit very broadly oval to nearly round in outline, 6 mm. wide and 7 mm. long; nucleus oval; wedge-shaped above, flattened below and marked

[22] Geol. Surv. Ohio, Vol. I, Part II, p. 372, pl. 43, fig. 4, 1873.

by a faint line from micropyle to base; wings of uniform width of about 1 mm., slightly emarginate.

The uniform width of the wings and more rounded outline distinguish this species from *C. cordatum*, *C. irregulare* and *C. obtusum*. It is smaller than *C. acutum* and the wings are not narrowed and extended as in that species.

Locality: Fire clay under the Upper Block Coal, Asherville.

Cardiocarpon biscuspidatum (Sternb.) Newb.

Plate VII, figs. 4 and 6; Pl. VIII, fig. 3.

1873. *Cardiocarpon bicuspidatum* Sternb. Newberry, Rep. Geol. Surv. Ohio, Vol. I, part II, p. 373, pl. 43, figs. 9, 9a.

The form shown in pl. VII, fig. 6 seems to agree closely with the Ohio forms described by Newberry. The specimen shown in pl. VII, fig. 4 is somewhat smaller and the margin is narrower than in the Ohio forms. Nuclei of forms doubtfully referred to this species are shown in pl. VI, figs. 8a, 8b.

Localities: Cincinnati, Bowling Green and Roadman School.

Cardicarpon cf. *circulare* Lx.

Plate VII, fig. 5.

The poor state of preservation of this specimen makes its determination a matter of uncertainty. It appears to be closely related to the form described by Lesquereux[23] as *C. circulare*. The wings are slightly more narrowed at the base and less truncate at the apex than in *C. circulare*.

Locality: Bowling Green.

Cardiocarpon subcirculare n. sp.

Plate VIII, fig. 5.

Fruit nearly round; about 1.1 centimeters wide, 1.2 centimeters long; nucleus round, 9 mm. in diameter, acutely pointed above, slightly truncated at the base; wings about 1 mm. in width at the base and a little greater at the top; wings rounded on the side next the micropyle, extended, pointed and close together above.

This form is related to *C. bicuspidatum* but is smaller and more rounded. It also differs from that species in that the nucleus and wings are more sharply pointed and prolonged above.

Locality: Roadman School.

Cardiocarpon sp.

Plate V, Fig. 8.

Fruit oval, somewhat truncate above, about 2.5 centimeters in width and 3.5 centimeters in length; wings about 8 mm. in width, slightly emargin-

[23] Coal Flora, Vol. III, p. 812, pl. CX, fig. 10.

ate above and a little rounded at the apex of the nucleus; nucleus rather narrowly oval, pointed above and marked by three comparatively large longitudinal ridges; basal part of fruit destroyed so that its exact nature cannot be determined.

This fruit appears to belong to a group of large, broad-winged seeds represented by *C. Girtyi*,[24] *C. Newberryi*, *C. Baileyi* and[25] *C. annulatum*. It is likely an undescribed species but owing to its poor state of preservation it is not thought admissible to describe it as such.

Locality: A single form was found at the Yoho School locality.

Cardiocarpon rugosum n. sp.

Pl. VI, Fig. 1.

Fruit slightly oval to nearly round, 21 mm. long, 19 mm. wide, the greatest width a little below the center; wings of uniform width of 2.5 mm. except at the top where the width is about 3 mm; wings close together at apex of nucleus, with small emargination above; nucleus nearly round, a little pointed at top, small depression at base which marks the attachment of pedicle; surface of nucleus finely rugose.

This species is rather close to *C. annulatum* but is smaller and has narrower wings more nearly equal in width. It is also close to *C. ovoideum*, but is larger, has wings of a more uniform width, and the nucleus is less acute above.

Locality: Yoho School.

Cardiocarpon ovoideum n. sp.

Pl. VI, fig. 2.

Fruit of moderate size, slightly oval, 17–18 mm. long, 16–17 mm. wide; nucleus almost round, extending upward, pointed at the top, slightly truncate or depressed at the base; wing blunt, rounded and much emarginate at apex, and slightly rounded on either side of the micropyle, near which it forms a border 3 mm. wide, narrowing downward toward the base where it is about 1.5 mm. in width; point of attachment of the pedicle faintly marked by a rounded depression at the base of the nucleus.

This species is probably related to *C. ovatum* and *C. conglobatum*[27] both of which have been reported from the Pennsylvanian of Arkansas. It differs from the former in that it is larger, more rounded and is more emarginate and does not have wings of equal width.

Locality: Yoho School.

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[24] Rep. Geol. Surv. Ohio, Vol. I, part II, p. 373, pl. 43, figs. 9, 9a.
For a discussion of apparently related forms see White's paper on the Stratigraphic Succession of the Fossil Flora of the Pottsville Formation in the Southern Anthracite Coal Fields of Pennsylvania, 20th An. Rep. U. S. G. S. Part II, p. 907.

[25] Stopes, M. C., Memoir 41, Geol. Surv. Canad., 1914, "The Fern Ledges" Carboniferous Flora of St. John, N. B., p. 92, Text fig. 21.

[26] Geol. Surv. Ohio, Vol. I, p. 374, pl. 43, figs. 8–8a.

[27] Coal Flora, III, p. 810, Pl. Cix., fig. 9,, 1884.

Cardiocarpon obtusum n. sp.

Plate X, figs. 13, 14.

Fruit small, oval or ovate-rectangular, 8.5 to 9 mm. long, 5.5 to 6 mm. wide; wings rounded and slightly emarginate at apex, about 2 mm. wide at micropyle, rather rapidly narrowing downward to less than 1 mm. in width a little below the middle of the altitude, then prolonged and dilated into a concave basal lobe 2 to 2.5 mm. wide, extending downward about 1.5 mm.; nucleus ovate, sharply acuminate at apex, marked by a small depression at the slightly truncate base, and a faint line extending from the micropyle downward a short distance.

The much greater extension of the wings at the apex and the basal dilation distinguish this species from *C. irregulare*,[28] a form which it closely resembles.

Locality: Numerous in the fire clay under the Upper Block Coal at Asherville.

Rhabdocarpon sp.

Plate VI, fig. 3.

Several representatives of this species were found but all of them were so poorly preserved that specific determination was a matter of uncertainty.

Locality: Yoho School.

[28] Idem. p. 810, Pl. Cix, fig. 11.

PLATE I.

1.	*Sphenophyllum tenue* D. W	X1	p. 410
2.	*Spenophyllum cuneifolium* (Sternb.) Zeiller		p. 411
3.	*S. cuneifolium* (Sternb.) Zeiller	X1	p. 411
4.	*Sphenopteris communis* Lx.	X1	p. 414
5.	*Sphenopteris* cf. *communis* Lx. *Zeilleria sp.* attached		p. 414
6.	*Sphenophyllum cuneifolium* (Sternb.) Zeiller	X1	p. 411
7.	*Sphenopteris* cf. *communis* Lx. *Zeilleria sp.* attached		p. 414
8	*Odontopteris Newberryi* Lx.	X1.	p. 419

All of the above specimens are from the Yoho School locality.

PLATE II.

1a.	*Odontopteris Newberryi* Lx.	X1	p. 419
1b.	*Pseudopecopteris* cf. *macilenta* L. and H.	X1	p. 416
2.	*Mariopteris muricata* Schloth.	X1	p. 415
3.	*Sphenophyllum cuneifolium* (Sternb.) Zeiller	X1	p. 411
4.	*Pseudopecopteris* cf. *macilenta* L. and H.	X1	p. 416
5.	*Pseudopecopteris* cf. *dimorpha* Lx.	X1	p. 416
6.	*Sphenopteris inequilateralis* Lx.	X1 ½	p. 414
7.	*Sphenopteris inequilateralis* Lx.	X1 ½	p. 414
8.	*Pecopteris sp.*	X1	p. 417
9.	*Alethopteris grandifolia* Newb.	X1	p. 418

All the above species are from the Yoho School locality.

PLATE III.

1.	*Alethopteris* sp. indet.	X1	p. 418
2.	*Alethopteris* sp. indet.	X1	p. 418
3.	*Alethopteris Evansii* Lx.	X1	p. 418
4.	*Neuropteris* sp.	X1	p. 418
5.	*Callipteridium* sp.	X1	p. 419
6.	*Alethopteris grandifolia* Newb.	X1	p. 418
7.	*Callipteridium* sp. a.	X1	p. 419

All of the above species are from the Yoho School locality.

PLATE IV.

1.	*Neuropteris* sp.	X1	p. 418
2.	*Callipteridium* sp.	X1	p. 419
3.	*Pecopteris plumosa* Artis.	X1	p. 416
4.	*Callipteridium* sp.	X1	p. 419
5.	*Pecopteris plumosa* Artis.	X1	p. 416
6.	*Pecopteris plumosa* Artis.	X1	p. 416
7.	*Mariopteris decipiens* Lx.	X1	p. 415

All of the above species are from the Yoho School locality.

PLATE V.

1.	Cyclopterid leaf of *Neuropteris* sp.	X1	p. 418
2.	*Neuropteris Elrodi* Lx.	X1	p. 417
3.	*Neuropteris* sp.	X1	p. 418
4.	*Mariopteris decipiens* Lx.	X1 ½	p. 415
5.	*Alethopteris* sp.	X1	p. 418
6.	*Lepidodendron yohoense* n. sp.	X1	p. 411
7.	*Lepidodendron clypeatum* Lx.	X1	p. 412
8.	*Cardiocarpon* sp. indet.	X1	p. 424
9.	*Cardiocarpon pachytestum* Lx.	X1	p. 422
10.	*Cardiocarpon annulatum* Newb.	X1	p. 421

All of the above species are from the Yoho School locality.

PLATE VI

1.	*Cardiocarpon rugosum* n. sp.	X1	p. 425
2.	*Cardiocarpon ovaloidum* n. sp.	X1	p. 425
3.	*Rhabdocarpon* sp.	X1	p. 426
4a–4b.	*Trigonocarpum hexacostatum* n. sp.	X1	p. 420
5a–5b.	*Trigonocarpum hexagonale* n. sp.	X1	p. 42c
6a–6b.	*Trigonocarpum ovatum* n. sp.	X1	p. 420
7.	*Trigonocarpum* cf. *schultzianum* Goepp. and Berg.	X1	p. 420
8a–8b.	Nuclei of *Cardiocarpon bicuspidatum?* (Sternb.) Newb.	X1	p. 424
9a–9b.	*Trigonocarpum* sp.	X1	p. 420
10, 11 and 12.	*Trigonocarpum* sp.	X1	p. 420

13.	*Pecopteris* sp.	X1	p. 417
14.	Indet. sp.	X1	p. 417
15.	*Lepidodendron clypeatum* Lx.	X1	p. 412
16.	*Sphenopteris* sp. indet.	X1	p. 409
17.	*Lepidodendron obovatum*? Sternb.	X1	p. 412

Nos. 1, 2, 3, and 7 are from the Yoho School locality; Nos. 4, 5, 6, 8, 9, 10, 11, 12, and 15 are from Cincinnati; Nos. 13, 14 and 16 are fron Reelsville locality; No. 17 is from Bowling Green.

PLATE VII

1, 2, and 3.	*Alethopteris Sertii* Brongn.	X1	p. 419
4.	*Cardiocarpon bicuspidatum*? (Sternb.) Newb.	X1	p. 424
5.	*Cardiocarpon* cf. *circulare* Lx.	X1	p. 424
6.	*Cariocarpon bicuspidatum* (Sternb.) Newb.	X1	p. 424
7.	*Lepidodendron obovatum*? Sternb.	X1	p. 412
8.	*Sigillaria elegans*? Sternb.	X1	p. 413
9.	*Cordiates Robbii* Daw.	X1	p. 420

All of the above species are from the Bowling Green locality.

PLATE VIII

1.	*Lepidodendron obovatum*? Sternb.	X1	p. 412
2.	*Lepidodendron aculeatum* Sternb.	X1	p. 413
3.	*Cardiocarpon bicuspidatum* (Sternb.) Newb.	X1	p. 424
4.	*Cardiocarpon annulatum*? Newb.	X1	p. 421
5.	*Cardiocarpon subcirculare* n. sp.	X1	p. 424
6.	*Lepidodendron obovatum*? Sternb.	X1	p. 412
7.	*Sigillaria elegans*? Sternb.	X1	p. 413
8.	*Calamites Suckowi* Brongn.	X1	p. 410

Nos. 1, 2, 3, 5, 6, and 7 are from the Roadman nchool locality. Nos. 4 and 8 ,are from the Liberty School locality.

PLATE IX.

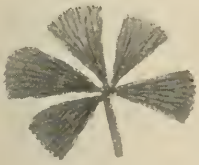
1.	*Pecopteris* sp.	X1	p. 417
2.	*Pseudopecopteris obtusiloba* (Brongn.) Lx	X1	p. 416
3.	*Taeniopteris* sp.	X1	p.
4.	*Neuropteris* sp.	X1	p. 418
5, 6.	*Pecopteris* sp.	X1	p. 417
7.	*Pseudopecopteris obtusiloba* (Brongn.) Lx.	X1	p. 416
8.	*Cordaianthus* sp.	X1	p. 421
9.	*Cardiocarpon acuminatum* n. sp.	X1	p. 422
10.	*Cardiocarpon cordatum*? n. sp.	X1	p. 423
11, 12 and 13.	*Pecopteris* cf. *abbreviata* Brongn.	X1	p. 417
14.	*Lepidodendron aculeatum*? Sternb.	X1	p. 413
15.	*Lepidodendron obovatum*? Sternb.	X1	p. 412

Nos. 1, 2, 3, and 7 are from the Liberty School locality; Nos. 4, 5 and 6 are from Schroepferman's mine; Nos. 8, 9 and 10 are from Baird's mine; Nos. 11, 12, 13, 14 and 15 are from the fire clay under the Upper Block Coal at Asherville.

PLATE X.

1.	*Neuropteris* sp.	X1	p. 418
2.	*Pecopteris* sp.	X1	p. 417
3.	*Sphenophyllum cuneifolium* (Sternb.) Zeiller	X1	p. 111
4.	*Cardiocarpon cuneatum* n. sp.	X1	p. 423
5.	*Cardiocarpon gracile* n. sp.	X1	p. 423
6.	*Cardiocarpon cuneatum* n. sp.	X1	p. 423
7, 8a, 9 and 12.	*Cardiocarpon irregulare*, n sp.	X1	p. 422
10.	*Cardiocarpon cordatum* n. sp.	X1	p. 423
11, 15.	*Cardiocarpon commune* n. sp.	X1	p. 423
13, 14.	*Cardiocarpon obtusum* n. sp.	X1	p. 426

All of the above species are from Asherville.



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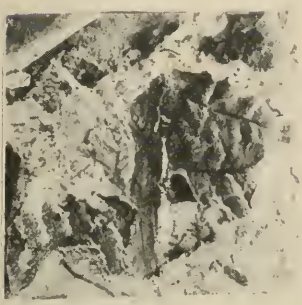

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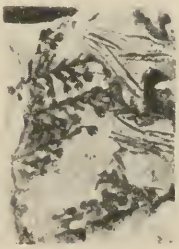

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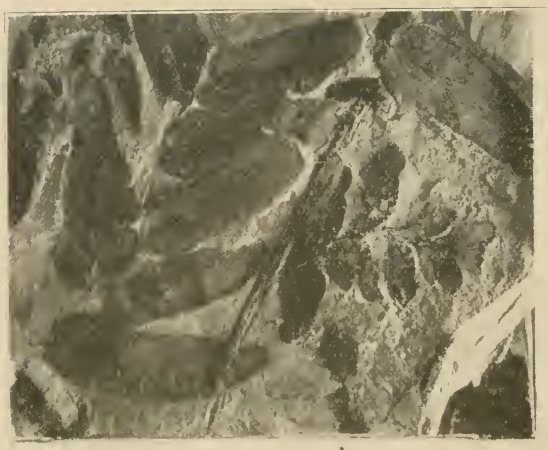
PLATE I



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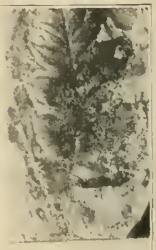
1 b



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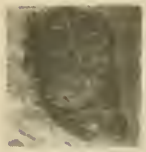

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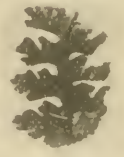

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PLATE II

PLATE III

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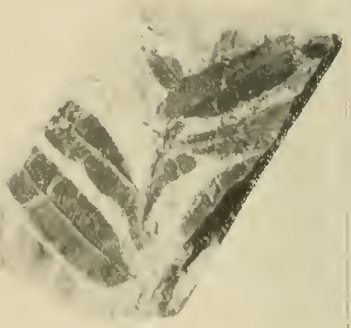

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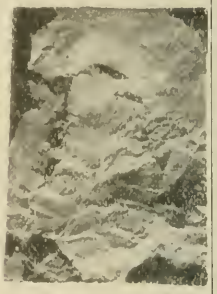

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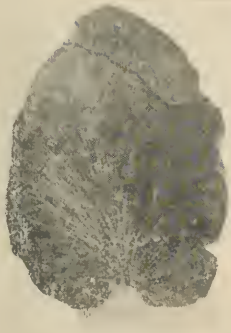

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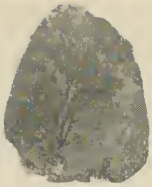

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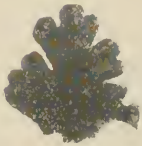

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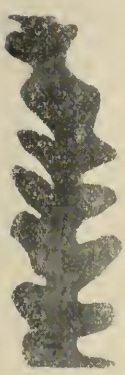

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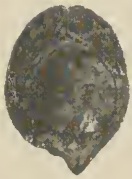

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PLATE V

PLATE VI

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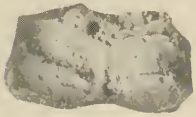

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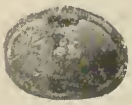

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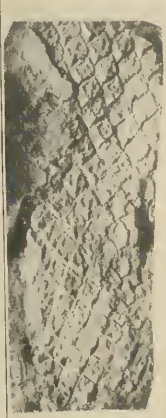

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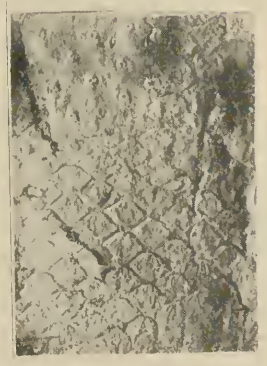

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PLATE VII

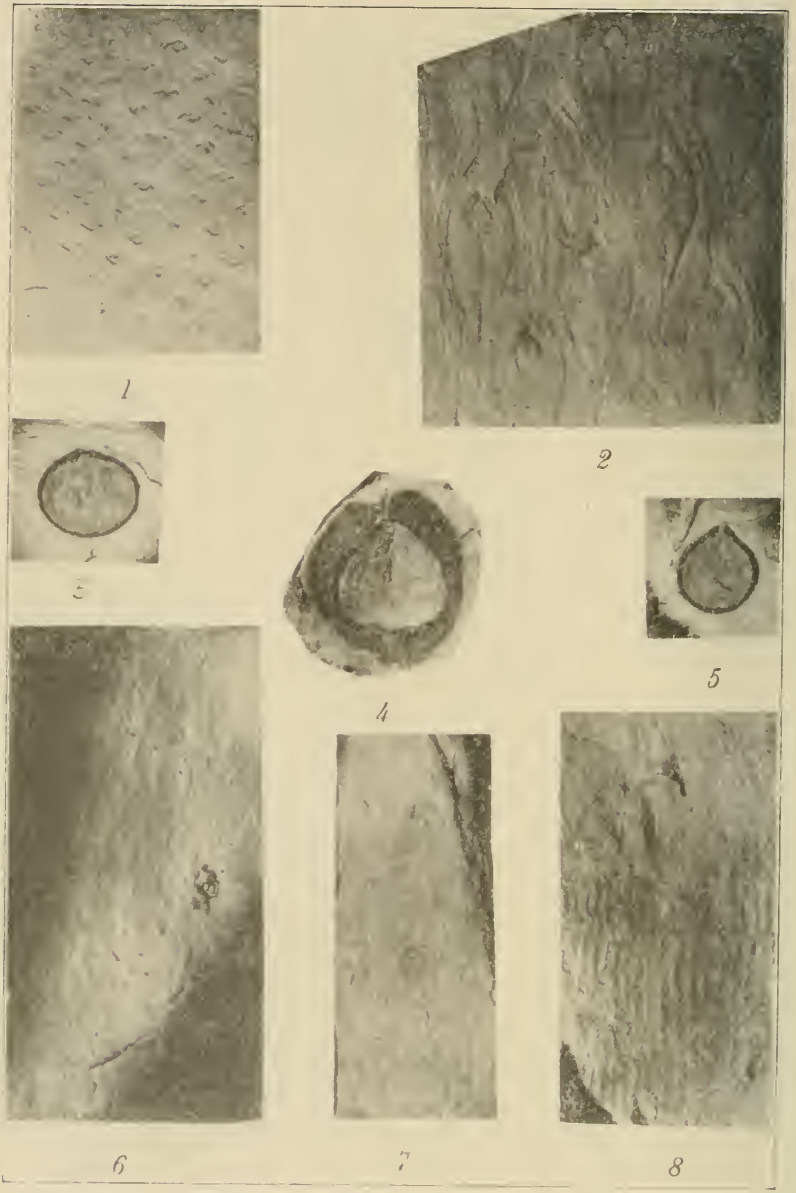


PLATE VIII

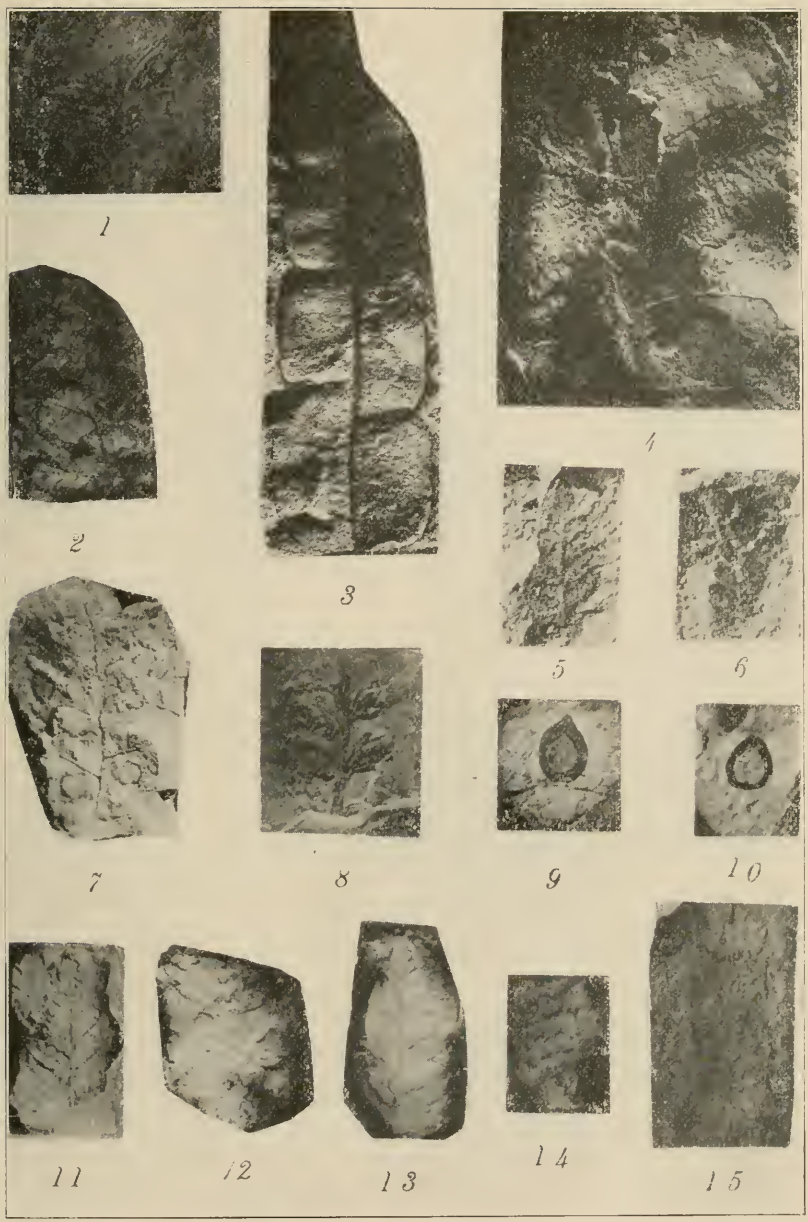
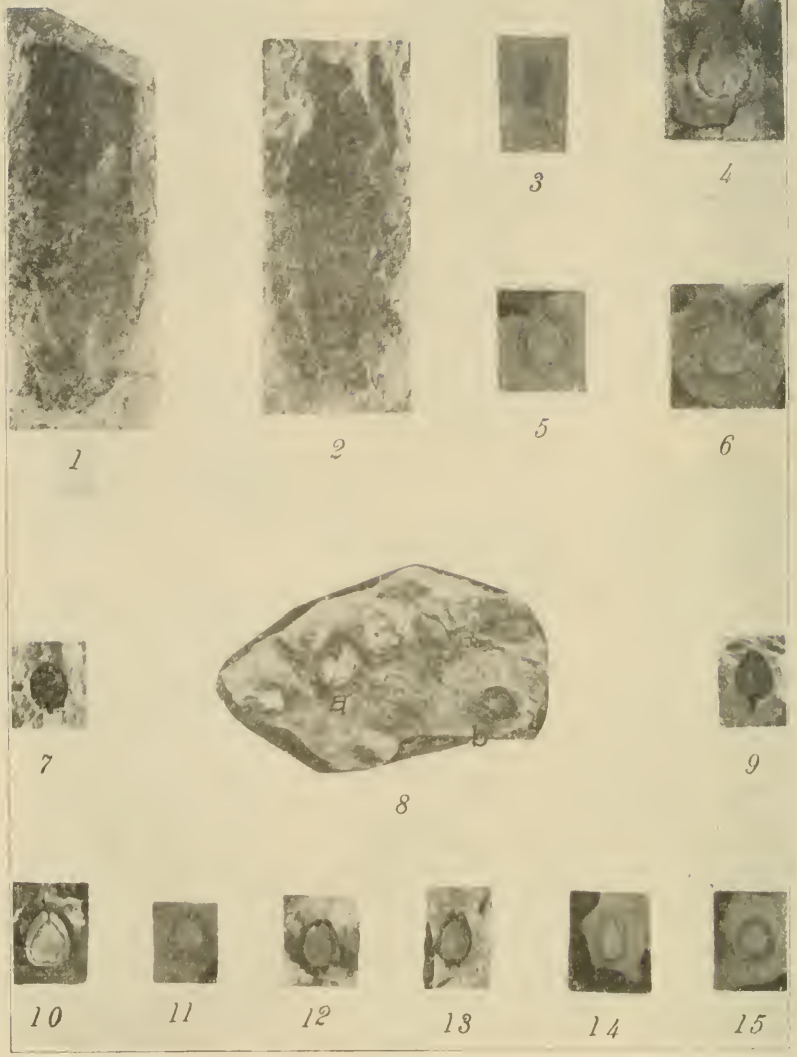


PLATE IX



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

PLATE X

MAP OF INDIANA SHOWING LOCATION OF COUNTIES.