L. Lesquereux Columbus O.
Bound May 1871

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Remarks & species to be added to my MS. for correction

1. Callipteridium crenaguata from a new specimen p. 397 f. A.
2. Dictyopteris Scheuchzeri. Roem. Ind. p. 493 f. 1.
3. Neuropteris Rogersii Ill. Rep. IV p. 382 f. 2.
4. Hymenophyllites dissectus so Mansfield's Ma 490 in Catalogue
5. Cyclopteris ollata Al & H. is probably that described as Neuropteris delicatula Al & H. (in my MS., compare Al & H. v. III pl. 217.
6. Neuropteris orbicularis Ill. Rep. IV p. 471 f. 2.
7. Alethopteris anthracina Heer in Catalogue of Mansfield's No. 489
8. Pseudopecopteris irregularis. Refer to this Sphenopteris? described p. 416 f. 2 from Ma 5 H.
9. " macilenta. Refer to this Neuropteris, after Lesquereux IV p. 416 f. 1.
10. " trifoliata
11. " obtusiloba

~~6B See Wood for an Odontopteris~~

Section to be made for the coal flora
Ind. for coal. also sub carboniferous mantle along the Whetstone

[illegible] p. 509, 510

questions to be considered in the plan p. 476

Neuroptera number of veins per cent to mile, p. 322

Geological Survey of Illinois.

Vol. IV

Part II.

Palaeontology of Illinois

Section II.

Report on the fossil plants of Illinois

By Leo Lesquereux.

1870.

pl. V. - XXXI.

See where this genus has been described and what are his characters. The genus does not appear to have been described ~~or~~ ~~not~~ by what Andrews says of the report that the genus was established by Dawson to include a form of Devonian fern named Neuropteris Dawsoni by Hall. The name is good and the genus is distinct. Ferns of very large size. Fronds simply pinnate one to two feet long or more, pinnae or leaflets alternate upon a thick half round rachis decurrent, linear lanceolate gradually narrowed to a point or acuminate or otherwise pointed, the upper ones dividing in the middle or from the base sometimes into two or three leaflets; veins very thin oblique, at first coming out at an acute angle of divergence from the broad midrib then passing to the borders in a less oblique divergence and turning upwards in reaching the border. Fig. 1. of my plate show the upper part of a frond, Fig 2 the middle. Fig 3 seems to differ at least by the more obtuse and broader lobes though the nervation is the same. I do not have seen the specimen however, my figure is made from a sketch of M. Southwell.

1 Megalopteris Southwellii, Lgy. has the character of the genus. Differs from the species published by Andrews by its slender form, the acutely acuminate leaflet, the nervation very thin but distinct. The epidermis of the leaves is a coaty skin as thick as common writing paper upon which the surface is marked as somewhat granular by irregularities crossing the veins about in right angle. It may be that fig 1 represent a whole frond in the process of development or perhaps a different species, as the base of the lower leaflets is not decurrent and continuous as in fig. 2 but passes to a border of the rachis marked by parallel lines and not by veinlets. The difference in color between these rachis and midrib of these two species seems too great for supposing them identical. I propose therefore to name the 1. Megalopteris fasciculata. 2 M. Southwellii. The nervation is ~~the same in both~~ ~~or rather~~ somewhat ~~the~~ different, the veinlets in 2 being more distant and thicker. Fig 3 may be named M. curviloba? or something like. None of the figures of Dawson or of Andrews show the nervation ~~so~~ as distinct as in my figure. Comparing the fragment of Megalopteris which I have and also those described and figured by Dawson. the average length of the leaflet is six times the length of their width. This can be seen in my fig. 1. Now I have a sketch from Southwell which represents fragment of a leaflet 11½ cent wide and therefore its length should have measured about 70 centimeters. The midrib is 6 millimeters broad, the veins very distinct and of course more distant than on my figure; at least so says Southwell. The character of nervation is however the same. The veinlets are very thin but very distinct, averaging at the borders three per millimeter or 16 to 17 per 5 millimeters of space; generally forking once at the base or simple at the base and forking once at the middle rarely above, passing from the border to near the midrib at an angle varying from 55 to 65. the veins being more oblique toward the point of the leaflet and nearly horizontal or in right angle to the rachis in their decurrent base and joining the midrib by abruptly curving downward and reaching it in an angle of about 30°. See borders of leaflet in Smith Pl III fig. a.

1 Calamites approximatus Ref. from p. 371 (1). Another specimen of Lacu. 589 a. Quite long, flattened 3 cent. broad, no the articulation without inflation, very short and irregular in width, from 6 to 10 mill. broad, this bulbifer at top. Scars of branches very few and irregular.

Teleophyllum

1. Dictyophyllum Ll & Hutt. Part of the Phlebopteris described by Brongniart are referred by Schimper to this genus. See how it is characterized. I have from Mazon creek a nodule L & 1689 representing a small new species of this genus which may be named Phlebopteris or Dictyophyllum Shortii. H. sp. a small leaf 4 ft cent long broadly obovate, enlarging upwards from the base, round truncate at the top where it is three centimeter broad, apparently entire or not lobed, with borders somewhat recurved. It has from the base a strong midrib, two millim broad, with alternate branches like lateral nerves of a dicotyledonous leaf going out at an acute angle of divergence of 40°, curving backwards on one side and inward on the other becoming thin and effaced toward the border, irregularly crossed by areolae, large with thick parallelogram obtuse alternate oblique to the primary or large nerve somewhat similar to nervules. A good figure should be made of this remarkable leaf.

FOSSIL PLANTS.

INTRODUCTORY REMARKS.

The generic classification of the species of fossil plants, enumerated and described in this paper, is the same as that in the second volume of this Report. Perhaps it would have been advisable to modify, by subdivision, a number of our genera, especially for some species of ferns, of which we have recently obtained fruiting specimens, which seem to indicate a relation to peculiar species of the present time. But as this Report is a mere continuation of the first, a change of classification would have rendered it more obscure to the student, and would have required a long discussion on the value of some of these new genera, without any advantage to science. For the fructifications of the fossil ferns are scarcely, if ever seen, except obscurely, through the substance of the leaflets under which they are attached, and even when the position of the *sori* or groups of fructifications relatively to the veins and veinlets, or to the borders of the leaflets can be ascertained, their true form, and especially the mode of attachment and of dehiscence of their *indusium* cannot be recognized. The natural affinity of these fruiting fossil fragments is, therefore, always more or less uncertain, and a mere change of name, without sufficient authority, tends to obscure, rather than to enlighten the classification. I have, therefore, merely appended some remarks to all the species, which, by their known organized parts, may differ in some way from the characters of the genera to which they are united. I have also, in this paper, omitted to repeat descriptions of genera and of species already given in the second volume of the Report, but have added to the names such remarks as have been suggested by the discovery of more complete specimens. In botanical palæontology, we have to deal merely with fragments, and none of these separate fragments are sufficient, in themselves, to indicate the general character of the whole plant to which they belong. The discovery of each part of a fossil plant adds, therefore, to our acquaintance with a species, and the record and description of any of the separ-

ate members, are often of more value to botanical science, than the description of so-called new species, established on some remains of a peculiar form, and of unknown relation.

The number and diversity of the plants published in this volume, tend to indicate the richness of the fossil flora of our Coal Measures, and at the same time, show an increasing activity in research.

The publication of the fossil flora of the second volume of the Geological Survey of Illinois, has excited a remarkable interest for botanical palæontology. Not only private gentlemen have given their time to the collection of specimens, but local societies have been formed for encouraging research, and founding cabinets of fossil plants. We can therefore hope soon to see our fossil flora in America as thoroughly studied and as well known as that of Europe, where this field of science has been ardently worked for more than a century.

Among those to whom the survey is especially indebted for the communication of valuable material used in the preparation of this Report, thanks are due to Mr. Jos. Even, of Morris, who, after the loss of his valuable cabinet by fire, has begun again his researches with renewed zeal and great success; and to Mr. S. S. Strong, of the same place, who has most liberally presented the State Cabinet and myself with a large number of specimens of rare and new species. Messrs. M. Prendel and John Collins, also of Morris; Mr. M. S. Hall, formerly of Wilmington, and Mr. Thos. Tijou, of Duquoin, have also furnished valuable contributions to this Report. As, moreover, the assistants of the State Geological Survey were instructed by the State Geologist carefully to look for and preserve specimens in their explorations, and as the Director of the Survey and myself worked hard in collecting specimens as often as opportunity permitted, the amount of materials which have been examined for this report, and which now mostly belong to the State Cabinet in Springfield, are extensive and of great value.

+ 1 Callipteridium, Weiss. See Schimper III p. 430 for description of this genus which is a very good one for the species which I wanted to place in Callipteris or Odontopteris. My C. Prardei is closely allied to if not identical with Neuropteris orata Germar for III pl XII which is a Callipteridium and it will be scarcely possible to separate it. It has only longer leaflet oblong oblique generally turned upwards and so perpendicular to the rachis, the terminal pinnule of the pinna long gradually narrowed to an obtuse point and the veinlet not flexuous as figured by Germar. Their veinlet are also much closer more numerous thicker and more distinct. This is far different from Pecopteris orata Bngt.

+ 2 C. Neuropteroides (blanford) n. sp. nov. L 9162 from Mazon creek closely allied to Pecopteris Gigantea Bngt. and Callipteris conferta of authors. The species or var. has the same kind of nervation but the leaflet are not decurrent nearly in a right angle to the rachis and obtusely pointed, proportionally longer and narrower than in all the European figures of this species. As this form is extremely variable, it may be an American variety, name it Conferta var. Americana and figure if possible. The leaflets are thick, coriaceous, the nervation coarse and distinct. veinlet fully exposed, forking once or twice. ~~Should be compared to what I have described as C. cremulata~~ Bngt. a species which Schimper considers the same as Callipteris conferta, is far different from it, at least in regard to the specimens which I have named thus. I have a large number of them from L 8148, S. 28 Lat. It is a true Callipteris or Pecopteris with narrow leaflet and nervation very distinct, the veins only forked once all equally distant thin but distinct, all coming out from the midrib. See p. 378 b. Mt. fig 1 d 1a.

+ 3 Callipteridium Mansfeldi. Sp. nov. Represented by Mt. 36 1 is evidently closely allied to C. Prardei. But it differs by much larger leaflet oblong lanceolate oblique, scythe shaped upwards distinctly so. The nervation is about the same, but the veins very thin ~~but~~ distinct and deeply impressed forking generally twice. The leaflets are attached to the rachis by the whole base and distinct to near the rachis where they join in an obtuse narrow sinus. — Comparing it again to C. Prardei, the difference is scarcely noticable except for the large scythe shaped form of the leaflet. The nervation is the same. In both the veinlet forks twice, once near the base and once of the branches forking again. In C. Mansfeldi the surface is not shrivelled though from the small specimen it is seen to be coriaceous and inflated as in C. Prardei. Fig. 2 is a Neuropteroid in character, the nervation is however somewhat coarse. The basilar lobe of the pinna is a as joined to the main rachis.

+ 4 Callipteris Prardei. L. CB. 41. N. 155 The under part of the specimen which is also figured like the other side shows the upper part of a pinna with the lower pinnules more distinctly attached to the rachis, not only are they ~~very~~ attached to the rachis in their whole width but their lower part is prolonged downwards and nearly to the base of the upper pinnule of the inferior secondary pinna. This character is very remarkable and interesting referring Lescuropteris Moorei to the same. What I said above of the relation of these two species is right. One pinna on the reverse shows the leaflet also subfalcate and broadly obtuse just of the same form as in C. Mansfeldi but only half as long and broad.

3786

1. Callipteridium neuropteroides spec. nov. I do not think that it may be compared to C. confertis though the nervation may be somewhat like. The lateral nerves are not very much curved, either very thick as by inflation of the epidermis similar to that which is remarked upon leaves of Neuropteris, or very thin though distinct where the epidermis is destroyed. Both these forms or casualties are marked upon fig. 3 & 3a enlarged of the Callipteris plate. The leaflets are either joined near the base or disjointed to the base and then their large base is slightly curved inside though really similar. The character is therefore Neuropteroidal, Pecopteroidal and Alethopteroid.

2. Callipteridium membranaceum spec. nov. (Pl. XVI.d) fig. 4–7. Frond poly pinnate. Pinnæ pinnately divided in (fig. 5) simple oblong obtuse undulate large pinnules in right angle to the rachis or slightly turned upwards, ~~either~~ attached to the rachis by their whole length, either joined at the base or separate and then the leaflets slightly rounded on both sides at the base. These leaflets average twelve to fourteen millim. long and 5 mill. broad, or as in fig. 4 the pinnæ are divided in narrower though slightly longer pinnules, the lower ones disjoin to at base but semi by their whole base rounded at both sides of the base or slightly decurrent by the lower, alternately oblique and equally short lobed, the lobes becoming less marked in passing up toward the point and the upper pinnules being entire, or as fig. 6 & 7 the pinnæ are bipinnately divided, the primary division being linear, of various length, pinnately divided in leaflets short oblong rounded which become shorter and smaller in the upper part of the pinnæ. All these divisions are exactly pecopteroidal but the nervation is evidently of Callipteris. This nervation when the specimen are looked dry is not seen at all even scarcely perceptible with the strong glass, but when the specimen is moistened with the tongue the veins black and thick become perfectly distinct through the reddish transparent substance of the plant. The nervation is exposed in 4c 5a 6c 7c enlarged and is exactly as seen upon the plant in 5c. The midrib is very thick and abruptly terminates toward the point of the leaflets as in C. hillerantii. This appears to be a character of Callipteris. We have I think to preserve it and to include into it C. hillerantii. But the definition should be amended. Remark that the plate represent the plant as it is when seen in its form dry state, the veins being invisible and that the enlarging parts represent the fragment as seen enlarged double when moistened and pellucid.

[illegible]

[illegible] ons; stem filiform, diebotrous;

[illegible] sp. nov.

[illegible]

General remarks on ferns.

1. See for difficulty of comparing them to those of our time Brongn. on Grand'Eury memoire p. 3. (1). On the large fronds of Neuropteris and Odontopteris same page (2)

[illegible] species to be named. Fig. 3. p. 545 is copied from a large speci[illegible] [illegible] about [illegible] feet long [illegible] what is already [illegible] if not [illegible]. The plant is [illegible], cartilag[illegible] [illegible] dichoto[illegible] [illegible] [illegible] straight or curved inward. The [illegible] is [illegible] and [illegible] [illegible] is broken in pieces. No trace of nerves are seen [illegible] a kind of Fucoidal plant. but more intimately [illegible] than any other [illegible] have seen. It may be compared to [illegible] (? [illegible])!

DESCRIPTION OF NEW SPECIES, AND AN ENUMERATION, WITH REMARKS, ON SPECIES ALREADY KNOWN.

FUCOIDES, OR MARINE PLANTS.

Genus CHONDRITES. Sternb., Vers. 2, p. 25.

Frond cartilaginous; stem filiform, dichotomous; branches cylindrical.

Chondrites Colletti, Sp. nov.

Frond large, dividing fan-like into numerous crowded branches, dichotomous, either diverging on both sides of the main axis or arched on one side; ultimate divisions simple, linear, cylindrical, with irregular borders.

This species is not as yet satisfactorily known. I have but recently received from Mr. John Collett, Eugene, Ind., some specimens of a black, fossiliferous limestone, whose surface is marked with the remains of these plants, true Fucoides. The species distantly resembles, by the curving of its branches, *Fucoides cauda galli*, Van. But it is evidently a compound of separate branches, dichotomous from near the base of the frond (the base is broken from the specimen), the branches in dividing and ascending, forming fan-like or flabellate fronds. The branches, which are ultimately simple, leave upon the stone a half cylindrical impression, and are distinct from each other. The locality is indicated as Towle's mill, five miles east of Lodi, Ind., and the geological position about the level of coal No. 1 of the Ill. section. If it is so, this black

fossiliferous limestone, whose characters are so much like those of the Penna. black limestone seen at the top of the millstone grit with *Caulerpites marginatus*, Lesqx., Jour. Am. Phil. Soc., vol. 13, p. 313, occupies the same level. This is a peculiar coincidence of a singular formation, which, exceptionally in the flora of the Coal Measures, contains Fucoides, in both the coal basins of Penna. and of Illinois.

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380 b. 2 —
380 c. 1.

FRONDS AND BRANCHES OF FERNS.

GENUS NEUROPTERIS, Brgt.

See note on the genus Neuropteris p. 381 c. & supplement to species p. 467

This genus, limited as it is, vol. ii, p. 427 of this Report contains some species, whose leaflets, more generally round, have no distinct medial nerve, and which, from this peculiarity of form and nervation, are referable to the genus *Nephropteris*, Brgt., already a modification or subdivision of the genus *Cyclopteris*, of the same author. As some of our species are represented, even on the same specimens, by fronds bearing both oblong leaflets with a well marked medial nerve, and nearly round ones without it; or by branches bearing round or polyform pinnules with a definite medial nerve, and oblong ones without a trace of it, the subdivision of the genus *Neuropteris* is as difficult as it is inconvenient, with the materials now at hand. This opinion is further supported by the descriptions and figures of some of our species.

380 b 3 1

NEUROPTERIS HIRSUTA, Lesqx.

Boston Jour. of Nat. Hist., 1854; State Geol. Rept. of Penna., p. 857, Pl. iii, 6*f*, Pl. iv, fig. 1 to 16, excl. syn.

The degree of relation of this species with *Neuropteris cordata*, Brgt., is not yet ascertained. In his admirable work on the Fossil Flora of the Permian (1864–65) p. 100, Pl. xi, fig. 1 and 2, Prof. Goppert has published as *Neuropteris cordata*, Brgt., part of a pinna, bearing on one side of its broad rachis a series of alternate, oblong, cordate, obtuse leaflets, one inch broad, four inches long, marked with a thick medial nerve, and on the other side diminutive leaflets, very short and enlarged, resembling, according to the author's remarks, some of those of the polymorphous *Neuropteris auriculata*, Brgt. If the true *Neuropteris cordata* has such leaflets of various forms alternately attached to a

Dec. 1 Neuropteris hirsuta Lesq. See note on the hairs p: 509. – One specimen N. 187 shows upon its surface round concave elevated spots which appear like Epiphyllae. Their size and position is too irregular to permit the supposition that they represent fructification. See also N. 133. for an oval elongated excrescence upon the leaflet much resembling a sphaeria or some other genus of epiphyllae.

Dec. 2 Neuropteris Rogersi Lesq. Penn: Geol. Rep: 1. 1856. pl. 7. fig. 2. Neuropteris Speciosa Lesq. Boston Soc: of Natl. History proceed: P. Cat: of fossil plants of the U. S. 1858.

Frond unknown. Leaflets either long, linear lanceolate abruptly short pointed, or broader shorter, ovate lanceolate or broadly oval, more or less pointed, all deeply cordiform with equal lobes at base. Medial nerve thin, scarcely more marked than the veins either ascending nearly to the point with veins anastomosing from it in the narrow leaflets, or merely short and basilar in the broad ones, the veins emerging from around the point of attach of the leaflets. Veins thin not inflated towards the base, distinct, forking four times, all parallel and preserving the same distance in their whole length, moderately arched from the base to the borders, abruptly curved upwards at the margins. Surface of the leaves evidently and narrowly crenulate or finely divided both ways.

It is a well characterized species, only distantly related to the following. The frond is unknown no remains of stem or rachis has been found in connection with it, though at the only locality where it has been obtained, the leaves are in abundance. All these leaves or leaflets are marked at the base with a round point of attach 1/8 of an inch broad opposed downwards by the two round auricles of the leaves which are equal in all specimens, or never more elongated on one side than on the other. This would seem to indicate that each leaflet was born upon a separate petiolel. The consistance or texture of the leaves is thinner than that of the following species. This with the thinner more distinct veins, narrow medial nerve, all of the same thickness, not inflated and parallel distinguish at first sight this species from the others of the same section. The size of the leaflets is not very variable. The largest specimen ever seen is the one figured in the Geol. Rep: of Penn: loc: cit.: the smallest obtained as yet is 3 inches long and one inch broad. The breadth of the leaves varies between 1 and 2 inches. Found only in the Shale of South Salem V. at Fort Parbon, in a most abandonned shaft just north and even within the village and opposite on the other side of the river in the same vein from a shaft which was still worked 1868. (27. 6. 71.) See fig. 449 a Cyclopteris of a peculiar form which apparently from the nervation at least belongs to this species. If so it had a frond. The number of the veinlets at the borders vary from 24 to 26 per inch according to the size of the leaflets. In the smallest which I have the number is 29. The cyclopteris above mentioned has only 40 per inch. This more than the leaves. But the margin of this Cyclopteris is cut horizontally and the veins are parallel without branches.

Dec. 3 Neuropteris hirsuta Lesq. N. decipiens. In counting the veinlets along the margins in the space of one inch. I find that most probably we have two species. The one upon the shale of Penn: is generally narrower lanceolate pointed or obtusely pointed with the surface marked by scattered, rare, very thin hairs. The veinlets more divided therefore veinlets more numerous more branching at or near the border and the space between them more inflated. The veinlets are thus far more obscure than in the following. In counting them along the border, I find ten in specimens very distinct as follow.

Sp. from Morgan Shale N. 137 has per inch 98 to 100 veinlets. – N. 42 Penn: 3. long leaf. 96 - 100 (upper part and base part)
Sp. N. 10 Penn: 3 inches leaf. 104. on the same spec. a narrow long leaflet 3. 98 no distinct
N. 56 veinlets very distinct flat. 100. N. 18 U. S. Fill. pl. 1. f. 1. 104.
Cy. 33. large leaf Penn: 95 to 104 viz 95 at a distance from the border. 104 at the border.

From this as from a number of specimens measured, the number of veins for this species varies from 96 to 104 the average being 100 per inch or 40 per centimeter.

The other species is as yet only represented by the nodules of Mazon Creek. The leaves are proportionally broader and more obtuse rarely lanceolate but rather oblong or with both sides parallel. The veinlets are more distinct and more distant marked at the bottom of the depression by a thread like filament. On the counterpart they are half round strightly elevated with the space between them scarcely inflated. The hairs are stronger, thicker more numerous, the petiole of the leaflets is thicker and broader and more persistant. In counting the veinlets generally more distinct at the borders than in the former species I find N. 178 base of leaf 60 upper part 76 veinlets per inch.
N. 126 lower and upper part both 76. N. 124 leaf 3. 4 inch long 74
N. 152 the largest spec. 5 inches long 70. N. 158 " " 74
N. 174 4 " base 72 & 68 N. 112 " " 74
N. 135 2 " 65. – The average being 69 to 71. per inch. + number

average 70 per inch = 28 per cent sometimes 30.

Land. 2 per cent.

of other measurements show the same difference – see over more [illegible]

It could be supposed perhaps that the swelling between the reinlets along the borders in specimens upon shale may cause the difference. But it is not so. For in some specimens on shale as for example in N. 15 the reinlets are perfectly distinct and seen in their whole length. And at first sight it is easy to see a great difference in the distance of the reinlets on good specimens of these species. ~~(These may be two species of Dicranopteris, the one representing the Neuropteris cordata, the other the Neuropteris acutifolia: Compare Dicranopteris~~ — If all the shale without exception represent as yet Neuropteris hirsuta, the nodules of Mazon creek have only the other species which would be named N. obliqua. With very few exceptions at least. For in specimens in the museum which are marked G. H. Perkins, I find one N. 258 with lanceolate pointed, nearly smooth leaves or with scarcely any hairs, close reinlets counting 86 to 90 per inches and which is evidently referable to N. hirsuta. This distribution may be considered as peculiar and perhaps indicating identity of both species differently characterized from different circumstances of mineralisation. But I do not think that it is the case. For in the shale of Morris there has been as yet found only one specimen of Neuropteris to my knowledge at least and this is of persistent whole at Mazon creek the other species is the most predominant of all the species found there. But this can not be considered as a reason of identity of both species. The distribution of species in the coal formation is essentially local as can be proved by the enumeration of many species of Neuropteris &c.

f. Neuropteris anomala. Pinnae striate, laminately divided. Penna large, linear lanceolate in outline, with a broad flat rachis where, beneath surface or epidermis show it as a compound of vascular fascicles mostly disjointed, more or less parallel, the external one of each side entering into the leaflets as a great medial nerve and there dividing into veins in ascending to the point. Leaflets opposite, cordate, lanceolate ~~ovate~~ obtusely pointed enlarged to the base which is rounded on both sides with the lower lobe slightly longer. Medial nerve broad, often divided in two at its base, flat, separating in ascending and three or four times dichotomous and arching more or less in the ultimate divisions to the borders. — We have of this species a large specimen apparently a whole penna one foot long and a small specimen representing only the terminal pinnules of the same form as the lateral one, only slightly smaller. The lateral leaflets are about 2 inches long, one inch broad at base, scarcely diminishing in size toward the point, somewhat distant from each other attached to the rachis by about one line of the leaflets and vesicle ~~and~~ opposite, nearly perpendicular to the rachis or slightly bended upwards near the point. The terminal pinnule is disconnected and rounded at base. The pellicle covering the flat rachis, like the epidermis of the leaflet is thin, transparent, and through it the fascicle of veins irregularly parallel in the rachis, passing into a broad medial nerve and from it, arching to the borders by their three dichotomous divisions or separate segments or fascicles. This division is more or less irregular or incomplete. Some thread like filaments are here and there detached from the bundle of veins and reinlets and traverse in various directions the regular reticulation of the veins & reinlets. The appearance of this species and this mode of reticulation is peculiar. Nothing can be compared to it but the reticulation of Odontopteris Schlotheimii. Indeed we have from Morris specimens of this last species which by the reddish color of the epidermis and by the division of the thread like filaments of the veins seem to indicate this species as a form of Odontopteris Schlotheimii. The vesicle and delicate texture of the rachis and leaflets as like had a floating plant and it is from this that we have in this Neuropteroid form the lower part of a partly immersed frond whose aerial branches are the common form of Odontopteris Schlotheimii. In any case this species should be carefully figured for publication. 25.7.71 See specimen N. 231

This name anomale has been sent to Prof. Bigsby — In Aug. 76 I found another specimen of this species at Shaft Mountain below Tremont. The upper black shale and the pellucid epidermis is not seen ~~anywhere~~ except the filamentary division of the veins which may be a result of maceration. The veins are distant for three or three, the leaflet as sub opposite curved to the borders especially near the base, as in Neuropteris the borders of veins slightly irregular just as in my figure, longer than lanceolate or oblong, point better. All the characters broad rachis ~~as~~ are the same as in my figure. The substance appears to have been thin. See Specimen No 1560. Sup. 381 (42) In No 1560 the leaflets are still more distant than in my figure

1 Genus Neuropteris. As far as represented by Neuropteris hirsuta Lesq. the genus is remarkably illustrated by the form of the leaves, the nervation and perhaps the fructification by Gymnogramma tomentosa, Dev. of which I have a specimen in my herbarium (G. 213). The form of the leaflet is that of Neuropteris hirsuta. The terminal leaflet is simple lobed in the middle, with the upper pinnule adherent to its base; the upper leaflets are entire then in descending undulate, then round lobed toward the base which is cordiform, then with two round leaflets at their base. The surface is as in N. hirsuta marked with short scattered appressed hairs, and the veins which were toward the border in nothing or in the same Neuropteris near or the lower side the sori along then all over. The surface thus representing exactly the inflated appearance of the veins or sori in some species of Neuropteris, and which Brongniart supposed to represent fructification. There is the marked difference however; that the leaflet or pinna below long petiole in descending being sessile only at the base of the upper or terminal pinnule. See on the subject Brongniart. Grand Eury mem.!

(2) Neuropteris anomala, Lesq. Describe another Neuropteris crenulata from the same locality, Sharp mountain below Tremont. Sp. 1565. represent this species still under a different form. It is a pinna, 12 cent. long, narrowly lanceolate in outline. Terminal pinnule 5 cent. long, narrowly ovate-oblong, narrowed into an slightly obtuse acuminate and narrowed also in the same degree to the main rachis, with borders undulate, lateral leaflets turned upwards and covering the rachis by their base, linear-lanceolate obtusely pointed, narrow, a little more than one cent. broad, comparatively long, the upper ones three cent. the lower ones about five, all undulate upon the borders, even undulate lobed toward the top, as seen from a detached leaflet at the base of the pinna. In this specimen the veins are distinctly seen, forking once or twice, generally formed of two thin parallel filaments which however in some part of the leaflet diverge and divide forming a kind of anomal nervation like that marked fig. 1a. This species appears somewhat related to Neuropteris Aquensis. In specimen 1560 the leaflets are very open, nearly in right angle to the broad flat regularly linear rachis 2 cent. broad at the base which is slightly enlarged on auricle on the lower side, seventeen millimeters broad at the point where they are bottom six centimeters from the base. They are thus nearly linear or very gradually narrowed upwards, the borders slightly irregularly undulate-crenulate, the crenulations scarcely distinct the midrib thick and enlarged at the base and in some leaflets thickened toward above the middle while in other it is (the midrib) not visible at all being flattened and its place marked by a few parallel veins.

3 Neuropteris auriculata. Bry. A small specimen No. 343 is exactly the species as figured in Germar Pl. IV. the upper part of a pinna with very thin veins, fruit!

4. [illegible]

381.6 Neuropteris fasciculata. The creasing of the leaflets along the medial nerve appears to be a permanent and valuable character of this species. Specimens N 207, 208 as N 127 are referable to it. His ~~accurately~~ the species which I have named N. lisa in the Penn. report. At least ~~[illegible]~~ ~~[illegible]~~ it is comparable to it by the splitting of the leaflets along the medial nerve. But it differs much by the more closely approached thin reinlet. N. 197 though obscure is also probably referable to this species as also N. 203. N. 137 though indistinct. N 177 U. S. F. fl. 91. fig 10 might be also referable to this. But the veins are not as distant and the leaflets are obtuse. (28.6.71) In leaves of medium size the veins count 60 to 64 at the borders with N. obtusa deprecus var. ined. The veins and reinlet are very thin not inflate, the epidermis also meet thinner generally equally adhering to both sides. Specimens of N. obtusa deprecus with hairy surface have thin pinna and veins as those of this species. But in N. obtusa deprecus the medial nerve is marked by a broad flat ribbon as to ascending to the middle or the 2/3 of the leaflets while in this species the medial nerve has a thin split in the middle of a broad depression and ascends to the point. The absence of hairs is also a marked character 22.7.71 referable to the species N. 381. 382. 383. 384! 385? this last Cyclopteris obliqua.

For division of the upper or terminal pinna and rachis, compare Pteris stenophylla of what I have specimen in my herbarium.

I 2 Cyclopteris (Neuropteris) trichomanoides Brgt. (Ma. 24.) Leaflet nearly round in outline, equilateral and emarginal cordate at the base (base desbroyeri). Veins flabellate very thin and close, sharp, nearly straight and scarcely curving in fanning to the borders where they become so thin and close that they are obsolete or scarcely visible. No species agree with this except the one described by Brongniart under the name. This nearly 7 mill. wide both ways. In Brongniart's figure the veins are not fasciculate toward the base as other species of Cyclopteris. It seem referable to an Odontopteris. Its substance and opaque surface being like that of O. squamosa when deprived of its epidermis. ~~compare my figures of this species and in my notes on it~~ (see below 2a)

I 3 Cyclopteris? obliqua? Leaves large oval obtuse 6 cent long 4½ to 6 cent broad, unequal at base, prolonged on one side into an obtuse auricle as in C. obliqua, Brgt. the auricle however descending less, and both sides recounding the round point of attachment of the leaflet. Veins very thin but distinct and somewhat distant inflated and fasciculate toward the base, curving to the borders. Substance of the leaf (thickness) and surface polished. Apparently referable to Neuropteris tenuis or Cordata very probably Cyclopteris obliqua Brgt.

II Neuropteris fasciculata. N° 1628 & 1628b counterpart. These large specimens of leaflet with distinct reinlet very close near the borders, a very thin midrib right. I think to be referable to N. fasciculata. Comparing them I find the same characters of nervation as marked above and a small leaflet N 1629 show the very unequal base prolonged downward on one side in a broad auricle like that of 1628. N° 1630 seems also this same.

I 2a Cyclopteris trichomanoides? Brgt. Mansfield has many specimen referable to the species described above under this name. I have figured. Ma 227. The largest leaflet 8 cent broad 6 long or from base to top. The veins at the borders are 140 to 50 per centimeter; no species except perhaps N. indavis has so close veins. Another leaf 7½ cent long 6 cent broad deeply cordate at the base, seemingly attached to the top of a striate short rachis has the upper borders undulate and somewhat split as in Brongniart figure and also as in the figures of Penn. Report Pl. IV fig 19. But the veins are less fasciculate at the base. The characters agree with those of Brgt species. In the last specimen the veins are very distinct

and their species.

1. Talaeopteris Schimper. Syn: Cyclopteris Göpp. Adiantites Brgt. Noeggerathia Sterg.
Frons bipinnata, ambitu late ovato-lanceolata. Pinnulae obovatae et obovato oblongae, inaequilaterae, basin versus sensim in pedicellum brevem subdecurrentem angustatae, singulae in rachi primaria pinnis interpositae, integerrimae vel (aetate?) margine plus minus lacerae. Nervi complures, e rachi egredientes, repetito dichotomi, suberecti ramulis pertenues numerosi. Pinnulae fertiles in medis pinnis dispositae, valde divisae sororum fasciculos numerosos pedicellatos in nervo primario excurrente gerentes, sori disciformes bivalves? (see p. 475) Le genre Noeggerathia tel qu'il est caractérisé par Schimper (Hist. veg. vol. 2 p. 129 est fort different de Talaeopteris. Lauriente supposite ency. p. 1000. As for the genus Cordaites Ung. Schimper places it at the end of the Cycadinae in figure inscribed under the name of Cycnostylum Brgt. with synonyms: Diplotheca Kurt. Noeggerathia nonnulli, Cordaites Ung. after description of the genus see vol 2 p. 190 Schimper remarks that the place of this vegetable has not as yet been fixed.

1. Talaeopteris hybernica (E. Forbes) Schimper veg. foss. p. 476 refers to this species Noeggerathia obtusa of the Geol. Report p. 854 Pl. 1. fig. 10 & 11. Not in the case of it is right. Noeggerathia minor loc. cit. would be referred to the same, the specimen which bears both species upon each surface, having had a pinna with leaflets intermediate in size to both. The description in the Geol. report is good but may be modified by Schimper. Our species are badly known and represents and should be worked for carefully 26.7.71. B.16 is a number of specimens which bring results tinct appear to represent the same species. The leaflets are cut in lobes or pinnae sections at the top. I cannot consider our American species as identical with Schimper species. It differs in many points specially the rounded enlarged top of the leaflet as especially marked in the specimen figured by Dawson in his manual.
Or Palopteris Ovacy see p. 454.

2. Lescuropteris Schimper Pal. veg. 1. p. 465. See for description of the genus and of the species Lescuropteris Moorii Schimper loc. citato. The author places it after Odontopteris. My specimens are placed in the last drawer of the Neuropteris p. 69.
Dr. Wm. Brown

3. Goniopteris Sch. Pal. veg. 1. p. 541. After his description the author remarks on the absence of fructification and on the impossibility of establishing characters from the fructification &c. saying Cet ouvre le nervation seule qu'est nous guider. Je avec well preserved fructifications of Goniopteres emarginata. The sori are open without apparent indusium formed of sporangia capsules of seeds placed star like around a central circular point slightly elevated and the capsules round oval form a conical sorus in six segments. The form of the seed capsules should be studied with the microscope. These sori are placed in regular order on both sides of the medial nerve forming two parallel rows of 6 each or more which fill the whole space between the border and the medial nerve. The sori are each placed upon the division of the nerve or one of the veins!! and not between. Schimper says in describing the division of Goniopteris desmopteroides: Soris nervulorum medio incidentes rotundi. In echantillon fructifer show the same form and disposition of sori both in G. conifolia & G. emarginata. 6.10.71.

Goniopteris emarginata [illegible] of this species, [illegible] that [illegible] Pecopteris unita Brgt. [illegible] specimen represent the genus with [illegible] the sori [illegible] the hairs are straight to the border [illegible] while in ascending the [illegible] or most always or upon the large specimen of New York the various forms of this species are seen together. Prof. Mayo [illegible] specimen [illegible] 235 [illegible] terminating [illegible] by two entire [illegible]

four and a half cent.

cent.

(Sup. 469 fig. 1)

Adiantites. Schp. Adiantites Auct. Frond simplex, pinnata, bi & tripinnata. Pinnulæ basin versus sensim angustatæ, oblongo-cuneatæ vel flabelliformes, integræ vel subdivisæ, pro more tenues; nervis numerosis, e basi divergentibus dichotomis. Schp. Veget. Pal. 1 p. 424

1 Adiantites nervosus (Brgt.) Schp. Fronde bipinnata, pinnulis obovato cuneatis, subintegris vel vix bi-trilobis, obtusissimis, nervulis flabellatim dichotomis, numerosis, approximatis, distinctissimis. Vg. Foss. p. 124 tab. 56 fig. 2.

To this species, I refer without doubt the small specimen O 41. This burnt branch of Canny Coal 1 B of Ill. Geol. Rept. I agree in toto with Brongniart figure and description even the form of the rachis i.e. large on specimen shows only two leaflets one of which is divided at the top in two lobes by emargination. 26. 7. 71.

2 Adiantites Theniformis Sp. nov. Frond tripinnate secondary pinnæ short, tri-quinquefoliate, distant, attached to the main rachis by a long smooth narrow winged petiol. rachis inflated in the middle, smooth. Pinnules alternate distant, obliquely attached to the rachis by a short broad pedicel, varying in form from obovate or theniform to broadly cuneate; terminal leaflet larger, obovate very obtuse sometimes cleft or emarginate at the top, sometimes merely undulate narrow at into the top of the secondary rachis. Nervs flabelliform from the base, dichotomous thin, numerous and distinct. Schimper does not mention the species but I figured and described in the Geol. Rept. of Cum. under the name of Nevropteris Bockschiana Gopp. I think therefore that it is a distinct species and should be referred to this genus Adiantites though we have two leaflets apparently terminal: B 18 & B 19 which have a deltoid form, being elongated upward to an obtuse point and tapering downward from the enlarged middle which by form and nervation are referable to species of the genus Palæopteris. Good drawings should be made of this species. Specimens B & 12 k. Image this last has longer narrower leaflets merely oblong or oblanceolate and in showing slightly bifurcate small terminal pinnule should be referred to this species. 26. 7. 71.

3 Cardiopteris Mach. Gopp. Appropriate plate & fig. — Complete specimen from Mazon Creek S. 001. Note the footnotes here with particular reference to the venation & figure except that the leaflet is not [illegible] and united! i.e. from comparison of our specimen in the parts. Doubtfull.

This is much like Sphenopteris mysta. May be the same. But Goppert's species has no trace of nervation. Schimper does not describe it.

not gonopteris

hemidelvide?

upon the veins as marked at Newport

Other specimen

near the base, with denticulate with the median nerve, with round

upper part of the pinna

of the midrib in other the leaflets are contiguous or separate, in some instances of the report the borders are not visibly serrulate or at least not so visibly as in the figures which were made from specimens at Springfield. We have only separate pinna. These are long and [illegible] flexuous

A very fine pinna from ~~Mapo~~ ~~Creek~~ Mooris on dials 1.250 represent the two forms figured in the Geol. Rep. of Ill with leaflets contiguous or separated and in this case united by the base of the leaflet decurrent and forming a border or margo along the rachis. In this specimen the secondary pinna nearly perpendicular to the main rachis (marked with points or dotted) or turned upwards are flexuous and long with parallel to the leaflets which are short but of the same width, borders slightly serrulate. I refer to the same

species two specimens F 260. representing the point of a bipinnate frond or part of frond. Triangular in outline tapering pointed; primary divisions slightly turned upwards on a comparatively broad pendulat rachis; lobes or leaflets oblique, oblong enlarged at base and united, decurrent obtuse pointed with nervation same as in F. 259. When the leaflets are disconnected at base, they unit by a decurrent border. 24.10.71.) See below. (?)

2. Alethopteris Crenulata. I have reviewed this species and compared it with all the figures given of Callipteris conferta to which Schimper refers it. Callipteris conferta has always the basilar veins more or less distinctly attached to the rachis, not to the midrib. In our species what however may not be the of Brongniart all the veins even the lower pair are always branching from the midrib. This species has nothing of a Callipteris but is either a Pecopteris or an Alethopteris. The veins as more generally forked from near the base sometimes on of the branches is also forking near the border. I don't have remarked this only upon a specimen with broad short leaflets at 142 of the Agassiz Museum and this forking double is only at one place in a pair of veins and near the point of the leaflets. It is certainly a good species. However the specimen remarked upon p. 352 (3) as P. crenulata N° 259 appears to be a mere form of P. oreopteridis. It is a segment of a pinna on side of which only is seen. Ultimate pinna somewhat flexuous long nine centimeters leaflets short, oblong obtuse joined at the somewhat decurrent base with the terminal pinnule short obtuse. Seem to be P. oreopteridis Brgt. but the rachis is very thick costulate. F. 260 is a fructiferous part perhaps referable to the same species.

3. Goniopteris sp. nov. fig. 2 Pl. LVIII (previous) fig. 1.c. a small branch or linear pinna with short obtuse leaflets turned upwards divided to near the slightly decurrent base with thin midrib and veins either simple or forking from above the middle and turned upwards. May be described by author? Specimen 49 of Gibson. Spring Creek. Ill's (in Lowe Catalogue)

572 Dendl.

[illegible] F 50 (2) and to of 353. The terminal ultimate [illegible] separated, linear, pinnules oblong or linear obtuse 6 to 7 mill. long connected [illegible] Elephant in Al-Lacie collection. [illegible] eight to 12 cent., width 8 to 20 mill. There are all about [illegible] the point of a small obtuse leaflet [illegible] proximately slightly oblique open, [illegible] rachis; 2.5 mill. broad either [illegible] on the border [illegible] or repeated to point [illegible] veins 6 to 12 [illegible] small [illegible] order [illegible]

L 1 Goniopteris ~~[illegible]~~ obtuta (may change name) Lacer spec. 685 a L 68 Here fragment of a pinna, one lanceolate to the point. The other fragment matching the bar of a pinna linear; pinnules open, nearly in right angle to the rachis, the thick coriaceous 8 to 13 millim. long 5 to 6 millim. broad, oblong obtuse some of them narrowed to the bar and oval sometimes ~~per~~ connected along ~~near~~ on the borders, all united at the base to near the top, some of them discovered all along midrib thick or broad flat, ascending to the lateral veins 10 to 14. thick, in acute angle to the midrib, curved, winged not straight, parallel, mostly simple in the largest leaflets, the two lowest ~~pair~~ forks once ~~first~~ ~~out near the bar~~ the middle. The appearance of this specimen is far different from that of the two other specimens and rather recall the forms of Callipteris of Europe, only the veins instead of being curved outside, are distinctly curved inside in the large leaflets, and nearly straight but in acute angle to the small ones. This fine species with thick coriaceous leaflet is from the Carboniferous of Pittsburg (not figured). The veins from the thick midrib are 12 to 15 pairs, those of the upper half of the leaflet very distinctly curved inside, those of the other or lower half more straight. The figures are good representatives of the two specimens seen.

Our specimens in Museum except Calamites gracilis Lesq in Rep. (vol 4 p. 436, Pl. 3, fig 5 med) do not show any difference from the European species & have admitted Schimper's species as marked in his Pal. veg. page 312 & 314

1. Calamites Suckowii Brgt, the most common of all in our Coal measures. The bark is thin very narrowly striate, as also the under surface; at least sometimes so the costæ are broad and flat, the articulations sometimes quite near each other. We have of this species among numerous others one splendid specimen which comes from Mary creek. It is flattened to about two inches, is 4½ inches wide 9 inches long with articulations scarcely 2 inches (two) distant, costæ 3½ mill. wide with large broad oval scars of leaves. The coal surface is a little thicker than in the generality of the specimens but not as thick as in another specimen of ours C 42. which has its surface coal bark about 1 mill. thick. For this reason I think that this specimen which is evidently the representative of C. nodosus Brgt Foss. Fl. Pl. 23 fig. 3 can not be referable to C. Suckowii though Schimper considers it identical and that C. nodosus Brgt is a good species. The space or sinuse between the costæ is concave and as broad as the costæ on which in C. Suckowii the sinuses are very narrow. The coaly surface is like the under surface narrowly striated and the articulations are variable in distance as in Pl. 15 fig 1. of Brongniart (see Grand'Eury p. 14).

2. Calamites Cistii Brgt. difficult to separate from the following species. Perhaps in my specimens none of which is too good some may be referable to C. dubius Brgt. Generally the striæ are narrower more equal and there is no trace of scars of branches but the articulations are (see Grand'Eury p. 19).

3. Calamites dubius Artis. The finest specimen of our Calamites represents this species (C 61) is 3 feet long scarcely one inch in diameter at its base 3 inches at the upper part where it is broken nearly cylindrical or scarcely flattened gradually tapering upward from the base where the articulations are the 1st 1 inch then the 3 following each 1¼ inch wide the 5th less than ¾ an inch and above this about two inches distance till to the upper one where they abruptly narrow to 1 inch and the last where the specimen is broken to ¾ an inch. The articulations are therefore most variable in distance and in this species at least the stem is not a curved rhizome but true erect stem without trace of roots which base is not ½ in diameter as it is three feet above. The surface coaly matter is thick varying from 4 to 5 mill and is narrowly striated like its under part or the surface of the internal mould as Schimper will have it. I have not in the Museum the specimen on which I made Calamites Sedriatus of the Geol Rep. of Penn. p. 850 Pl 2 Fig 1. It is probably belongs to this species or to C. Suckowii. Any how the species can not be preserved, no more than C. disjunctus Lesq loc cit Pl. 2 fig 5. See for C. dubius described in Schp. Veg. Pal. p. 313.

4. C. approximatus Schl. We have only three specimens of the species which is rare in our American Coal measures. At least I have scarcely seen any in the collections which I have examined.

5. Calamites Cannæformis Brgt. including C. decoratus Brgt is represented by numerous good specimens. Schimper does not mention either as synonym or as species C. pachyderma Brgt. We have one fine specimen with articulations 9 inches distant, 5 centimetres wide, coal bark as thick which agrees exactly with the description of this species by Brongniart Foss. Fl. p. 132 Pl XXII. It is to be remarked that our specimen indicate the nodose form or inflated articulations as in his C. nodosus which Schimper unites to C. Suckowii and which for some of its representatives like this one would be united to C. cannæformis (see p. 312 fig 3)

6. Calamites gracilis Lesq. as described in the 3d vol of Rep. P. see above is a good species. Though no trace of sheath can be observed at the articulations, these are marked as in calamites by very small nodes or indications of attach of leaves. The stem is very narrowly and equally striate as in some stems of grass. The articulations do not vary much in their distance which is about 1 inch. Stem exactly 5 mill wide 14 inches long. (31. 5/72).

Pres.

Le musée possède dans les nodules de Mazon creek un nombre d'échantillons contenant seulement le diaphragme des spores & parenchyme. Il y en a cinq dans lesquels le diaphragme est représenté à partie centrale perforée comme Lindley & Hutton l'ont vu. Le diaphragme persistant mince a peu près un demi millimètre d'épaisseur de consistance spongieuse, apparaissant comme percé de pores ou petits trous comme l'indiquent une substance cellulaire. L'épaisseur de ces tissus bien sur le diaphragme & pores de diamètre of the specimen C. 43 which is broken in three pieces. The like the other specimens evidently show that the stem was hollow. The base of the ribs which cover to the diaphragm is perfectly well preserved and open on specimen C. 72. part of the stem has been broken, crushed upon the diaphragm which is distinctly seen through the thin substance of the stem. Another specimen C. 59 is still more instructive. By compression the stem has been so to say disarticulated. the diaphragm resisting the pressure is left about horizontal with the border and branches of the stem is attached it on one side. The upper border per contra has been flattened and compressed to the internal part of the diaphragm and thus the whole circumference of the stem is apparently meshed  in this way the diaphragm in a is seen of the spongy appearance remarked above.

1. Calamites & Calamodendreae, see. Bryt. mem. in Grand Eury p. 7 on the difference and character of their vegetable remains.

2 Calamites undulatus Bryt. as Schimper remarks, this form is a mere var. of C. suckowii. I have numerous specimens from Aldrich Montevallo mines Al 17-21 which are undulate on one side and straight on the other. This however do not explain the cause of the undulations for if it is as Schimper says by a mere vertical compression, both sides of the flattened cylinder should be equally undulat. - In this case the epidermis is preserved by a shining coating of coal showing the costa to be obtuse and very thinly striat. The specimens bear traces of branches and are distantly articulated. In vol. III. p. 455 Schimper considers the C. undulatus from Arkansas as syn. of Bornia radiata et d'après la figure et la description qu'il en donne il faudrait rapporter tous les échantillons à peu près qui ont été rapportés du sub carbonifère de l'Alabama les échantillons se distinguent par l'absence de tubercules aux articulations, le grand variété des côtes which are very thinly striat and generally covered with a thin coating of polished coal. Many specimens are undulate as in the Arkansas figure of C. undulatus. Some have the costa less than one millimeter broad while others have them as broad as those of C. gigas Bryt, a small specimen from Helena coal mines having them 6 millimeters wide and undulate across under the pellicle of coal like the specimen from Arkansas. This can not be considered as a character for in some specimens from the Woodworth mines, the costa on one side of the specimen are ~~broad in the length while they are~~ closely joined but distinctly linear in the length while on the other they are wrinkled crosswise as in the Arkansas specimen. They have generally a tendency to undulating but only on one side. This species differs from C. suckowii by distant articulations and absence of tubercules. It however bears traces of branches at the articulations, small however like those of Calamites cruciatus, Bryt.

see for Calamites p. 371 for Calamodendron & 370 for Calamostachys

Antholithes Pitcairnia Ld & Hutt. The museum has numerous specimen of this species especially two nodules Di 94 & Di 95. representing a narrowly striated stem 3 millim wide, bearing on the axil of a long linear leaf like bracte with a prominent medial nerve alternate or opposite oval fructifications apparently formed of a number of foliules folding upon each others and containing seeds. They seems at least indicated by irregular intervals which are seen in the internal part of the horizontally broken ovules. I think that by cutting and polishing these ovules can be studied and their internal composition recognised with the microscope. I can not compare Lindley with these specimen but they appear to represent the same species. Di 76. & other specimen from Gomroy show the ovul as surrounded by pointed scales the points departing the ovule. A very fine specimen Di 92 of apparently the same species and upon a nodule from Maya creek show two kinds of cones just like what I have named in this vol. Strutzia bracteata P. 427 Pl. 21 fig 6 to 9. The kind has longer pedicel with apparently a single oval lanceolate obtuse ovule sustained upon a long bract. the other bears short pedicelled ovate cones with imbricated ovate truncat scales. It is the same species as the one represented by the other specimen and the Strutzia of this vol is probably referable to it. I find nothing in Schimper in relation to this. He puts Geinitz Schutzia vol 2 p. 355 in the Genera incerta affinitatis of the Conifers. and quoted as synonime Antholites Zamites of Hackyopitys. see Pal. regetl. p. 360)

From the observations of Grand Eury and of Goldenberg (see Schp. reg. Pal. p. 562) the Antholithes are the flowers of Cordaites. See also Brongniart on Grand Eury p. 14 & 15. (1)

2. Antholithes Pitcairnia Ld & Hutt. is represented perfectly identical in three branches specimen of Lacue N. 251. 252, 253. They exactly agree with Ld. & Hut figure

Araucarites.

1 Araucarites spicæformis. Germ. Pl. 33 fig. 8. We have three specimens Di 2 which represent this species but though the specimens are better than those figured by German, they do not positively show if the division of the branches are opening pinna of fern or filaments as figured by German. The secondary pinna in one specimen have still a [illegible] and rather seem referable to some fruiting fern.

Tycnophyllum Brgt. Cordaites,
Flabellaria Stern. Noggerathia nonnul. Cordaites Ung.

1 Tycnophyllum angustifolium sp. nova. Foliis spiralites trium dispositis, elbas dilatata linearibus, tenuim angustatis, inflatis, subcylindricis, angustis elongatis acutis integerrimis, nervis continuis, distinctis parallelis, simplicibus.

This species is far different from any other described by its narrow leaves, not broader than 6 mill. often narrower, attached like cordaites in a spiral position around a narrow stem 1 cent. ~~mill.~~ wide slightly ~~enlarged~~ narrowed at the point of attachement either exactly linear or gradually tapering to a point. The parallel veins are comparatively thick, distinctly marked, ~~nearly~~ as distinct as in Cordaites borassifolia but ~~not half as~~ more distant ~~and not equal~~ 4 to 5 in one millim. varying in thickness. It is a true Cordaites, with the epidermis undistinctly marked by striate parallelpiped cells as Schimper describes it which by the mode of attachement of the leaves especially much differs from Noggerathia palmaeformis Gopp. The museum has many specimens from Cottville and other places. The texture of the leaves is hard and the leaves as seen in spec. Di 6 appear to have been subcylindrical their print in the shale being always concave and their ~~[illegible]~~ transverse breaking looking like a flattened cylinder. Some leaves of this species less than three millim. wide with same nervation & consistance appear like glumaceous leaves and this appearence is the more striking that some of them are horizontally marked as by the articulations of the sheaths. This appearence is due to irregularity of the stone and may perhaps not be of a true organism. The specimen Di 6 has not stem, the leaves appearing as forming a bundle of top leaves and diverging from a centre ~~up~~ in all direction. Di 96 from Morris has the stem and leaves as described here. Its leaves are more flattened than in the Cottville specimen, but the characters are alike. Di 6 b. shows the appearence of articulations like sheaths while Di 6 c shows the enlarged base of a leaf at its point of attachement.

2 Tycnophyllum angustifolium Ligg. Di 5: is a remarkable specimen and certainly referable to this species. It represents a leaf of the same consistance, same nervation as the former linear, longitudinally split in lacinia 4 to 5 millim. wide, parallel, the splitting being irregular or at some place, the lacinia uniting again upward or downward and being wider or narrower sometimes like a mere thread. Near the base one of the lacinia separates from the leaf or compound of leaves in a short linear, obtuse tongue, a kind of division which appears anormal or merely casual. This is an as yet unexplainable form of probably this species which after all may belong to some other kind of vegetable as Tycnophyllum. Di 4a shows the species also with that peculiar division by splitting. It represents a narrow leaf, not 3 mill wide enlarging upward as if unfolding a cylindrical leaf and separating by split and as by crushing in four or five lacinia one of which is as large as the ~~base~~ whole leaf at its base. It is undoubtedly division as also the appearence of the sheaths or articulations is seen also upon Noggerathia palmaeformis ~~not~~ as figured by Geinitz, Pl. 22, fig. 7.

3 Noeggerathia palmaeformis Gopp. I refer with some doubts to this species as figured in Geinitz loc. cit. Specimen Di 92 from Mayo Creek & Di 47 b from Cottville. The nerves are more obscure, covered by a thicker pellicule, more equal and equally distant. Geinitz says that the substance of the leaves was thin. It appears indeed thinner or at least not as hard and siliceous as in the former species. The leaves are broader fasciculate, enlarging in ascending. In comparing this specimen with the former I find that it is not a true [illegible] specimen on account of the consistance of the veins which are not all parallel.

Cordaites gracilis.

4 Noeggerathia palmaeformis? Sp. ? Lesq. ? Lesq. ? the specimens Di 4 which are of the same plant are referable to this species. The leaves are attached in spiral to a stem 1 centim. broad; narrowing at the point of attachment. one centimeter broader above the base enlarging upward to twenty two millim. and gradually decreasing upward to an obtuse point, perfectly entire, marked by distinct, parallel equally distant veins ½ a millim. distant with surface marked by parallel per areolation or reticulation. For the width of the leaves, the distance of the veins equal and parallel, this form agrees well with Flabellaria palmaeformis Gopp. But in our species the leaves are narrowed to a point at the moment and not linear as described by Goppert. The species may therefore be considered as different.

5 Noeggerathia Crassa Gopp. Our specimen Di 32 from Mazon creek agrees in toto with figure and description of Goeppert Uebergangsz. T. 220 pl. 40. I have sent to Brgt. the counterpart of this specimen. It shows a large thick somewhat cylindrical leaf gradually enlarging upward doubly striate, with striae irregular in size somewhat resembling a stem or Calamites in the striae also vary in distance. The specimen bears also Cyperites ammonis. The leaf is 3 centim. wide at base and more than 7 cent. at the upper part where it is broken. The preserved part is 20 cent long. Its base is depressed into the stem looking as if attached to a stem.

6 Cordaites Borassifolius Ung. Gen & Spe. To this species, I refer large linear leaves obtusely pointed? split or entire at the point, 7 centim. broad apparently very long with parallel nerves, irregular in thickness, close to each other 5 to 6 or more in one millimeter and marked across by parallel per areolation. The species exactly agrees with Schimper's description but Schimper says nothing of the number of veins which is far greater than in No. 4. This species is easily known by the size of the leaves, the closely approached and irregular veins. Specimen Di 9 seems to be a crushed leaf of the same species or rather of (see 8) ? 36 (1).

7 Flabellaria principalis Germ. It has the same nervation as indicated in Germ. figures 2 & 2a Tab. 21. and like the same fig. 21 is enlarging upwards and splitting in lacinia. The veins are generally of two kind, primary ones about 1 millim. distance separated by 3-4 intermediate thinne veins. They are however irregular and often become indistinctly meared. The same differences seen in the veins of Noeggerathia Crassa; but the primary veins are twice as distant.

4b. Two specimens Di 18 are apparently at least by the distant veins referable to this species. The leaves however appear narrower and linear and the primary nerves separated by narrow veinlets. The specimens are too obscure for determination.

8 Flabellaria? a broad linear leaf of somewhat thick, 8 centim wide with parallel distinct well marked veins irregular in thickness 2½ per millim or 6 in two millim distance. Referable to Cordaites borassifolius; but the veins are more distinct and more deeply marked. The areolation parallel per pedal is marked.

9 Cordaites with narrow leaves. See Cordaites Grand'Eury Lea Houillère and Campbell on this Pal. world. p. 13 (1).

10 Artisia or Sternbergia. See Brongniart on Grand'Eury p. 13 (2).

Most of the species of Cordaites are referable to the genus Dicranophyllum Dbr. The observations of Brongniart upon this genus are repeated still more clearly in Rep. Pal. vol III p. 560.

See p. 478a

1 Cordaites Borassifolia Sternb. Ma. 90. two specimen from Mansfield represent this species as described by Corda. One of the specs. 90: has the base marked with radular punctiform small scars as indicated as characters of the genus in Schp. Vez. Bal. p. 561.; the point of the leaf represented by another specimen is split and obtuse; the veins are generally as indicated by Corda primary ones more marked separated from their, but in the same leaves and under the thin epidermis the veins appear all equal. The primary ones being formed of a fascicle of two veinlets which after erosion of the epidermis appear as separate veins and of the same size as the intermediate one. The distribution of these parallel veins present however a great deal of difference and variety in the same leaf. The very thin cross veinlets forming the square areolation are scarcely discernable. This specimen 90? present an interesting feature. The leaf is marked with round dots or holes ½ to 1 millim. in diameter appearing like sphaeria. These are produced by small balls of clay iron for they appear profusely on both sides of the leaves, upon the naked stone as interposed between the layers wherein the leaf is preserved. (See p. 420)

2 Cordaites ~~[illegible]~~ borassifolius N. 1 of 1.359 is apparently the species described and figured by Dawson Dev. plants p. 44 pl XIV, fig. 164 under the name of Cordaites spec.

3 Cordaite N. 407 p. 360 is from description the same as I have seen at Morris (Oct. 67.). The leaves are comparatively short, narrowed from a round a very obtuse somewhat inflated point to the base 1 cent broad, while at the point it is 12½ millim broad with longitudinal lines distant, obtuse and comparatively broad.

4 Cordaites gracilis. Sp. nov. Stem slender elongated, (the specimen I have received from Morris, L. 1607) showing a branch or stem, 17 centimeters long, eight millimeter broad at the base and first at the top. This stem or rachis is covered by a thick pellicle of coaly matter one millim. thick about whose surface is regular punctate as also but less distinctly the subcortical surface. The bases are close, all around the stem distichous by compression alternate the upper ones three millim. distant on the same side, or one and a half millimeter between them, sessile by a slightly narrowed short pedicelled base, either in right angle to the stem or turned backward from the point of attachement narrow, four millimeter broad above the point of attachement which is only two and a half millimeters broad, in clasping half the stem; enlarging very gradually towards the point where they are just one cent broad. They appear short. The preserved entire is 9 cent long only and obliquely at the top and there slightly reflexed. They are generally covered of a coaly epidermis which however is easily separated. When surface is very closely, narrowly but obscurely lined, the lines about equal; but under the epidermis the venation is more distinct and visible. The medial veins being distant nearly one millimeter separated by ~~[illegible]~~ thin ~~[illegible]~~ thin very close veinlets, and regular across. The obliquely truncate leaves at the top may be considered as a character of this form which, by the size of the leaves separated by veinlets seem to represent the fragment figured by Dawson Dev. plant p. 47 pl XIV fig. 165 which is merely named a form of Cordaite. The obliquely truncate point is slightly obtuse. Comparing this to Cordaite angustifolia of Dit. the specimen with stem and bases [illegible] show the stem and leaves narrower by one half the venation primary less distinct in the upper part and in the decorticated the primary nerves less strongly marked, not as distinct ~~and~~ with ~~one intermediate veinlet while in that form~~ see correction 534 (p. 478) ~~there are two or three~~. The venation across about the same as the primary ones.

Note of specimen 90 which is in this new mode modified merely by equal close narrow lines (not separated) which is the general character of the primary nerves as distinct in this specimen.

1. Brachmannia tuberculata. H. Lea. Descr. Mem. on Grand Jury p. 18.
In the cabinet of J. J. Nicoll I have seen an ova of this species 5 ½ cent long and three and an half broad with an axis apparently narrow.

× 1 Lescuropteris Schp. The genus is well described by Schimper and its place, at least considering its nervation, the forms of its pinnae and their division, is between the Odontopteris and the Alethopteris. To this genus may be added probably Alethopteris Sullivantii, on account of its nervation at least and any how Lescuropteris Pardei described C.B. p. 41 N 155 which has a nervation in perfect concordance to that of Lescuropteris Moorii or half Alethopteris half Odontopteris. For the essential character, in this nervation, the secondary veins, at the base of the pinnules going out of the rachis and curving to the border, the other from a narrow midrib, in an acute angle of divergence, curving toward the border and dichotomous, forking once or twice as in the Neuropteris and joining the borders nearly in a right angle to them. To this genus may be added:

× 2. Lescuropteris Mansfieldii sp. nov. Pinna lanceolate; (the fragment appearing of a pinna is 12 cent long, 3 cent broad from the middle to the base, linear-lanceolate, gradually narrowed to the point, pinnately divided in oblong, obtuse, open pinnules 1 to 2 cent long 6 to 7 mill. broad toward the base where they are joined by a very acute sinus, the borders often imbricating or joined from the middle to the base; left shaped or curved outside middle nerve thin, dissolving below the top of the pinnules; secondary veins at an acute angle of divergence curving in passing to the borders, rarely simple mere generally forking twice rarely more, reaching the borders in right angles to them. Lower veins from the rachis which is narrow and channeled in the middle. This pinna has a remarkable analogy to L. Pardei but differs by its consistence which is thinner and not coriaceous by the thinner closer secondary veins. The difference is not great.

Lepidocarpus Gen. nov. This genus should be preserved for those stems of organism which I have described in the Penn.a Geol. Report p. 876 under the name of Brachyphyllum. By two specimens recently discovered, (August 1876) in Pennsylvania they apparently represent peculiar fruits in long grapes, or cylindrical cones, apparently hard capsules or seed pods containing spores. One species is described in this vol. p. 463 c (18) under the name of Carpolithes imbricatus and is figured in my plates. another is in the Geol. Rep. of Penn: loc. cit. as Brachyphyllum obtusum and one or two others are represented by specimens recently discovered. The character of this genus may be described as: linear, long fruit bearing rachis or receptacle, linear, flat or cylindrical, bearing sessile flattened or inflated and angular capsules, either imbricated all around and covering the axis or placed on both sides and distichous. The species may be named as follow.

1 Lepidocarpus imbricatus? or any other specific name, for the one described p. 463 c (18). See p. 366.

2. Lepidocarpus quadrangularis. sp. nov. Rachis narrow half a centimeter about. capsules sessiles, alternate distichous on both sides of the rachis, inflated, obtusely quadrangular or cubical, obliquely truncate at the outer end, nearly on right angle or slightly turned upwards along the rachis. This which is represented specimen N° 38 of Mr Lorenz of Chestnut Hill, Philadelphia may be a form of the branch which I have described in Penn.a Rep.t loc. cit. as, this being flattened and the capsules compressed or merely representing the fruiting axis with scars of the detached capsules. One branch of this stem with scars all around and compressed flattened capsules on one side, evidently the same species as that Brachyphyllum obtusum is seen of the reverse of the specimen representing Lepidocarpus quadrangularis. by cuboidal distichous capsules.

3. Lepidocarpus pectinatus sp. nov. Rachis flat, and broad 10 to 12 millimeters, obscurely and irregularly striate capsules oblong ovate by their whole bar, short, 7 millim. long. abruptly pointed in the middle, four to five millimeters broad showing by crosscut a flattened rhomboidal form ◇ and contiguous on the borders. The fragment L.e 1564 found at Salem v. of Sharp. mountain near Tremont is very small but quite distinct. The capsules are evidently distichous and placed on the side of the Rachis, one of which only is preserved. These fragments should be carefully figured. Compare to this Brachyphyllum mammillare Brgt as figured by Schimper Pal Veget Pl LXXV figs 18 & 19. Refer to this N° 423 Lacoe. with larger less compressed branch as figured. It may be however a different species much different from the figure

1 Lepidocarpus imbricatus. Sp. Goldenberg pl XVI. fig. 9 has the base of a cone with some likeness to this. The axis is however broader in Goldenberg figure and the scars of the sporange round. P.

Sporocarpes. Genus incert. Agglomeration of spores either agglutinated together without any apparent involucral organism or united by filament or by a band of support in either vertical or horizontal rows. Spores of comparatively large size, discernible to the naked eyes.

1 Sporocarpes nudes. Sp. nov. N 296, 295, 297, 292, 291, 299 of Lacoe specimen. Round or oval groups of sporangia apparently glued together by the borders and therefore of various forms irregularly ignear or polygonal with a smooth and convex surface. No trace of envelope is perceptible around these agglomerations which measure seven to eight millim in diameter. remarkable for

2 Sporocarpes. ingrossus, Sp. nov. 307, 308, 309, 306, 314. Spores agglomerated in an oval group twice as large as that of the former species 12 to 14 millim long 7 to 8 millim. broad, placed lengthwise or in vertical rows, flattened with a marked point or very small nucleus in the middle, with a border raised above the surface which is thus concave. These sporocarpes appear when empty like a frame of undulated strias vertical as in 307.

3. Sporocarpes ~~irregularly~~ undulatis ~~ordinatis~~ Sp. nov. N 301. Lacoe specimen. Agglomeration of spores slightly broader and shorter than the former, nearly ignear. Spores in horizontal rows apparently in the axils of a small scaly sporange. These scales seem to be the sporanges after dispersion of the spores.

Sporangites, Sporochytes & Sporoplegma.

I believe that the agglomerations of spores (macrospores) evidently of Lycopodiaceae species must be generically described as sporangites when the seeds sporophores are of a same form and evidently attached to a support or marked by a point of attachment to it. Sporochytes (σπορος and χυτος adv. vide angiogonen in mem. proceeds) agglomerated generally inordinately without trace of support or covering I have a few of them, and sporoplegma as spores in boxes or baskets for those that I have described above.

4. ~~Sporangites pteris pennatus~~ (?) N 294 This is merely a bracket of Cecropiaceae ~~alternately~~ pennate on a narrow flexuous rachis, ~~inflated~~ in the middle. Four millimeters long, two millimeters broad, ~~truncate~~ at both ends, contiguous by their whole length. Recently ~~a small~~ pennule of fern with the divisions in right angle to the rachis ~~without~~ trace of nerve, inflated and pennately placed. Compare other specimen.

5 Sporangites ? — It is necessary to study these bodies very carefully that agglomerations of small seeds, macrospores, attached to stems like the sporanges of ferns is ~~there~~ in the cod by both our specimens Ma 236, two specimens. One of them has these seeds widely spread and without any apparent order over the shale as this is flexuous. The other has them evidently appendiculate or attached to branches of a stem. This has to be carefully examined. They have the characters of macrospores positively and very distinct. They are clearly visible to the eyes, half to 3/4 ths of a millimeters in the flattened, crowded and empty state in fig. 236. but still showing their original round triquetre form. or when attached to the pedicel globular with ⊗ vertex in triquetre order, just like the spores published by Hooker with the Cones of Lycopodendron N V & G. From this it is evident that these can not be called sporanges. They are free macrospores born either into the cones or possibly at the seem upon racemes. In all the specimens I have of another in glomerules. and figure

(1) Sporocystis planus Ly — Spo. medius p. 367 (1) under N. 239 Lc we have
seen specimen representing this species, but capsules before opening. The capsules are
broadly oval rather round convex on the surface which is irregularly pitted by
compression between the seeds (under of it whose place is clearly marked
by the depression of the surface which is thin specimen). Some of the opened ones
are open the same specimen the capsules which they contain are variable in
size, shape and position resembling an agglomeration of very small inflated
capsules containing seeds? or spores? But in others these capsules are flat
and are figured bearing a central scar surrounding a point

Bornia.

1. Bornia radiata, A good fine specimen from Raint creek represents the species or at least a Bornia as the genus is described by Schimper. The articulation are distant, the ribs comparatively large obtuse like the the furrows between, not deeply marked. The space from the surface to the central axis is two & an half centimeter. The central axis is ribbed like the surface, but its width is not seen as it is broken in the length parallely to its border. The widest part seen is 8 millim.

There is in the cabinet of Mr Lacoe 14 80 a subconglomerate representing a splendid branch 14 cent long, 5 mill. broad, with articulation 2½ cent distant bearing 30–40 linear distinct leaves less than one mill. broad. 6½ cent. long straight very oblique sometimes curved inward but not much, that reach round a dendriculate exactly resembles the figure 8 of Bornia radiata given in Schimper Atlas pl XXIV, the leaves appearing also united or approached by two together at the base. I have no doubt that it answers to the same species.

Calamostachys.

Calamostachys tijpica. Schp. I p. 328 Cda Wollmannia gracilis Hs II. p. 53. Pl. XV f. 1-3. Stems branches flattened. half a centimeter broad distinctly regularly striate with flat slightly linear comparatively broad costa articulations a little more than one centimeter distant, not strangled or contracted nor inflated. leaves open somewhat curved inwards narrow one millimeter, nearly flat or slightly convex with the surface opaque without trace of medial nerve three centimeters long not numerous 16-20 in each verticil gradually narrowed to a slightly obtuse point. Fructifications of the same character, articulations 2½ cent distant. with spikes in verticils stipes born upon a short pedicel, scarcely two millimeters long cylindrical half a centimeter in diameter, seven centimeters long bearing on the axils of verticillate leaves oval sessile nutlets two millimeters long, nearly as broad, broadest toward the apex; space between the fructiferous verticils 2½ millimeters. Leaves (fructiferous) open at base, curved upwards, for the base enveloping the nutlets half centimeter long linear lanceolate, gradually acuminate, nerved. The branch which is inflated at its base, point of attachment to the stem bears one dozen or more of these fructiferous spikes those of the base apparently distichous on one both sides of the branch. The intermediate one seem to destroyed or attached to the counterpart of the stalk. The scar of the point of attachment of the ears is distinctly seen upon the articulations corresponding with the costa 3-4 upon the upper surface between the base of the preserved ears

1. Calamites approximatus Schlott. A fine specimen in J. F. Mansfield collection Ma 51. represents a stem only 3 p cent broad with articulations 2 p cent distant toward the base, four cent in the upper part; inflated at the articulation which are slightly marked and covered with the striæ, marked upon the articulations by broadly oval or rather round, enlarged in the side O scars of branches or leaves placed in quincunx or in the line & separated each by one articulation ∴ These scars are 8 millim broad and 6 mill high. This form exactly agrees with Schimper description Pal. Veg. 1. p. 314 and also with that of Geinitz Kent. whose fig. pl XI fig. 3 has the same characters as this fragment. This is Cal. cruciatus Brgt. Cal regularis Kent. who has also a good figure of the species. The specimen might be figured. But a note on the different characters may be sufficient see p. 314

Grand'Eury describes merely as species well known C. Suckowii, C. Cistii, C. Ramosus, C. Cannæformis and as species imperfectly known or doubtfull. C. gracilis, Weiss. C. Gigas Brgt. C. pachydermus? Brgt. C. anceps Weiss. Note that the last specie seem to be identical from Weiss fig. Gl. XIII & XIV.

Schimper describes 1. C. Suckowii Brg and as syn. C. commune, Ett. C. ramosus Art. C. nodosus St. C. carinatus, St. C. inflectus, Gutb. C. æqualis St. C. undulatus St. & Asterophyllites foliosus (kind) Gein.

2 C. Cistii, Brgt. without syn.

3. C. dubius Artis very closely allied to the former merely differing by the sulcus costis interpositis, lineatis.

4 C. approximatus Schlott. with syn: C. regularis, cruciatus, ornatus, Bronzniart C. cruciatus, approximatus, elongatus, Gutb. alternans, difformis, Petzholdii, St. biodermis Gutb.
C. varians, St.
C. Pseudobambusæ, Artis etc.

5 C. cannæformis, Schlott. with syn. C. decoratus, Brgt. Nodosus, Schott C. Steinhauer Brgt.

6 C. decoratus Sich (not Brgt).

7 C. gigas. Brgt.

From the observations of my specimens I am disposed to admit:

1 Calamites Suckowii Brgt. the most common of our species.
2 C. Cistii, which I find very difficult to separate fro. C. dubius.
3 C. dubius Artis.
4 C. Cannæformis, Brgt.
5 C. Gigas. Brgt.
6 C. Pachydermus. Brgt.
7 C. Gracilis Weiss.

2. Calamites ramosus? Brg. specimen Ma 220 is a fine branch 28 cent long, from four to four & half cent broad, with 5 articulations the lowest one four and a half cent distant, the upper one a little more than seven cent distant. with flat distinct striæ rather continuous than alternating and more than inflated but not distinctly bearing inflated small bolters at the point of junction two of the articulations have one branch scar distinctly marked but not inflated the flat striæ are two and a half to three millim broad and scarcely marked by lines. The branch is somewhat narrowed downward. I have another

specimen from Cannelton No. 352. A stem 43 mm cent long, 7 to 8 cent. broad, flat, with only three articulations, ribs flat, broad 2 & 3 millim, with an obtuse (sillon) the ribs without stria but covered with a thin coating of coal. It bears at one of the articulations one branch, oblique to the stem nearly 10 cent long without articulations two cent broad in the upper part but gradually narrowed to the point of attachement where it is only 1½ cent broad. The ribs are alternet at the articulations rarely inflated. The lower articulation as then marked with oval mamillæ but they both look truncate or broken. – See on this C. Ramosus Artis, as described by Grand Eury. It is exactly the same as this species and should be preserved as species.

(1) Calamites subtænia, Sqe. This is a good species evidently, the same as has been described by Grand Eury p. 31 with wood cut. I have received it from Cannelton and other localities. This woman's to follows.

[illegible] Prof. There is in [illegible] specimens large piece of this [illegible] which is considered as [illegible] articulations. In some of these specimens [illegible] 45 cent or more. The costæ are distant the [illegible] is raised or rarely distinct to [illegible] the upper head of the carina when decorticated. [illegible] narrow [illegible] mill. [illegible] mill. The more [illegible] but sometimes especially when flattened [illegible] The character of the rocks appearing under the bark is rec[illegible] to appear [illegible] species which in fossil more likely represent. – There is another fragment [illegible] sub or a branch of [illegible] which has all the [illegible] species [illegible] from 1½ to 3 cent diameter. The stem 2 cent. in diam, articulations [illegible] from 1½ to 3 cent distance. The ribs extremely small, ½ millim, obtuse, [illegible] or rarely left the intervals as in C. dubius. Scars of leaves indistinct articulations dull and not as in my C. disjunctus.

3. Calamites Cannæformis? Prof. I can not indeed separat this specie a rather small stem of the C. cannæformis a C. suckowii. Both specimens of Aldrich, 63 & 63b. have the base of the stem. The first 22 cent long 5½ cent broad flattened 6½ cent. has the articulations, the two lowest ½ cent long, the upper, the ninth on 5½ cent long. Scars of leaves round oval either mamillæ convex or concave scars by the disjunction of the mamillæ are all placed at the top of the costæ, the base being merely inflated at the articulation. The costæ at the base are broader 4 mill. those of the top only 2 millim, the costæ being continuous or rarely alternat. The bark is then and thenly lined in the length. The bars bear sometimes scars of rootlet, few however. This agree exactly with Schimper description of this species which he considers as subcarboniferous. It is evidently C. Steinhauerii of Prof. But it does not agree with fig. 2 description of the species by Buchl. where the specimen must like our 63b. is named C. suckowii, his cal. Cannæformis pl. fig 2 bears without scars of leaves, nor does it agree with Weiss which has C. cannæformis represented without tubercles or scars and with costæ alternat much narrow and more rounded. In our specimens they are nearly flat and the carina very narrow. Ours is C. decorates Prof. Steinhauer. But not his C. cannæformis which has the bar much elongated while in ours it is short round truncate a character of C. cannæformis which the other has [illegible] C. suckowii.

common rachis, as Goppert describes, our *Neuropteris hirsuta* is certainly not identical with it. For this very common and polymorphous species of ours, whose frond is sometimes 5 feet long, and at least tripinnate, and generally bears compound tertiary alternate pinnæ or pinnules formed of a large oblong or lanceolate obtuse leaflet, cordiform at base, having on each side, and attached to the base of its slightly elongated pedicel, a small round or veniform pinnule, which is as different in its form as in its nervation from the main middle leaflet. This one has generally a well marked, sometimes thick medial nerve, from which the veins go out, anastomosing and curving to the borders; while the veins of the small basilar leaflets all come out of an enlarged or circular base, without trace of a medial nerve. These leaflets are, therefore, true *Nephropteris*, while the main pinnule is a *Neuropteris*. We have obtained from various parts of our Coal Measures, where this species is the most abundant of all, numerous specimens which all show the same characters. The pinnæ decrease in size to the point, and the two upper leaflets under the terminal pinnule are simple or do not bear at the base the small round pinnules; all the others are compound. This terminal pinnule is large, round oval, obtuse and entire. On the other side, Prof. F. A. Rœmer has published in the Paleontographia (1860) p. 186, Pl. 29, fig. 4, a leaf which he considers identical with *Neuropteris cordata*, Brgt., though he calls it *Dictyopteris cordata*. It resembles one large leaflet of *Neuropteris hirsuta* by its form, and by the straight pointed hairs with which its surface is marked. But in the leaf figured by the German author, the veins and veinlets are undulate, and in curving and anastomosing, they pass from one to the other, forming a kind of reticulation, like that which characterizes the genus *Dictyopteris*. As this peculiar mode of reticulation is not remarked in our species, we have to consider it as different from *Neuropteris cordata*, Brgt.

Neuropteris fasciculata, Sp. nov.

Pl. v, fig. 1 to 4.

Frond pinnately divided, bearing alternate ovate lanceolate pointed leaflets, variable in size, irregularly rounded or auriculate at the base, being more extended on one side than on the other, or truncate on one side, and rounded on the other. Medial nerve distinct, and comparatively broad, either descending to the point of the leaflets, or disappearing at or below the middle, sometimes absent; veinlets thin, close to each other, scarcely distinct, arched, forking in ascending.

This species, by the divisions of the leaves, presents a truly peculiar appearance, which does not compare with any previously known fossil plants, except perhaps with some of the abnormal forms of *Neuropteris hirsuta*. It is evidently distinct from this last species, as shown by its smooth (not hairy) surface, its thinner texture, its more closely approached veinlets, by the pointed form and the peculiar division of the leaflets, which are generally united three together, ~~and~~ by a subdivision of the main rachis. In the specimen represented by fig. 3, the large leaflet has a well marked medial nerve, while the small ones have no trace of it. The specimen represented by fig. 4 is creased in the middle, but the secondary nerves come out from the broad, round base, as in the genus *Cyclopteris*. I consider it as one of the leaflets attached to a round, perhaps climbing stem, while the others represent the top leaves I have only seen of this species the four specimens figured here. Figs. 2 and 3 are from the bottom clay of the upper coal bed of Neelyville, Morgan Co.; the two others in concretions from Mazon creek, Grundy Co.

Neuropteris Collinsii, Sp. nov.

Pl. v, fig. 5 and 6.

The mode of division of this species is still unknown, as it has been found as yet only in separate leaflets. These leaflets are large, from two to three inches long, one and a-half to two inches wide, either oval in outline or oblong ovate, and smooth. The veins and veinlets are thin and distinct, inflated near the base, emerging from an oblique or horizontal truncate broad base, many times forking in ascending, and but slightly arched. The leaflets have no trace of a medial nerve, and could not, therefore, be referable to the genus *Nephropteris*, Brgt

But as it has been seen to be the case with species of this genus, other leaflets, taken from different parts of the same plant, may have another kind of nervation. Our species is related to *Neuropteris ingens*, Lind & Hutt., Foss. Flora, vol. 2, Pl. 91a, by the form and size of the leaflets, but it differs by the mode of division of the veins, which do not radiate from one common point, but ascend in slightly curving lines to the borders from an enlarged base, where they become parallel, resembling, in that manner, the nervation of an *Odontopteris*. In our species also, the veins, though inflated near the base, are not as distinct as in the English species, which is compared to *Neuropteris au-*

see 24627. small leaf. Characters good & persistant.

1. Neuropteris Collinsii Lsq. The species is known as yet by cyclopterioid leaflets. They are not large at least as seen from the specimens now on hand, three from Mingo Creek & three from Penn. Both leaflet figured pl. 5 are from the State cabinet of Ill. and are not on hand. The largest four specimens N 251 is oval obtuse, enlarged toward an abruptly cut broad base. 2 inches long not quite 1 inch broad in its broadest part. The others are cyclopterioid or round about as broad as long. Character: texture of the leaflets thin generally ruminat plicat along the borders. Veins and veinlet as indicated in the description, forking about 5 times from the base to the borders where in the leaflet measured above they count 40 50 to 60 per inch at the margin. It is still doubtfull if N. inflata of the 2d vol. of the Ill. Geol. Report is referable to this. The specimen is not in my possession. But as far as I can remember the substance of the leaves is thick & coriaceous and the veins more deeply marked though nearer to each other. One specimen of our N. 246 might be perhaps referable to this N. inflata. The veins are more deeply marked, the space between them more inflated and they are more approached to each other measuring on specimen N 246 about of the same size as N 251, 80 & 82 veinlet per inch on the borders. N. German of the Penn. Report and N. inflata are still indifferently known and are therefore as species as not doubtful.) — The above remark in ( ) is to be erased and

2 Neuropteris inflata Lsq. considered as a distinct species from the former. The leaflets are very marked, inflated at base becoming thin to the borders where they count 50 to 52 per inch (or more) so surface is inflated or convex the epidermis thin and therefore the leaflet often ruminate and at the borders the veinlets are often erased and obscure. — After reexamination and comparison of the specimens in my possession viz: N. 206. Cy. g. N 251, N 387. 388, 389. 390. I can not a marked difference nor point out a good character to separate N. inflata from N. Collinsii, if N. 206 is the true N. Collinsii which I think it is. It is therefore better to refer them to the same specie which is as far as it is known till now, only a Cyclopteris or rather Nephropteris. 24. 7. 71. — Since writing the above, I have obtained from Strong a fine specimen N 462 representing the terminal leaflet half bursted with two lateral leaflets at its base; the rachis is thick 1/10 of an inch, about, ascending into the base of the terminal leaflet into a broad median nerve which pass out in a point and disappear at 1/4 of the leaf. The terminal leaflet appears oval-obtuse? Surface of the leaf ruminate in the length, its substance apparently thin; characters of the veins and veinlet as described above. The lateral leaflets are attached to the rachis by a broad base, the leaflets marked in the middle by a depression rather than by a medial nerve are round oval about 1 inch long a little more than one inch broad with veinlets thin not inflated to the base but marked at the base by inflation of the leaflets. The surface has not any hairs. This species is recognizable at once by its proportionally broad rachis which is nearly smoth, merely marked in the middle by a deep narrow furrow 3/11/71. Should be separated from N. Collinsii. Compare Filicites Conchaceus Gutb. & Kaulf. p 227 Pl. LXXII fig 5.

3. Neuropteris inflata Lsq. Al. 14 & 15. These specimens represent the species in a form which I have not seen before and which may be separed as a new species or a var minor. They represent fragment of ultimate penna with subopposit pinnules attached by a broad base to a comparatively broad rachis, slightly turned upwards or at an open angle of divergence narrowed at the upper base border to the rachis, enlarged at the lower one without middle nerve but a broad scarcely noticeable depression in the middle, inflated both as are also the veins which are inflated at the base, very thin toward the border and somewhat undistinct as if mined an appearance remarked the same upon the specimen N 462 described above. There is no trace of difference whatever neither in the nervation, nor in the form of the leaflets which are oblong very obtuse, 10 to 15 millimeter long and 6 to 8 millim broad. I can not see any character to separate these. Veins 30 to 34 per cent along the borders, inflated irregular, mined and as separated by one or two very thin veinlets. Description right. A specimen of Aldrich from Montwellen Team is referable to this. Not of the var minor only part of a penna

1 Neuropteris tenuifolia. Bgt. It is possible that we have two species with about the same form of leaflets, one with the lobe more acute leaflet and coarse nervation and another with rather obtuse and thin leaflet. No. 110 a specimen from Carnegie Penn. Represents a pinnule found nearly triangular about 10 cent long with close the sixth subordinate pinnae turned upwards straight some of them flexuous or recurved the lowest twelve cent long, regularly diminishing to the upper one when the specimen is broken and which are only three and a half cent long. The form of the pinnules and also of the terminal one is that of N. tenuifolia but the substance of the leaflet thick and subcoriaceous this should be compared with other specimens from other localities, those of the Rauch creek and Tunnel seem for example.

2 Neuropteris Rogersii. No. 4 & 5 10 These two specimens evidently represent the species. the last exactly like my fig. 9 of Pl VI; the other the top of a pinna unhappily broken with a narrow flexuous rachis, grooved in the middle, bearing a lower nearly round leaflet ~~near~~ three and a half centimeter across and a top leaflet, lobed ~~in the upper one~~ one side also broken is the upper part. with the peculiar venation of the species.

Neuropteris. – Number of veins in one centimeter along the border

N. decipiens. 30.–32. per centimeter

N. Clarkii 32

N. hirsuta 40

N. crenata & angustifolia. 50–60.

D1. Neuropteris gigantea Bryt. see for this species description and figures U.S. pt. 1012 &c. All I know about this species is mentioned in the description. I see that the leaflets appear inflated at their margins. 8.7.71. It does not agree very well with Schimper's description; the pinna being rather alternate than opposite and the leaflets scarcely scythe shaped. Nevertheless the appearance is the same as in Hamburg's figure. 10.7.71.

D2. Neuropteris Grangeri Bryt. From the figure of Brongniart this species p. 237 pl. 68 fig 1. is not the one which I described above p. 383b 3. Our species has the leaflets oblong not enlarged at the base, of the same form as those of N. Loschii but longer and distant. The veinlets are ~~not~~ valde notates as said by Brongniart. It is evident that N. Grangeri & N. Cistii of Bryt are the same species and that we have as yet for its representative the only small specimen N. 30c figured as said above. It is for pl. N. 15 fig 6 & 7. Therefore the name of N. Grangeri ought to be changed. Specimen N 115 b. has a pinna just with the same form of leaflets and nearly as marked veinlets as specimen N 9 Hag. U.S. for pl. N 15 fig 6 which I considered as N. Cistii together with a pinna of larger leaflet and a Cyclopteris. On another specimen N. 67 there appear to be some leaflet horizontally cut at base as they are in Brongniart's figure of Neuropteris Cistii Pl 70 fig. 3. It appears therefore that we have only one species or that all our specimens may indifferently represent Neuropteris Cistii or N. Grangeri. They are all put together in drawer under the name of N. Grangeri. 7.8.71. A specimen from Mayer creek N 474 has leaflets somewhat pointed and also more enlarged at base with a broad medial nerve like those of Brongt. figure but proportionally longer.

D3. Neuropteris tenuifolia Bryt or species distincta. Specimens N 31, N 31a. N 31b. N 403. The nervation of the small species whose leaflets are smaller than those of Neuropteris Loschii more inclined and more decurrent on the rachis toward the point is especially marked by the pointed form of its inferior leaflets which expand downwards to a point. The veins & veinlets are more distant and not quite so arched as in N. tenuifolia to which it resembles. 7.8.71. The nervation is the same as in specimen N 115 fig 1. and the inferior leaflet are quite different in form, the upper leaflet more inclined and more decurrent and the leaflet generally broader & shorter. This separated in drawer with specimen N 35 from Johnstown.

D4. Neuropteris sp. nova? Specimen N. 35 from Johnstown a number of them all representing separate over half broken leaflets which do not give a satisfactory idea of the species. The leaflets are broad at base, narrowed upward to an obtuse point, no medial nerve visible; veinlets very thin very close to each other, denser and more numerous than in any of the other species known from our coal measures, scarcely arched. Perhaps referable to N. obscura.

D5. Neuropteris Grangeri? Bryt. There is in the Coll. of Easton college a specimen with a branch of Neuropteres, fig. p. 531 fig. 10 with broadly ovate leaflets enlarged at base, sessile, obtuse at point with thick veins as marked in figure mostly branching once and therefore somewhat distantly attached to the middle nerve in the upper side, to the rachis at base on the lower, which may represent Neuropteris Grangeri. The point of the leaflet is as marked in my figure. The right side should be completed. In the base, the leaflet round first toward the rachis on the lower side and then are slightly decurrent.

D6. Neuropteris tenuifolia Bryt. The specimens N. 13 from Montevallo vein of Aldrich belong to this species the terminal leaflet is comparatively long, 7 millim very narrow 1½ millim in the broadest part lanceolat pointed, the upper veinlet are very small, decurrent and the nervation very thin but distinct. Agree fully with the description. Remarks on the two forms figured the one with rhomboidal shorter terminal leaflet and lateral leaflets at right angles the other with terminal leaflet narrower etc.

D7. Neuropteris subfalcata. I have described it as N. subfalcata (B 13 N 32 and figured it from large leaves from Helena. There from Montevallo two small specimens, N 31 & 32 whose leaflet is right angle to the rachis which is narrow have about the same form, at least the same equal base, broader contiguous or imbricat. The leaflets are only 12 millim long 4 millim broad oblong or linear obtuse. The specimens are too poor for positive identification. I believe however that they represent the same species.

D8. Neuropteris Grangeri. I have seen a good specimen of this species agreeing with Brongniart's fig. 2 description of N. Grangeri & N. Cistii at the Valentine pit near Dremont August 1876.

383 b.

1. Neuropteris Loschii Brgt. The description already made of this species - Penn. Geol. Rep. p. 858 and - U.S. Foss. Flp. with the figures of this species are wrong or incomplete. The frond is at least tripinnate, large, triangular, pinnae long, linear lanceolate with both secondary and tertiary rachis striate; pinnules alternate attached to the rachis by a broad pedicel, short, obtuse, very obtuse, proportionally broad, varying in length from 1/4th to 1/2 of an inch, seldom one time and an half as long as they are broad, close to each other, somewhat inclined to the base, not so close towards the point of the pinna nearly truncate at base with the inferior lobe slightly elongated. Terminal pinnule proportionally large, ovate, obtuse, entire or slightly obtusely lobed in the middle lower and inferior pinnule longer, rhomboid or oval, oblique passing to the cyclopteroid form. Medial nerve marked by a basilar depression marked upward to about one fourth of the leaflet. Veins somewhat distinct and inflated near the base, dichotomous, forking four times in the small leaflets much arched and therefore perpendicular to the borders at the point where they reach them and there also very close and undistinct. The surface of the leaflet is always smooth or polished. Its characters are preserved in every specimen seen as yet. 7.7.71

D. 2. Neuropteris rotundifolia? Lesq. This species represented by the small specimen N. 41 and figured - U.S. P. Pl. 15 fig. 10. Though the medial nerve is more marked and longer than in N. Loschii, the veins and veinlets thinner but more distinct and not inflated toward the base and though also the leaflets are opposite, this species might be a variety of it or of N. Loschii. It is comparable to nothing else. See what Sternberg says of its N. rotundifolia. It might perhaps be also N. gindani, but though somewhat like it by the nervation, the form of the leaflets and their position are far different. 7.7.71. See 2b. leaflet would 8-10 veins per millim. at the base

D. 3. Neuropteris Grangeri? Brgt. This species if it is that of Brongniart is separated from Neuropteris Loschii by its narrower rachis, by the leaflets more distant, the space between them being often as large as the width of the leaflet; by the form of the leaflets proportionally longer, nearly oval, not abruptly cut at base but rounded at the upper base; by the terminal leaflet lanceolate, thinly pointed enlarged in an obtuse scarcely marked lobe in the middle and especially by the veinlets which are more distinct near the borders and not inflated at base. Though these characters are marked upon every one of the specimens which I collected at Port Carbon, N. 112 has nevertheless the terminal leaflet slightly shorter and more obtuse and N. 104 still more so, showing thus a close affinity with N. Loschii. It is seen that in this last No. the terminal leaflet appears to have been folded and does not show its whole length. 7.7.71. Impossible to Brongniart to decide if this is N. Grangeri or N. Cistii. N. 115a which by the distant leaflets, the locality reinside is referred to this species has terminal leaflet shorter and more pointed with the upper leaflet longer lanceolate pointed on one side and short obtuse on the other while N. 115b which has the terminal leaflet and the nervation of this species, has short lateral leaflets generally close to each other, though not as much as in N. Loschii. This is a good and distinct species see p. 383 b. 2. 17.7.71)

4. Neuropteris Cistii Brgt. The only specimen seen as yet of this species is N. 9 exactly figured - U.S. P. Pl. 15 fig. 6 & 7. It is easily separated from the three foregoing species by the oval form of its leaflets nearly equal and rounded at base distant, with a basilar medial nerve and sharp, very distinct veins, forking three times and therefore more distant than in the former species. The terminal leaflet is not known.

D. 2. b. Neuropteris rotundifolia? Sternb. is evidently N. Capitata Lesq. Ill. Geol. Rep. Vol 4 p. 383. which has the leaflets mostly opposite or whose form and nervation agree entirely with N. 41 pl. pl. 15 fig. 10. U.S.P. pl. see Brgt. Pl. 70 fig. 1. with leaflets alternate. p. 856 N. 41 b. is what I at first mistook for a description and figures of this species. U.S.P. Pl. N. 12. and for description of the Cyclopteroid leaves. Geol. Rep. Penn. p. 856. Both these descriptions are good for about satisfactory. The description of this species in the Penn. Geol. Rep. p. 858 is worth nothing. The frond is unknown as well as the position of the pinna relatively to it. Except if specimen N. 31. of U.S. P. Pl. 6. 12 fig. 4 belongs to this species. This specimen with N. 106 which comes from the same place indicate the frond as triangular and the pinna therefore attached to the main rachis in an open angle or nearly perpendicular to it. The leaflets of N. Tenuifolia are decurrent near the point of the pinna twice as long as they are large, &c: see description. The veins branch 4 to 5 times according to the size of the leaflet, are distinct from N. Loschii and other parent species by the length of the leaflets, the veinlets less arched more distinct though very thin, the terminal leaflet pointed. N. N. 31 belongs to this species the inferior leaflet and its peculiar form is another character which separates this species from its congeners. 8.7.71. N. 114 is also referable to this species though the leaflets are shorter. It has the pinna very oblique on the rachis but proportionally very long. #1 though the impression would thus it identical. (see 383 -)

riculata, Brgt., a plant which has not yet been discovered in our Coal Measures. The two specimens figured in this Report, have been found in the concretions of Mazon creek, the first one, fig. 5, by Mr. John Collins, to whom the species is dedicated. Other and larger leaflets of the same species have been obtained from the same place.

NEUROPTERIS CAPITATA, Sp. nov.

Pl. vii, fig. 1, and Pl. vii, fig. 14

FROND or part of frond bi-pinnately divided, triangular in outline or tapering upwards from an enlarged base; pinnæ linear, with alternate, oblong, short, very obtuse, broad, contiguous pinnules, and a proportionally very large triangular obtusely pointed terminal leaflet, obtusely lobed on each side near its base. Medial nerve, none; veinlets scarcely visible to the naked eye, coming out from the narrowed base of the leaflets, strongly arched towards the borders, with numerous bifurcations. At the upper part, or near the point of the frond, as seen in Pl. vii, fig. 1, the pinnæ become shorter, less divided, and at last mere pinnules attached to the rachis by a broad pedicel. All leaflets are unsymmetrical at the base, being auricled or elongated downwards, or toward the main rachis, and merely rounded on the other side.

The general appearance of this species is somewhat similar to that of *Neuropteris Loschii*, Brgt., from which it is readily distinguished by its proportionally broader, round-topped pinnules, more abruptly cut at the base, its polished smooth surface, and the large terminal triangular leaflet. The large specimen figured is from Murphysborough; the other has been found in concretions at Mazon creek. The same species is abundant in the roof shales of the main four-feet coal bed at Yellow creek, Ohio.

1 (1846)

NEUROPTERIS FIMBRIATA, Lesqx.

Pl. vi, fig. 4.

2, 3 (1846)

Cyclopteris fimbriata, Lesqx.

Journ. Bost. Soc. Nat. Hist., 1854, p. 416.

1 (1846).

This species has also been published in part, and from isolated leaflets, in the Geol. Rep. of Penn., p. 855, Pl. iv., fig. 17 and 18, as a *Cyclopteris*. The specimens now on hand represent it with a pinnate frond having an undulating, flexuous, round, finely striate rachis, marked with points as if it had been scaly, which bears alternate, distant, broadly oblong or ovate, sometimes nearly round leaflets, entire at the round auriculate base, attached to the rachis by a broad pedicel. These leaflets are finely fringed from the middle upwards by long, undulating, narrow laciniæ. The veins which come out parallel from the broad pedicel and divide three or four times in ascending, are thin but distinct, slightly arched towards the borders and ascend to the top of the fringes. The specimen figured here from the concretions of Mazon creek, and found by Mr. S. S. Strong, seems to show that the species was a climbing fern resembling by its nervation and its mode of division a *Lygodium*. It has been supposed that the fimbriate leaves were the fruiting part of a species, which in its sterile form has entire leaflets, as it happens with some ferns of our time. But the fringe is not inflated, and the laciniæ, though very distinct in some specimens, do not show any trace of remains of sporanges. Like the former species, this one is, by its nervation, a *Nephropteris*, at least so far as it is known. It varies much in the size of its leaflets, some being still smaller than those figured here, while most of the others found detached from the stem, and which are broad oval or nearly round in outline, are about two inches or more in diameter. It is one of the finest and rarest species of our Coal Measures, though it has been found at different places over the whole extent of the N. American coal fields. When this species was first published, no plant of this kind had yet been found in the Coal Measures of Europe, but recently Prof. Heer has given in his *Urwelt der Schweiz*, under the name of *Neuropteris lacerata*, Heer, l. cit., p. 12, fig. 11, a species which has a near relation to ours. It is a round leaflet, bordered by a narrow fringe, which, unlike ours, is nearly regular with equal narrow divisions. As far as can be seen from a mere woodcut, the species is a truly different one. Prof. W. P. Schimper, in his *Palæontologie vegetale*, seems to consider both species as identical, for he says of *Neuropteris* (*Cyclopteris*) *lacerata*, Herr, that it is found at Saarbruck and in some places in North America. If both species are identical, our name has the

1. Neuropteris fimbriata Lesq. N. tenuinervis Lesq. N. dentata Lesq. Penn. rep. &c. These three species are very difficult to separate and perhaps with better specimens they may be found to be only one species. Neuropteris fimbriata in its natural form or in its small pinna as seen in U.S. Foss. fl. pl 15 fig. 1. has a tripinnate frond. Pinna apparently large, triangular in outline with alternate, nearly linear slightly lanceolate pinna with alternate, oblong, obtuse leaflets, slightly decurring at the top of the ~~leaflet~~ pinna, oblong, obtuse, rounded at base, slightly more abruptly cut at the lower internal lobe, attached to the rachis by a broad base varying in size from half an inch to one inch or more with veins more or less emerging from the base of the leaflet dividing or forking twice or thrice in cursing to the border, medial nerve none or merely basilar and rudimentary. Veins & veinlets thin, but distinct and somewhat distant. Rachis finely striate and equally so in its whole thickness without medial inflation ~~or~~ or depression. In specimen fig. pl. 15 lower cut or separate pinna with leaflets a little more than half an inch long, but two of the leaflets rarely somewhat fringed at the top, indicating identity of the small form with simple leaflets with the large one with fringed leaflets. Generally the veinlets, at least in the cyclopteroid leaves are ~~much~~ inflated at base. — Neuropteris tenuinervis is not satisfactorily known. Its certain representatives in our specimens is the one fig. Pl 15 f. 7 of the Penn. report and another N. 11. both of the same locality. The leaflet are irregularly oval. In N. 11 b appearing irregularly deeply undulate and short fringed at the point. In N. 11. the ~~large~~ leaflet is longer deeply cut and irregularly lobed but the point is broken and not seen. All are marked by the thin medial nerve as marked in fig. 2 description of the Penn. rep. As in the former species the veins come out from a broad base, but they are not inflated below as thin as in the former species, less distinct and more approached. A large leaf fig. 10 referable to this species is enlarged from a broad base than lanceolate obtuse with short fringe at the point. — Neuropteris dentata as represented by specimens N. 85 & N. 1119, none of those quoted in the Penn. report being in my possession, is still more difficult to separate. The leaflets are proportionally longer, twice as long as they are large, ovate-lanceolate, of a thicker coriaceous texture cut near the top in short irregular lacinia, with veins flabellate branching from a broad base, scarcely arched therefore appearing like leaflets of Odontopteris inflated and very close to each other. Both specimens may invalidate the separation of these species on first distinct characters 3.7. 71. See how many times the veins branch in small leaflets of Neuropteris fimbriata and mark it in its character.

2. Neuropteris undans Lesq. Geol. Rep. Penn. Cyclopteris undans p. 855 pl 4 fig. 19 to 22 & Neuropteris undans loc. cit. p. 859. pl 5 fig. 1 & 2. Also for. fl. pl 16 fig. 1 to 5. Frond tripolypinnately divided. Pinna long, linear lanceolate. Leaflets close to each other, the border generally overlapping each other varying in size from half an inch to about two inches, the large ones lanceolate obtuse from a round auricled base, the inferior lobe slightly longer; the small ones oblong obtuse all attached to the irregularly striated rachis by a broad base or petiole, and more or less undulate on the border. Medial nerve scarcely visible, merely basilar, with veins more or less emerging from the base of the leaflets inflated at base (generally pustulate) arched and much divided in ascending in leaflets fig. in 1 long they form six times) becoming very close though distinct at the border. Cyclopteroid leaflets broadly oval or nearly round, marginate or irregularly cordate at base by rounded auricle with the margins deeply undulate or irregularly serrate at the top. Veins flabelly form, dichotomous very slender and close toward the border, united in pairs and ~~the~~ flated toward the base &c. I consider this as a very good species characterized by the form of the leaflet the nervation &c. The veinlets and veins are quite arched and though very longest the margins still distinct. This species for its short medial nerve may be placed after N. fimbriata.

3. Neuropteris plicata? Lesq. (or spec. nov.) Frond bi or tripinnate. Pinna lanceolate pointed, leaflets alternate or opposite, open nearly perpendicular on the irregularly striate rachis, oblong obtuse or slightly lanceolate obtuse slightly depth shaped sessile or attached to the rachis by a broad pedicel with the base horizontal or truncate on the inferior lobe slightly elongated. The dial vein marked as in N. tenuinervis by a thin filament ascending 1/3 of the leaflets veins more or less flabellate are emerging from the broad base. Thin ~~obscurely~~ seen through the thick pinnachine, branching 6 times in the large leaflet 1/4 inches long arched to the border though not quite as much as in the former species. The borders of the leaflets are slightly undulate. But it much differs from the former by their more distant less arched veinlets &c. I have seen only two specimens of this both figured U.S. fl. pl. N 13 f. 1 & 2. oth from Conway C. It is also comparable to N. tenuifolia Bryt. But nervation and thickness of the leaflets show it different compare Bryt & Sternbg. Penn. Rep. pl XX fig. 3 good figure. Lindsay 57. 71.

1. Neuropteris gallica? spec. nov. Has about the same form of pinna and leaflets as the former. Pinnæ long, linear, pinnatifid, horizontal, truncate at base with the inferior lobe slightly longer varying in size from half an inch to a little more than one inch, oblong equal rounded, slightly enlarging above, medial nerve broad flat as ending to 2/3, veins scarcely arched except near the base straight, thin, very close. Texture of the leaves thick, surface inflated. It differs from the former merely by the slightly more obtuse, terminal leaflet, more obtuse and equal leaflets, veinlets scarcely arched or straight from the upper middle of the leaflets. Specific difference may be caused by the difference of the substance of the leaves. Fig. 3 of Pl. 13 Ch. S. fol. belongs to this species. 5 & 7 make drawing of this species. See Neuropteris gallica Sap. Hopf. 258 pl. V. fig 3. See p 386 (1).

2. Neuropteris flexuosa. Brgt. appears to be the species represented by specimen Ma 30. 31. The form of the leaves is like that of pl XIII fig 1 N. plicata in U.S. flor. with the nervature coarse however and the mid rib broad and flat. Comparable also to N. subfalcata & pl VII fig 5 & 6 but differing by broad rachis coarse nervature leaflet not turned up etc. The leaflets however especially in specimen 31 are distant or separate and somewhat like those of N. plicata, the lower base of the leaves being however less distinctly auriculate than in plicata. See p 385c (1).

3. Neuropteris hirsuta? fuciny? A small specimen in the collection of New Brunswick No 15? has the reins inflated in the middle or marked by an oval protuberance resembling fructifications or sporophilla. It is about like those marked by Brongniart, but the borders are slightly upturned and the middle concave. They are parallel to each other as this

4. Neuropteris ~~cordata var~~ angustifolia?? Brgt. I have from Mansfield No 8b. 2 no 45 with other specimen less valuable two specimens, the first representing a crushed pinna with small ovate pinnules at the base of large one lanceolate obtusely pointed, more or less unequal at the base which represents exactly Brongniart's species of ~~var~~ angustifolia except that the middle leaflets are much larger. Brongniart remarks ~~however~~ that in his ~~species~~ cordata the reins are very distinct and very distant (tres marquées & très espacées) a character which evidently separates evidently this species from the European one. For, if the middle nerve is very thin as remarked by Brongniart, for his species, the veinlets are also in ours very thin and close, measuring at the borders 93 veinlets at least in one inch. This character would identify these leaves of Mansfield with N. hirsuta Sagor and indeed I see one or two distinct hairs upon the surface of the leaves of the large specimen 8b. Compare 386b. 3. The smaller red Brgt. sage of his N. Scheuzeri which bears fruit of the podical which joins all the leaves of this group to the rachis: nervuli tenuissimis arcuatis dichotomis ~~frequentes~~ ~~arcuatis~~ approximatis and remarks in his N. angustifolia: nervulis plurie dichotomis arcuatis tenuissimis, approximatis that this species is perhaps a mere variety of the forme N. Scheuchzeri. I have therefore to omit entirely N. cordifolia which is as yet unknown to me except if perhaps it is represented by Neuropteris decipiens which however has the leaves very pillows a thick middle nervule etc. and to admit N. hirsuta, with its character N. angustifolia = N. Scheuchzeri which may be a var of N. decipiens and N. decipiens. N. hirsuta is represented at Cannelton in Mansfield collection by leaves of the same character. In N. angustifolia the middle leaves are very variable in length. - Specimen 8b has

them from 5 to 10 cent long an 12 to 20 mill broad at base above the leaflets which are nearly round, truncat at base, 8 millim across, both ways, becoming larger in descending and the pedicel is about as long as these leaflets are large, from 5 to 8 millim. large. Most of the leaflet are obtuse rounded at top or obtusely pointed (this is the point of the large leaflet, wedat to truncate, equal or very unequal at the base. In all the midrib is very thin, effaced much lower than the point. The large separat leaflet is eleven cent long 2 ½ cent broad just above the very unequal base from which point it very gradually narrowed to the point or top see p. 467.

7. Neuroptes flexuosa Brgt. We have in Mansfield specimen Ma 108. part of a penna, one side only with five leaflets; pinnules approximate imbricat oblong curved (arcuatis) obtuse with the lower angle of the leaflet more or less expanded pinnule terminale large (triangular lanceolat) ovato lanceolat. Brgt with reins very thin dichotomous (Brgt definition), appearing with Brgt description and figure and bearing reins inflated in leaflet just as there of Pl. 65 fig 3 and 3a considered by Brgt a fruity specimen. Though Brgt says of the terminal pinnule that it is ovato lanceolate, his figure shows it enlarged in the middle and lengthwise rhomboidale. The crowded imbricated leaflets, with reins coarser than in N. tenuifolia, but more divided and closer, forking 4 times in leaflet 3 cent long inflated ~~toward the base~~ from the middle downward and with a thick midrib appear as described by Brgt. In my plate U.S. fl. V. fig. 2 & 3 the form of the terminal pinnule is about the same and in some specimens with large penna, they are perpendicular to the rachis and also in fig 2 the rachis is thick and flexuous. But here the leaflets are distant, thinner forking ~~twice or~~ thrice and not inflated toward the base. (It may be that fig 2 represent also N. undulata, but the terminal pinnule though sub rhomboidae in the length is pointed as in N. tenuifolia whose leaflets also are generally smaller). In comparing Ma 30 & Ma 62a both specimen with large leaflets like this, distinct and separated in both, I find the reins of N. 30 closer more divided. But they are inflated in both forms and it is the greater division only which separates them. These species are very much alike as N. flexuosa & N. tenuifolia and very difficult to separate; at least in the middle leaflets of large penna where the terminal leaflet is not visible. I have now Sept 76 received from Prof White a number of specimens Fa 1 to 6 (catalogue p. 56) representing the pinna with straight or flexuous rachis of the pinna especially flexuous toward the top and straight for the broader rachis with pinnules either in right angle to the rachis, especially when larger or inclined upward either separated or imbricated and with the terminal pinnule ovale, obtuse, enlarged in the middle but very obtuse and short generally at least. For in one specimen Fa 6 the terminal leaflet is longer and more taper pointed or less obtuse. By the character this species is certainly that of Brongniart and somewhat variable. The leaflets either distinct or imbricat are oblong, very obtuse, enlarged in width at the base, especially in the lower side. Many of the specimens represent that inflation of the reins supposed by Brgt to be fruit. They are in some leaflets very regular but evidently caused by sulphuret as seen in specimens Fa 8 & 8a, for in some specimens the granulations produced by sulphuret are marked upon the specimen where there is no trace of leaves.

1. Neuropteris vermicularis Lesq. The description is not quite right. To it add for the position of the leaflets: that they are perpendicular to the rachis (spreads to) except near the top of small pinnae (I have seen them inclined upwards only in the small specimen pl. VI fig. 3. which belongs to Sprengfield Coll.). And nearly round at the base, say: and nearly round or truncate at the base with the lowest lobe slightly elongated. For the nervation say: the veinlets thrice forking in curving to the borders, deeply marked, distinct on by maceration &c. – The main rachis is broad, straight, the middle part winding and slightly striated, both borders flat and smooth. This character is not marked upon the figure which therefore is incorrect. For the balance, the figure is right. (24. 6. 71). For this species compare figures in U.S. pl. VI 13 fig. 5 to 9 and those of Ill. Geol. 4 pl. VI fig. 13.

2. Neuropteris alpina Ettingh. (Odontopteris Brongn. – Gein. – Schimper Tai. p. 457. I believe to be right in referring to this species spec. 113 of our collection (Amherst coll.) also the specimen pl. I fig. 1 which was copied from a specimen belonging to Mr. Barnard of Springfield and returned to him. Our specimen agree very well with the description and figures of the European authors. There is nevertheless some difference in Schimper's description. He says: pinnulis majusculis dense confertis and imbricatis; pinnula basilari interdum paululo inaequaliter rotundata, bilobata, both characters not as yet observed on our specimen. The characters are as follow: Frond tripinnate primary pinnae apparently long and triangular. Secondary pinna long lanceolate or linear lanceolate tapering to an obtuse point by a long linear lanceolate obtuse terminal leaflet. Division or leaflet oblong, obtuse, entire, attached to the rachis by nearly their whole base, rounded on both sides or slightly auriculate on the internal base varying in size from 1/4th of an inch to one inch and an half. Medial nerve distinct; secondary veins emerging from it twice dichotomous. The veins, as much in the form, size and position of the leaflet as in the mode of nervation. The main rachis is very broad, marked by three or more equal striae or lines close to each other. The leaflets are generally separated in our specimen at least sometimes distant as in fig. 2, but never imbricated. In the upper part of the primary pinnae or of the frond the pinnules becoming shorter sometimes round are contiguous and toward the point of the pinna become more and more connate, forming at last a long linear obtuse slightly lobed terminal pinnule. These upper pinnules have their ramifications from the rachis which in the pinna becomes a true medial nerve as it happens with species of Neuropteris. But this can not be considered as forcing the character of Odontopteris to the species and I consider it either as a true Neuropteris or perhaps as Schimper says: a species of his new genus Lescuropteris.

3. Neuropteris cerebrodes Brgt. I have no descriptions of this species, U.S. pl. 44 fig. 11, 11 a. are correct. Dawson's well known figure specimen N 113, which has some inlets just like those of Brongniart figure 2 pl. 64 and at the same time some gives appearance running to Neuropteris elegans, I am not sure it is a good species. Another specimen N 113 b. seems to indicate analogy of forms with Neuropteris Ovata Hoff. & N. Rarinervis Bunb. The separation of these species is very difficult.

4. Neuropteris Agassizii (sp. nov.). Polypinnat? Pinna long (leaf of one upon spec. N 113 measures 11 inches) linear lanceolate, bearing alternate or opposite combined sessile leaflets of large size one to two inches long, 3/4 of an inch to 1 inch broad oval – deltoid in outline, rounded or truncate at base, divided in two or three opposite lobes by deep acute sinuses, terminal lobe round obtuse; Margin entire or the margin is equally serrate except along the sinuses. Medial nerve well marked and the veins emerging from it, twice dichotomous, veinlets going to the point of the teeth in curving according to the breadth of the leaflets. This species which in its small form seems to pass to N. cerebrodes & N. Alpina but well distinct from both not only in the form and dissection of the leaflets but in the veinlets ascending to points of the serratures &c. 14. 7. 71. Mallepiate.

5. Neuropteris Verbenaefolia Lesq. see description & figure opposite p. 385. Description is satisfactory. Species far different from any of the sections, though the nervation is still the same. Differs most from the two former species by the form of the leaflets rounded at base &c.

right of precedence, and should be preserved, it having been published, with description, in 1854, in the Journal of the Bost. Soc. Nat. Hist.; and in 1858, in the Report of the Geological Survey of Penna., with figures and description, while Prof. Herr's species was published ten years later.

85⁶ 1

Neuropteris vermicularis, Lesqx.

Pl. vi, fig. 1, 2, 3.

This species, described in the 4th vol. of the Geol. Report of Kentucky, p. 434, has not before been figured. The frond is apparently tripinnate, with linear lanceolate somewhat obtuse pinnæ, and alternate, oblong very obtuse leaflets, placed at a short distance from each other. They are slightly narrowed in the middle, turned upwards or a little scythe-shaped, and nearly round, and equal at the corners of the base. The terminal leaflet, fig. 3, is oblong obtuse, regularly and equally undulate-lobed on both sides. The nervation is particularly distinct, the medial nerve being short and thick, and the veinlets distant, twice forking in curving to the borders, round, deeply marked, easily detached from the substance of the leaves, polished and thus appearing like pieces of rain worms. The main rachis is broad, straight, and irregularly striate. The general appearance of this species is like that of the large forms of *Neuropteris rarinervis*, Bunb., but its nervation is far different, the veinlets in this last species being flat, or looking as if formed of two parallel lines.

Found in the concretions of Mazon creek.

Pinna sometimes long. See spec. 2416 14 from Mazon creek with broader leaflets 3½ cent. long, 1½ broad at base, oblong obtuse etc.

veinlets

with flat bar

85⁶ 2, 3, 4, 5

Neuropteris verbenæfolia, Lesqx.

Pl. vi, fig. 5 and 6.

Frond pinnate; rachis round, slightly and regularly striate; leaves alternate, varying in length from half an inch to four inches and a-half, proportionally broad, ovate lanceolate-obtuse in outline, truncate at the base, regularly serrulate-toothed on the borders, attached to the rachis by a broad pedicel, medial nerve narrow but distinct; veinlets distinct and distant, thin, moderately arched in ascending to the borders, forking twice, the last divisions descending to the point of the teeth.

386b 1 (2)(2b)

The figure and description given of this species in the 2d vol. of this Report, p. 431, pl. xxxvii, fig. 1, are imperfect, being made from the only specimen found at the time. Better specimens now on hand show that this fern evidently belongs to the genus *Neuropteris*, not only by its nervation, but by its ramification and the position of the leaves on the rachis. The species nearest to this is *Neuropteris crenulata*, Brgt., easily distinguished by its elongated narrower leaves, with crenulate rather than ~~toothed~~ borders, and the thickness of its veinlets. Our fig. 5 represents a specimen whose upper leaflets, scarcely dentate, have the surface wrinkled around, and marked by points of irregular size, placed without order, which resemble traces of fructification, the epidermis appearing as if it had been perforated by glomerules of spores placed under it. This peculiar appearance may result from the process of maceration. It is too obscurely marked to merit more than a passing mention.

386b. 3.4.5.

NEUROPTERIS RARINERVIS, Bunb.

Pl. viii, fig. 1 to 6.

The specimens figured 1 to 4 on this plate, from the concretions of Mazon creek, bear round leaflets, apparently attached on both sides of a secondary rachis, as are generally the pinnules of a *Neuropteris*. According to this appearance we should have not only to consider these leaves as representing a new species, but also to accept the genus *Nephropteris* or *Cyclopteris* for their classification. But I think that the parts represented in fig. 1 and 2, are not fragments of a secondary pinna with alternate pinnules attached to it, but only parts of primary pinnæ with the basilar leaflets of the secondary pinnæ attached to them, in the same way as such leaflets are attached along the rachis in fig. 6, which represents a fragment of pinna of *Neuropteris rarinervis*.

This remarkable specimen is also from Mazon creek. As is easily seen, it shows a primary rachis with the base of its divisions marked by the remains of the secondary branches and the two basilar leaflets on each side of them. If this branch were longer, we should see these basilar leaflets more and more enlarged, becoming round farther down, and then showing the same forms as we see on fig. 1 and 2. In vol. 2, p. 429, in a foot-note of this Report, mention is made of a specimen from Newport, R. I., which bears on the same part of a frond two round cyclopteroidal leaflets attached at the axil of secondary pinnæ, while the same pinnæ bear true neuropteroidal oblong pinnules, with a medial nerve. As this specimen elucidates the position of the two kinds of leaflets, and as it is the only one found as yet elucidating this peculiar difference, I have figured it fig. 5, as affording the most conclusive representation of the unity of both the genera *Neuropteris* and *Nephropteris*. This figure, I

D. 1. Neuropteris terminervis Lsqx. Penn: geol. report. 1859 Pl. 5 fig. 7 & 8. This specie is a good well characterized one. His represented in the nodules of Mazon creek by specimen N. 203. To the characters marked in the description of the Penn: report added: that veins & reinlets though sometimes inflated at base (it is rather the space between them that is inflated) are little the medial nerve very thin, distinctly ~~seen~~ or seen with difficulty posthing thrice; undulate or apparently running into each others, like those of a Dicksonites. The last characte is not yet ascertained. The branches or pinna have a comparatively very thick regularly 5 striated rachis. Better specimen are desirable though the species is certain. (22.6.71). Part II to Odontopteris.

D 2 Neuropteris Clarksonii Lsqx. See corrected description of it in Penn: Geol. Rep.t p. 857. The species is represented from Mazon creek by specimens in nodules: N 233, N 136, N 202, N 200, N 199 and for its cyclopteroid leaflets by sp. N 208. Perhaps Cy 45, Cy 44, Cy 126 and Cy 36 which represent Cyclopteris obliqua Brgt. may belong to this species? I doubt of it on account of the undulate borders of this last species in our specimens and also on account of the rounded outline (23.6.71). Nevertheless N. 200 evidently belonging to this species has undulat border and the same appearence as those cyclopteroid leaflets above marked. I refer also to this species with some doubt N. 209 & N. 210. (see 26).

D. 3. Neuropteris rarinervis, Bunt. The flat double reinlets which I have mentioned in W. Geol. Rep. vol. 2. as characteristic of this species are generally evidently seen or perceivable upon the large cyclopteroid leaflets but rarely so upon the small leaflets of the multiple pinna. The specimens of the nodules as N. 217 & 219 do not show this dedoubling of the reinlets but on the contrary they are there destroyed and replaced on both sides of the specimen by deep furrows or grooves marking distinctly the place and division of the veins & reinlets. By searching for them however they are found sometimes. I have still to reexamine a numbe of specimens upon shale to see if that cyclopteroid & neuropteroid specimen represent a single species.

4 Neuropteris Scheuchzeri Lsqx. at last as far as I is represented in the nodul specimen N. 226. appear to be merely a var of N. rarinervis. The nervation is the same though the lowest pair of rein is forked thrice and the veins are flat & double. The form of the pinnuls is about the same. This species therefore if it is not delenda is certainly dubia. Scheuchzeri specimen is Methopteris N. 26 (see p. 291 c)

D 2. Neuropteris Clarksonii Lsqx. Corrected description: Frond irregularly, bipinnately or andinately pinnules simple, broadly lanceolate above, shortly pointed, cordate or irregularly auriculate and hard at the base by the inferior lobes becoming more or less elongated, terminal pinnule lance-shaped, obtusely pointed, equally and deeply and obtusely lobell on both sides, in the middle, medial vein thick or marked by a broad depression ascending to the point. veins dichotomous, forking three to five times in curving to the borders, strongly marked and distinct &c: midrib detach as in Dens upon the flat depression of the medial nerve is often marked by a thin thread like grove into the middle like vein terminus according to the size of the leaflets the number of the reinlets along the border vary from 52 to 80 ~~cross~~ per inch. The cyclopteroid leaflets have 52 reinlets per inch at the border. 28/6. 71. Remark on the locality or geol. station of the species that I have a good specimen of it on N. 31 a from Rowan run mines low coal. Remark also that the reinlets especially the ultimate divisions which are long are generally flexuous or slightly undulat and per place running into each others. Rem. that this specie has not besides leaflets under the long ones. (see 388 d (13))

D 5. Neuropteris Germari Lsqx. Cyclopteris, Adiantites Goepp.t see Sch. mpes Veget. Val. p. 426. Schimper remarks on this species that it is not satisfactorily known. I have published it in Penn: Geol. Rep.t p. 856 pl 5 fig. 7. the figure of a specimen which show the peculiar mode of laceration of the leaflets and which therefore confirm the species as described by Germar and Hualfer first and by Göppert hereafter. From Mazon creek we have another specimen by 46 which is still more remarkable and more puzzling. It represents a branch of Aphlebia (Sphenophyllum) hirsuta Lsqx. Penn. rep.t bearing on one side of its pinnately or dichotomously divided rachis a branch of Aphlebia and on the other side a slightly lacerated pinnule of Cyclopteris Germari well characterized by its deeply marked veins & reinlets remarkably broad flat, 5 times dichotomous and by its disposition to lacerate and divide at the border. The laciniæ are not quite seen they being apparently hided in the stone. This may be one of those case of superposition of two organs or parts of different plants as they are often remarked in the shale of the coal. But it is quite a remarkable coincidence to see from the figures of Hualfer the laceration of the leaves repeated in Penn: specimen and to see the same kind of leaves of a peculiar neuropteris attached to a stem whose branches are lacerated just in the same way as are the leaves figured by Hualfer & by myself. It is certain anyhow that Adiantites Germari is a good species as we can have them from fragment in the Carboniferous formations. 24.7.71. See note in catalogue of Storrs specimen (1824) S. 21. which is a new and good specimen of this species, for different from Neuropteris inflata also a good species. I have figured another specimen from Wilkes

D1 1 Neuropteris obscura Sigg. I have recently Sept. 76 obtained many specimens from the tunnel vein of Shaw Mt. below Tremont. This species has by the form of its pinnae and leaflets the same character as N. tenuifolia, Brgt. differing merely by the large size of the leaflet and pinnae which however are sometimes as small even smaller than in N. tenuifolia, by the scarcely prolonged or auricled base of the leaflets and which are generally enlarged toward the top, by the very obscure or rather total obliteration of the veins from the entire surface, and the distinct (straight) not arched of the veins as apparent wherever they may be discernable. The terminal leaflet is lanceolate obtuse or pointed as in N. tenuifolia. The lateral ones vary from 15 to 25 millim. long and from 3 to 10 mill. broad. The upper leaflets are decurrent as in N. tenuifolia Brgt. The substance of the leaflet is thick, subcoriaceous the surface (upper) sometimes polished, the leaflets often pedunculat or with their base somewhat elongated.

D2 N. undans Sigg. Ma 118 from Carmelto is a very fine specimen referable to this species with the form of my fig. 2161 IV of the Pens. Report. It turned on one side from a broad point of attachement but entire merely undulat, nine cent. broad and only 5/4 cent high from the point of attachement to the top. — The nervature is straight not curved very thin but distinct with the glass.

D3 Neuropteris (Cyclopteris) plicata St. I found in Sacrewell, N 2149, X 439 which I think are referable to this species. The leaves are variable some long oval-lanceolate obtuse like those of N. heterophylla but with borders undulat the nervation less distinct and without trace of hairs, other large broadly oval obtuse cordate at base with the surface wrinkled and the border undulat other still nearly round still more wrinkled on the surface, of all these leaves the veins are scarcely distinct to the naked eyes. Though the substance is thin, it is slightly polished. This may be still a variety of N. heterophylla for on the leaves oval lanceolat I see distinct trace of hairs even some deeply marked. I therefore leave this all with N. heterophylla. — 3a. One of these leaves is represented in 1.5 [illegible] for different species in hairs referable to N. [illegible] is a very [illegible] oblong obtuse, cordat at base with slight, unequal [illegible] 7 cent long 5 cent broad near the base with border nearly parallel to [illegible] middle nerve less marked lateral veins distinct and distinct. [illegible] 10 per cent at the borders with smooth surface and no trace of hairs (see icon 6) [illegible] Neuropteris Scorchii Brgt. Now as this shows that the surface of the leaflet is not always polished. Unlike much very large according to the size of the pinnae 45 cent. long [illegible] has the lower pinnae a pinna which was very large approaching [illegible] the second pinna 15 cent long. The rachis [illegible] the part preserved in 15 and long [illegible] 8 to 9 mill. broad. [illegible] broad in the pinnules 16 millim long and 8 to 9 mill. broad.

D5 Neuropteris inflata St. Sacre 542 is like the fig. 4 of Pl. 7. The top leaflets of the pinnae which are oval same form as those figured on the lower [illegible] the lateleaflets [illegible]

D6 [illegible] Neuropteris [illegible] a new species perhaps [illegible] N. inflata. [illegible] Cyclopteris [illegible]

[illegible] Pittsburg [illegible]

[illegible] Number of men at the baden 35 per centimeter

3874. 1. Neuropteris coriacea Sigg. Of this species I have obtained from Mr G. S. Armstrong of Morris and from the Nodules of Mayo creek a fine specimen which is minus the thick fruiting epidermis, nearly a counterpart of the one figured here. The pinnules, which are alternate (not opposite as said in description) show near the base of the pinna a tendency to become lobate at base. They turn upwards and the well marked nervation is as indicated in the figure, the veins at first straight up at a narrow angle from the thick medial nerve then curving to the border, the lowest pair branching or forking twice, the middle ones forking once with the base veinlet simple and the upper forking again. The upper veins forking only once. Though these veins are well marked they are not broad and double as in N. vasonervis Ozan. The leaflets also have a far different form. This specimen indicates that the one figured in this report represent indeed a fruiting pinna. (1.6.71). I am not yet quite certain of this. The museum has besides the specimen above mentioned three specimens N. 220, N. 221, N. 222 ~~(perhaps N. 224)~~ all indicate a thick epidermis or thick leaflets, these being deeply marked into the counter part of the nodule. The veins and veinlets being broad and deep, the intervening space is per place inflated, forming the appearance marked upon my figure of N. 8. It is only when the epidermis is destroyed by maceration that the veins & veinlets are seen in their form as simple and filiform. It is evidently a good species. The nervation is as indicated above. (23.6.71.).

2. Neuropteris Desoui. Sigg. Frond apparently very large and much divided, at least tripinnate, pari a thick, flat, smooth, equally narrowly striate rachis; pinna long, linear lanceolate, distant, horizontal or turned upwards, separated generally each by two nearly opposite pinnules of various form, recent upon the main rachis, pinnules lanceolate, from an elarged round lobed base, obtusely pointed or undulate lobed, or merely undulat or entire on the borders, distant from each other becoming approached and coalescent, coalescent at the top, forming a compound lunulat equally round lobed and pointed terminal leaflet. Leaflets of the secondary rachis lanceolate divided at the base in two opposite lobes, oval leaflets or merely lobed and equally undulate to the point. Lycopteroid leaflet very variable in their form generally cordate or cut at the narrow base, enlarging upwards irregularly lobed or cut on one side, entire on the other, diversely cut lobed and dentate at the top with veins distinct dichotomous slightly curved. In the leaflets of the ~~base~~ pinna, the medial nerve is deep marked nearly to the top and the veins ancestrozoning from it are their flexuous well marked, scarcely arched forking twice. The species is extremely polymorphous. The bases appear of a thick texture have the surface generally polished and are therefore easily recognized though often found detached from the pinna. Fl. 4. of the U. S. flora is well made and quite correct. It is also represented pl. 20 figs 5, 6, 7, 8 of the Penn. report. The large stems appear sometimes as having grown in water bearing ~~hexam~~ fistulose stems and bearing variously dissected leaflets resembling some kind of Aphlebia. A proof more that Aphlebia is a fern. (10.7.71.) see Penn. rep. t. Pl. 20 fig. 5.

3. Neuropteris coriacea Sigg. Compare Odontopteris Reichiana Gutb. in Poehl pl. XVIII fig. 2. It is intermediate between N. vasonervis and N. Desoui. From the fragments obtained all from Mayo creek, it is pinnate, frond triangular at base, its upper part, pinna short, linear lanceolate or merely linear obtuse, pointed, alternate rachis marked into middle by a depression or channeled, leaflets alternate, thick, leaving a deep impression upon the stone and evidently coriaceous, lanceolate, obtusely pointed in the larger pinna, the lower pinnules cordate at base, in the lowest leaflets round lobed at one side as seen in the figure of this report. In the small pinna N. 221. the upper leaflets become confluent forming a short obtuse lobed terminal pinnule. Medial nerve strong deep, ascending to the top of the pinna, veins forking once or twice according to the size of the leaflets, more arched than in N. Desoui, much inflated in the form which appears fructified, broad and deeply marked in specimens which like N. 264 do not appear to bear fructification. In this specimen the thick leaflets have the borders undulat. Terminal leaflet proportionately large, deltoid, undulate on one side with a large obtuse lobe on the other, obtusely pointed. The form of the terminal lunule distinguishes it from both N. vasonervis & N. Desoui see above 1. where some of the characters of this species are indicated. 11.7.71. Its nervation is as indicated in. A better figure showing nervation should be made. One specimen recently obtained from Mr Strong N. 475 shows more distinctly the characters of this species. The leaflets are often lobed or divided from the top of the pinna and by the depression of the deep leaflets upon the border of the leaflets these borders become crenulate (3.10.71).

think, demonstrates that all the leaflets represented in our plate viii, fig. 1 to 6, belong to the same species. The cyclopteroidal leaflets of this species vary in size from little more than half an inch to four or five inches in diameter.

Neuropteris inflata, Lesqx.

Geol. Rep. of Ill., vol. ii, p. 431, Pl. xxxvii, fig. 2.

Though a few specimens of this species have been found in the concretions of Mazon creek since its description was made, these specimens do not indicate in the nature and characters of this plant anything more than was formerly known. All these specimens have only two basilar? round inflated leaflets, of a thick coriaceous substance, without any traces of lateral branches. One of the specimens has the leaflet of one side lacerated, or cut in lanceolate linear laciniæ, much like the leaves published in the Geol. Report of Penna., p. 856, Pl. v, fig. 5, as *Cyclopteris Germari*, Gopp? As the specimen which I considered then (1854, Bost. Soc. of N. H.) as referable to Goppert's species, is not in my possession, I cannot, by comparison, ascertain if it is or is not identical with ours. Moreover, as both the European and the American species are founded on mere fragments of specimens, we must consider the species which they represent as still uncertain or doubtful.

Neuropteris coriacea, Sp. nov.

Pl. viii, fig. 7 and 8.

We have of this species only a small branch in a concretion from Mazon creek. It is part of a secondary pinna, lanceolate in outline, bearing nearly opposite oblong lanceolate obtusely pointed pinnules, turned upwards at an acute angle to the rachis, and gradually diminishing in size to the terminal leaflet, which appears proportionally broad. As it is broken from the middle upwards, its form is unknown. The texture of the leaflets is thick, and the smooth epidermis is inflated along the veins and veinlets in an irregular manner, as seen in fig. 8, enlarged.

This inflation may be caused by groups of spores or elongated sori, placed along the veins which are twice forked, and along their divisions. A swelling

of this kind on the veinlets of *Neuropteris cordata*, Brgt., and which is also often remarked on specimens of our *N. hirsuta*, has been considered by European authors as representing organs of fructification. As the form and thickness of the inflation is very irregular, it may be caused on both species by some casual influence in the process of mineralization. The basilar leaflets of this species show a tendency to be divided into lobes and pinnules, having thus the same form as some of those of *Neuropteris Desorii*, Lesqx., to which this species is related, and from which it differs only by the thick epidermis, and by the more distant ramification of the veinlets. The small fragment mentioned in vol. ii of this Report, p. 430, as possibly belonging to *N. Desorii*, Lesqx., is referable to this species.

Genus DICTYOPTERIS, Gutbier.

Aldr. u Verst., p. 62.

Frond at least tripinnate, pinnæ linear-lanceolate, bearing alternate leaflets much variable in size, ovate-oblong obtuse squarely cut at the base, with equal lobes on both sides, or with the lower lobes slightly elongated. Medial nerve none, or merely basilar; veinlets anastomosing from the base, arched towards the borders, but irregularly undulating in ascending, and forming by their contact an oval-polygonal reticulation.

Dictyopteris rubella, Sp. nov.

Pl. vii, fig. 2 to 6.

Frond bi or tripinnate; pinnæ linear-lanceolate, with alternate oblong or oval-lanceolate leaflets, attached to the rachis by a broad pedicel. The inferior basilar lobes, as is generally the case in the species of the genus *Neuropteris*, are slightly longer or protracted into a little obtuse auricle. The terminal leaflet, somewhat broader and longer, is oval in outline, obtuse, and cut on one side into a short obtuse lobe, fig. 2. The leaflets of the large inferior pinnæ are more distant, larger, truncate at the base, slightly scythe-shaped outwards; and

1. Neuropteris Lesquereuxii Lesq. Ill. Geol. rep. vol. 2. p. 430. Pl. 36 fig 4 The description and figure of this species are right. specimen destroyed by fire at Penn. Never seen but once see 388. 1

+ 2 Neuropteris pachyderma Lesq. Ill. Geol. Rep. vol 2 p. 430 Pl. 36 fig 5. Same remark as for the former species.

+ 3 Neuropteris inflata Lesq. Ill. Geol. Rep. vol 2 p. 431 Pl. 37 fig 2. may be the same species as N. Collinsii Lesq. see my note this vol. p. 382 – 1.

+ 4 Neuropteris flexuosa Bgt. Species as yet uncertain. I do not know it to be American. at least I do not know if any other species is referable to it.

+ 5 Neuropteris rotundifolia Bgt. The leaflets referred to it appear to belong to my Neuropteris capitata Lesq see this vol. p. 383 b – 2.

+ 6 Neuropteris plicata Penn. may be ~~an~~ Neuropteris spec. nova, described this vol. 3, p. 33 4 b no see p. 384 b.

× 7 Neuropteris Villersii Bgt. as described and figured Penn. report p. 858 Pl 3 fig 3. Schimper in his Tat. veg. p. 446 considers this species of Bgt. as representing the upper part of a pinna of Neuropteris auriculata Bog. But the Neuropteris has not as yet been discovered in our Carboniferous formation and we have 2 specimens N. 6. figured in the Penn. report loc. cit. & N. 60. which both for the direction of the veinlets agree well enough with Brongniart's description and figure of N. Villersii. Bgt. says: nervulis numerosis, dichotomis arcuatis. while in our specimen the veins & veinlets are not very numerous forking only three or four times in leaflet 1¼ inch long and they are not arcuate but straight. Schimper's description of Neuropteris auriculata indicate the same difference. Our specimens are apparently referable to Neuropteris callosa Lesq. (neut. which should be described perhaps as an Odontopteris but for its cyclopteroid leaflets)

× 8 Neuropteris heterophylla Bgt. I do not think that this species is represented on Coal measures. At least I have not a single specimen which could be referable to it with certainty. Most of what I considered as belonging to this species is of Neuropteris Desorii Lesq. One single specimen of ours N. 117 which I consider as representing the upper part of a penna of N. tenuifolia or Lockii (in this case it would be a new species) might be referred to the species rather from the description of Schimper which consider it as the same as N. tenuifolia Bgt. The specimen represent the upper part of a frond like the one of U. S. T. Pl. pl 3 fig 3 N. Lockii. But the terminal leaflet of the penna is not seen. Brongniart's Pl. 71 fig B is about 1/12 it. The veins & veinlets are very thin but more distinct and distant than in N. Lockii and therefore belongs to N. tenuifolia Bgt. This tends to prove that Schimper is right in considering both species as identical. Our N. Desorii which in the beginning of my researches I considered as the N. heterophylla is a totally different. – 13. 7. 71.

9 Neuropteris spec. nova. Specimen N. 80. Perhaps the fruiting branch of a Neuropteris. It is the top of a small penna with four lateral leaflets on each side and a terminal leaflet broken at the middle. Leaflets narrow scarcely more than one eight of an inch about 3/40 of an inch long, turned upwards or nearly erect, linear tapering to an obtuse or truncated points. rounded at the base in the upper pair, prolonged down the rachis into a round auricle attached to the round costate narrow rachis by a thick pedicel which scales upwards to a thick medial nerve which ascends to 2/3 of the leaflets. Veins and veinlets very strongly marked though thin, therefore prominent and distinct more than in any other Neuropteris at least five times dichotomous branching to the borders where 104 veinlets are easily counted for ½ of an inch. this would give 208 to the inch proving how remarkably distinct they are. They are at first ascending along the medial nerve and then moderately curved to the borders. This species represented by this small penna is especially remarkable by its strong though thin veins & veinlets its narrow rachis the round pedicel of the leaflets continued prominent into a strong medial nerve. It is not the fruiting part of some known species of Neuropteris. It is a fine well marked species. Its small leaflets are in their form like a miniature of N. Clattoni but with proportionally longer leaflet. 13. 7. 71.

10 Neuropteris sp. nova: N. 82. Top of a penna with a broad undulate, deeply striate rachis having on each side about 5 lanceolate or linear lanceolate ~~leaflets~~ large leaflet about 1½ inches long turned or curved upwards with each two round leaflets at their base as in Neuropteris hirsuta. The pedicel of the leaflets is broad and passes into a broad depression marked in the middle by a narrow thread like filament. Veins dichotomous about 5 time divided rather thin but strongly marked and distinct, measuring at the borders 100 per inch. Surface of the leaflets marked with prominent straight short hairs. Basilar leaflets round with veins and veinlets flabellate and dichotomous emerging from a bar and straight. This specimen

388c may represent the upper part of a pinna of Odontopteris Wortheni or of Neuropteris
decipiens? (sp. nov.) Neither the leaflets nor the part between them is inflated and the
veins are marked like the veinlets as rominent upon the surface and not by
a hollow scar. The broad decy contact rachis is not like any of those of
species of Neuropteris known to me but the venation is exactly Neuropteroidal.
It is placed with Odontopteris Wortheni till better specimens are obtained 13.7.71.

1 Neuropteris Evini Lsqx. Could be compared with N. crenulata Brgt for the nervation
but certainly distinct by the pedicel of the leaflets the narrow rachis &c see above 388c &c.

2 N. rarinervis Lsqx. Penn. Rep. I. 857 Pl. 3 fig. 2. Referable perhaps to N.
fimbriata this rep. p. 381b 1. The specimen is not in my hand. Rogers had it
and I can not compare. Such a species from a single specimen is obviously doubtful.

3 Neuropteris amlacifolia Sternb. The only specimen from which is referable to this
species and which I consider a Brongniart species fig. for. p. 229 Pl. 63 fig. 1 is on
a large shale 5511 and were three small separate leaflets N. 276 are seen at different place
detached from the rachis. The emptical one is cordate rounded much smaller than
Brongniart's figure but exactly of the same form. The veinlets many times dichotomous
are thin and somewhat inflated and distinct. The surface of the leaflets is minisy and
trace of a pedicel is marked at the base of the leaflets. Nothing is known of this species
but what Schlotheim has published as indicated by Brgt as Filicites acuminatus Schl.
Nachr. zur Petref. p. 412 Tab 16 fig 4. from this figure the veins appear close but distinct.
He does not describe them. Apparently a very rare plant. Schlotheim mentions that
the specimen of his is the only one found with leaflet attached to the rachis 15.7.71.

4. Neuropteris delicatula Lsqx. Penn. Rep. I. 858 Pl. XX fig 2. Scheinsper fait
certe aliquo an Odontopteris fig. Sal. p. 463. Certe ma conviction tant qu'il n'est
que forme separée du Neuropteris fimbriata as this is figured in U. S. T. Pl. 15
fig. 1. Of course before the relation between this and the Cyclopteroid
leaflets of N. fimbriata was ascertained, I could but consider it as a peculiar
species. (15.7.71.) I believe it to be made of two species 2 of N. fimbriata 2a of Neuropteris tenuifolia.

D5 Neuropteris gibbosa Lsqx. Penn. Rep. I. 858 Pl. 5 fig. 3. may be referable
to N. plicata Hen or N. obscura sp. nov. Lsqx. Specimen is not in hand. Compare

6. N. minor Lsqx. Penn. Rep. I. 859 Pl. 3 fig 4 may be N. rarinervis, at least it looks so from
the figure and from the description p. 859.

7 Neuropteris adiantites Lsqx. Penn. Rep. I. 860 Pl. XX fig. 1. Looks as an Odontopteris
Specimen not in my hands. Compare if possible or if not

D8 Neuropteris unguiculata Brgt. The specimens called which agree with Brongniart's
description of his species Fos. I. p. 231 Pl. 64 fig 3 & 4 though exactly corresponding in form
to those of the French author belong to Neuropteris Clarksoni Lesq. see

9 Neuropteris microstalla Brgt. is uncertain. It is built on Mazon creek specimens which
are not distinct enough. It may be either N. minor or N. rarinervis Bunb.

10 Neuropteris? sp.? Spec. O 22 & 23. A remarkable form. The upper
part of a bipinnate pinna on frond. Primary pinna alternate short linear
lanceolate pointed? Divisions round-oval very obtuse the inferior ones distinct though
imbricate at base, sessile by a broad base, truncate at base, the superior ones becoming confluent
and decurrent on the rachis, smaller with an apparently small terminal pinna. Upper
leaflet with the veins coming out from the rachis distinctly, inferior ones with veins
coalescent from a broad base and without medial nerve. The same specimen has
on the reverse O 23 a segment of a pinna whose upper leaflet are those of Odontopteris
Schlotheimi with round small cyclopteroid leaflet with sinus on one side and
a large lanceolate Neuropteroid leaflet on the other. The specimen which has some
other parts of pinna with opposite oblong leaflets larger than those of N. Rochei
may represent N. rotundifolia. Then if it is the case N. Neuropteris capitata can
not be considered as the same. 15.7.71.

11 Neuropteris? sp.? Specimen O 27. Also a simple pinna lanceolate tapering
pointed or pointed having 11 pairs of leaflets. Leaflets proportionally long, sinus equal
or obtuse, resembling in form those of Neuropteris tenuifolia. Leaflet close to each
other, inserted on the wider lanceolate base attached to the rachis by a broad base,
higher on set at the upper side. The venation of the two lower pairs of leaflets is Neuropteroid
and regular with the medial nerve marked to the middle and the veins distinct
thrice dichotomous distinct like the veinlets not much curved. Much like those of

Omitted

Omitted?

9 Neuropteris tenuifolia. From this upward the nervation is quite prominent, the veins raised very undulate inflated perpendicular with the surface of the leaflets irregularly rough-ridged on each side. The terminal leaflet not seen in its whole, it appears very small or a Neuropteris and tapers downward to obtuse acuminate. Document contains leaflets of this form of an Odontopteris. maybe Kurcaea??

10 Neuropteris orbiculata! John. Specimen N. 493 from Pottsville (Penney) is apparently referable to this species. The veins are exactly perpendicular to the rachis, wind at least small of them in the lower part of the rachis they become oblong rachis at nervation is visible, the veins being concave. It may be some deformation of N. Tenuis. The specimen is too small and obscure for conclusion see p. 467 b. rather Neuropteris sp. from Pottsville = N. obscura.

13 Neuropteris Clarkii Lesq. Some pinnae are linear with oblique oblong obtusely pointed or obtuse leaflet like those of N. vermicularis etc. See L. 1615 from Mazon Creek. The leaflets are however generally enlarged at the lower base side and the nervation is strong and distant. The terminal leaflet is also a characteristic. See fig. 1 of my plate U.S. flora. see sup. p. 467

14 Neuropteris undata Lesq. Specimen L. 1616 from Mazon Creek, given by Thomas clearly the character of this species as described in the Geol. Report as N. tenuinervis which I supposed might be the same. It is a large leaflet ovate obtuse, 6½ cent broad at base long, 3½ cent broad at the base with deeply undulate borders, a narrow midrib, distinct to the point as the lateral veins, emerging at the base from an enlarged base and above from the thin midrib. The veins are distant but not inflated, distinct with the glass only. see p. 386 c. 2 — see

15 Neuropteris pachyderma Ill. Rep. II p. 430 Pl. 36 fig. 5. — I have of this species a fine specimen L. 1618 rec. from Strong. It represents a whole pinna 13 cent long, lanceolate or gradually tapering to a compound lanceolate obtuse pinnule obtuse lobate on each side. Those pinnules ovat obtuse 16 to 18 millim long, 10 to 11 millim broad, truncate or cordate at the base slightly oblique to the rachis to which they are attached either by their whole base (truncate) or by the middle forming an enlarged pedicell as it is marked in the fig. of the Ill. Report vol. II. These leaflets are very thick, inflated without any trace of nervation except in one or two of the leaflets which appear as obscurely marked with very thin veins cutting through the thick epidermis parallel at the base forking once or twice. This is therefore a true Odontopteris. In the lower pinnules which are cordate and attached to the rachis by the enlarged midrib, the lateral veins appear to come out of the midrib and to incline in slightly curving toward the border. Their concave border are surrounded by a flat narrow entire ring. All the ovalate leaflets except those of the two upper pairs are separated to the base.

16. Odontopteris aequalis. Ill. Rep. II p. 434 Pl. 36 fig. 2. is represented by a fragment of Nodule L. 1619, L. 1619 b. the middle part of a pinna of which three pairs of pinnules only are preserved on each side. These are oblong equal, very obtuse slightly decurrent and joined above the rachis by a narrow obtuse sinus attached by their whole base to the narrow rachis from which come out the veins nearly parallel, slightly diverging from the midrib toward the border bifurcating once near the base and once toward the point. The leaflets are inflated as in the former specimen but the veins distinct, the border around the leaflets are also flattened just as in O. pachyderma. I believe therefore that both specimens represent the same species as in the upper part of L. 1618 the leaflets are also joined to the rachis by their whole base, connected above. The rachis and with narrow obtuse sinuses. To this should also be referred L. 1620, L. 1620 b. where leaflets are broadest tongue, attached by an enlarged middle with the middle veins more prominent. See 389 b. (3) & Suppl. 467 b.

389 ~~Species incertae sedis~~ ~~Odontopteris alboarcuata~~ Pinnatifida

1. Odontopteris ~~subcrenulata~~ sp. nov. No. 12. Pinnae lanceolate shortly secondary pinnae linear obtuse, short, the lowe ones about 3 cent long ~~gradually~~ ~~lobed~~ pinnately deeply lobed, gradually shortening upwards and passing up into simple terminal pinnule. Pinnule short obtuse or rounded nearly quadrangular in outline evidently but minutely crenulate at the top. Veins either from dividing of the middle nerve or from the rachis slightly decurrent at the base forking once or twice, ~~the~~ understand and thick covered by the epidermis, close and more numerous than in O. Schlotheimii to which this species resembles. It differs also by the shorter secondary pinnae and the shorter nearly square ~~or~~ lobes or pinnules. It has also some likeness to O. crenulata, ~~but the pinnules are joined at the base, not decurrent and not enlarged on the lower side at base~~ as in O. crenulata. The substance of the leaves is also thicker. This species is somewhat like O. Böhmii Gutb. but the leaflets are much larger in the America specimen and ~~crenulate~~ serrate. (1) It may be after all a mere var. of O. Schlotheimii with the end of the veins passing up and slightly above the border of the leaflets. All the characters of form and nervation are the same. The comparison of better specimens may decide what it is. see 390 (6d)) Catherwood

(1) There is no relation to O. Böhmii Gutb.

2. Odontopteris Brardii, Brgt. A number of specimens (a 8 to 8n in my Catalogue p. 56 represent this species, it seems, though they are mere fragments of pinnae four to 6 cent long, fragmentary and only 1½ cent broad or less. The leaflets have about the same form as those figured in Bronniart, that is, they are oblong obtuse, or slightly pointed and scarcely falcate toward the point, ~~sessile~~ by their whole base, either joined near the rachis or slightly decurrent along the rachis before their connection at base. They are comparatively broader and shorter than in the European species, averaging five to 8 millimeters broad toward the base and 8 to 9 millim. long. The middle nerve is more or less distinctly marked though the secondary veins which are extremely thin and close mostly come up from the rachis ~~though~~ the upper ones are evidently from the middle nerve to which they are in an acute angle of divergence and straight to the border. This character, the extremely thin veins, the shorter broader leaflets obtuse or obtusely pointed are indeed differences marked enough from the European species. These pinnae rather represent Odontopteris alata Lesq. the more so that one of them has the terminal leaflet preserved it being long, 3½ cent, enlarged above the base and then gradually narrowed into a long acumen of the same character as in O. alata of my Cat. of Coll. Ills, but still with a longer ~~narrower~~ acumen. This differs from my description by the veins which are not distinctly marked but as said above very thin and close somewhat indistinct. ~~From the~~ ~~I seem and~~ This should be referable however to O. alata rather than to O. Brardii of Brgt.

3 (From 389d) This specimen No. 1620 has the leaflets broader, shorter, all separated but with a border imbricating 1½ centimeter long and seems as broad as long. They are rounded upward and cordate at the base with the same nervation as in Odontopteris Neuropteris crenulata as figured in my Flora of the U. S. Flora. This is referable to Neuropteris crenulata by the spec. No. 1621. See note on Odontopteris & Neuropteris pachydermata p. 470 b.

the axillar pinnules, still larger and cyclopteroidal in form, are attached around the stem by a half circular notch, nearly surrounded by two broad auricles. The veins, anastomosing from the base without medial nerve and in their undulations forming oval-polygonal elongated meshes, curve towards the borders, where the last divisions end in arched close lines.

In this species, found in soft shales at Murphysborough, the epidermis or substance of the leaflets has become, by maceration, separable from the stone, and is easily obtained in lamellæ. Whole pinnules can be got in that way without any earthy substance adhering to them; and in that semi-opaque state their texture and nervation are easily studied with the glass. The veins present, under the microscope, the appearance marked in fig. 2.

When the 2d vol. of this Report was published, no species of this genus had been found in Illinois. Now this new one, obtained in numerous and well preserved specimens, not only adds a beautiful species to the flora of the Coal Measures, but furnishes us new evidence on some questions concerning the vegetation of plants of this kind. First, our specimens prove, beyond doubt, the close relation of this genus with the former. The form of the fronds, of the pinnaæ, of the leaflets, and their variety in size and shape, are exactly alike in both genera. Truly but for its nervation, we should have in our new *Dictyopteris* a *Neuropteris* scarcely distinguishable from *Neuropteris Loschii*, or *Neuropteris tenuifolia*. But further, the peculiar nervation, as well as the peculiar reddish color of the plant in its fossil state, permit us to identify the large leaflets of the species of this genus with the small ones, or afford the proof that for *Dictyopteris* as for *Neuropteris*, the large round cyclopteroidal pinnules, always found isolated, really belong to species represented by pinnæ bearing small leaflets of a widely different form. It would not certainly be possible to admit specific identity between the leaves represented, pl. vii, fig. 2, and those of fig. 5, without those peculiarities of structure remarked in both.

The species of *Dictyopteris* are rare in the Coal Measures. In the United States none had as yet been found but *D. obliqua*, Bunb., whose remains are very abundant at some places in Pennsylvania and Ohio, and which have also been found, but rarely, in Kentucky and Arkansas. By the form of its leaflets, its ramification f c. f, this last species is related to *Dictyopteris Brongnarti*, Gutb., the only species of this genus known in the Coal Measures of Europe. For *D. neuropteroides*, Gutb., described from a few small leaflets, is, according to Prof. Ellinghausen, a true *Neuropteris*, and *Dictyopteris cordata*, Roem., according to the remarks of the author himself, is a variety of *Neuropteris cordata*, Brgt., as his *D. Hoffmanni* seems to be a variety of *D. Brongnarti*, Gutb.

Genus ODONTOPTERIS, Brgt.

Ill. Geol. Report, vol. ii, p. 432.

Odontopteris subcuneata, Bunb.

Pl. viii, fig. 10 and 10b.

From the specimen figured here from Mazon creek, it is clear that the fern published under this name in the Ill. Geol. Report, vol. ii, p. 433, pl. xxxvi, fig. 3, does not belong to this species. It is referable to *Odontopteris heterophylla*, Lesqx., loc. cet., p. 433, pl. xxxviii, fig. 2 to 5. The pinnules of *Odontopteris subcuneata*, Bunb., are opposite, proportionally longer and narrower, slightly narrowed in the middle, and enlarged to the very obtuse point. The veins are closer to each other; and as the English author has figured them, they curve downward before coming into the border of the rachis, and descend in fascicules along the somewhat decurrent base of the leaflets. In their lower part and just above the decurrent border, these leaflets are all strongly bowed. The terminal pinnule is broken above the middle; it is proportionally large, and appears to be oval-obtuse, entire or without any lateral lobe. I owe this specimen, the most perfect known of this peculiar species, to the kindness of Mr. Michael Prendel, of Morris, Ill.

Odontopteris Bradleyi, Sp. nov.

Pl. viii, fig. 14.

Nothing is known of this species but the leaflet, which has been copied in our figure. It is lanceolate pointed, somewhat contracted at its base in a broad pedicel. The veins are closely approached, sharply and deeply marked, dichotomous in ascending, nearly straight from the base, where they become parallel. The veins and veinlets of this species are too close to each other and too numerous to admit it as related to *O. heterophylla*, Lesq., which has its leaflets sometimes pointed. It may be compared only to *Odontopteris acuminata*, Ll. and Hutt, of the Oolite.

In concretions from Mazon creek.

1 Odontopteris subcuneata Bunt. Specimen O. 25 & O 26. should perhaps be referred to this species. The nervation appears similar. It is the case at least for O. 26. Which differs from O 24. the specimen published and figured here, by shorter, proportionally broad leaflets, enlarged above sometimes lobed or wound oval, generally obtuse, less strongly lowed at the inferior base, those veins & veinlets less distinct and the upper borders of the leaflets more or less undulate-crenulate or simple lobed. In O. 26 also, the leaflets are generally alternate, not opposite and the rachis is broader. The general look of the penna is far different, the leaflets in O 24 being distant, equally oblique narrower near the base while those of O 26. are closer, sometimes overlapping each others on the borders. A specimen O. 25 is evidently hairy, the pairs being however rare, scattered, difficult to see and the pinna or main leaf divided on one side and entire on the other, it is referable to O. Northeni Lsqx. (23.6.71). For O 26. see below 10.

2 Odontopteris squamosa Lsqx. Venn. Rep. 1. 860 pl XII fig. 2 & 2a. Schimper confounds it as formerly the same as O. Brardei. We have of this last species a number of specimens from Newport R. I. There is evidently a great difference in the form of the leaflet independently in the nervation which is thinner closer and of a different character. I consider it as a good species. The nervation is well marked in O1 and should be carefully figured. By comparison

3 Odontopteris Brardii Brgt. Two specimens O 18 & O 20 appear referable to this species if they do not belong to O. alata Lsqx. I do not have the specimen of O. alata for comparison but the leaflets are not as much separated from each other, proportionally broader & more pointed showing some more resemblance to the European specimen as figured by Brongniart. Our american specimens however have the point of the leaflets turned upwards and not curved toward the point of the pinna and the leaflets towards the point are not as much enlarged and have indeed a different appearance. 15.7.71 I consider my Odontopteris alata a good species though Schimper thinks it probably the same as O. Brardei. Indeed all these Odontopteris can pass from one to the other for example specimen O 33 from Morris that has a pinna whose leaflets agree exactly with those of O. Brardei Brgt or rather of O. alata Lsqx. Schlotheim Petrefact pl. 3 fig 6. has O. Schlotheimii with leaflet evidently moved from the middle like Morris. We have such leaflets from Newport R. I. generally in connection with Odontopteris Brardei or alata. Nevertheless we can not mix up species for some leaflets or leaflets when even we do not know to which species they belong. I believe from comparison of our specimens with Brongniart's figure & description that we have not as yet O. Brardei but that all our specimen of Newport referred to this species belong to O. alata. Compare the leaflets which are generally oblong and obtuse and on the penna figure of my Catalogue, the winged stems and the form the leaflets terminal on the rachis with that of the inferior leaflets in Brgt figure 15.7.71 see 390

4 Odontopteris Schlotheimii Brgt. Besides the splendid specimen figured in U. S. Geol. Rep. pl. 6 fig. 4. & 5 we have plenty of broken specimens of this species that show how they show diverse appearances of the plant. They are all of a reddish color and therefore easily distinguishable. Among them there is one marked N. 231 which looks like a Neuropteris but which demands comparison with better specimens. The characters of O. Schlotheimii are indicated in Brongniart and in my report see p. 470 & 471 U. S. Geol. Rep. pl. 6. 15.7.71

5 Odontopteris crenulata Brgt. A small specimen O 40 with the character indicated by Brongniart & showing that this species is a good one. Schimper refers my O. intermedia to O. Brardii, a mistake, I think. The nervation being broader more prominent in my specimen and the point of the leaflets appearing slightly crenulate. It might be referable perhaps to O. crenulata. As yet the specimen must be preserved. 15.7.71. see p. 390 & 7.

6 Odontopteris intermedia Lsqx. see above (5)

7 Odontopteris species nova or crenulata L. 28. or O. abbreviata. A small pinna with short, rounded slightly oblique linear obtuse pinna. Pinna cut into obtuse leaflets joined from the middle or rather obtuse lobes crenulate at the point. Veins thick, scarcely branching all emerging from the secondary stem. Primary is hairy & thick. 15.7.71.

8 Odontopteris subcuneata Bunt. represented by O. 2. & O 20. see description p. 390.

9 Odontopteris Northeni Lsqx. O. 25. A specimen from Mazo Creek, representing a single pinnule 6 to 7 lobed on one side while the other side is entire. The description & fig. in Geol Rep. Ill. vol. 2 p. 432. pl. 36 fig 1 are right.

10 Odontopteris species nova. O. 3. A single specimen representing a pinna with a broad smooth rachis merely that in the middle by the continuation of the veinlets descending to it

3910 c. Pinna divided into alternate oval very obtuse leaflets sometimes enlarged and chanced at the top. Nervation very slightly decurrent to the rachis [illegible] nervation at base. [illegible] medial vein is stronger and dichotomous; secondary veins twice or thrice dichotomous; lateral veins descending to the base of the leaflet are less marked but also once or twice dichotomous. This species might be referred to O. rectinervata. But it differs much in the form of the leaflets which are gradually narrower toward the base, proportionally shorter and broad, alternate crowded, even imbricate at the borders and by the nervation. It has not any veins and has a far different nervation than that of O. Worthenii. 15.7.71.

Fig. 90 Odontopteris Schlotheimii Brgt. Hist. Geol. Rep. vol 2 p. 433 Pl. 38 Fig. 2-5. Description and figures right. The specimens are not as good as there on hand to make the report. 15.7.71. See p. 470 b. 4.

Odontopteris Schlotheimii Brgt. We have two specimens 0.38 & 0.48 of this species, from Morris which indicate fructification on the borders of the leaflets and which therefore should be figured. 24.7.71.

3. Odontopteris alata Brgt. Remark upon one of my specimens, O 20. that the inferior leaflet, is, near the top of the pinna attached upon the main rachis therefore rendering the rachis winged and that in descending these inferior leaflets become attached to the base of the secondary rachis as Schimper has remarked it. We should therefore consider our specimen of O. alata as a var of O. Braeckii. 10.8.71. See p. 470 a. 1.

4. Odontopteris deformata n. sp. nov. ined. (name may be changed). See specimens 017 a. 0.57. Subpinnate. Pinnae linear lanceolate, narrow, frequently long. Spec: 0.57 has one about 1 foot long.) Bipinnate becoming merely pinnate at and near the top; pinnae short, open near the base, oblique toward the upper part, sessile to a proportionally broad rachis, short, less than three centimeters long, linear lanceolate, pinnules joined merely near the base, free near the top where they become more and more confluent. Small & small: long, [illegible] 2 inches at base, lanceolate, obtusely pointed or oblong obtuse with the veins nearly rectangular than parallel dichotomous. Upper leaflets or pinnules much broader and longer entire or slightly lobed oblong obtuse terminal pinnule deltoid, obtusely lobed on one side, obtuse. The plant is far different of any one as yet published having merely some distant resemblance to Odontopt. in Mem. of Brgt. In short pinnae becoming gradually not pinnate near the top of the long narrow pinna [illegible] broad base entire leaflet, the [illegible] veins to give to this species a particular appearance. 12.X.71. The large shale 0.57 has some have pinnae of O. Braeckii & N. Agassizii.

(4) Nam deformata given to Brgt.

5. Odontopteris Britannica Gutt. Mr. Southwell sends sketch of a small branch of fronds exactly similar to what is published under that name by Geinitz. See p. 471 b. 4.

6 Odontopteris. Brgt. see Mem. on Grand Eury p. 4.

D7 Odontopteris reticulata Brgt. I refer to this species the specimen of Torrent of Chestnut Hill No 31. It represents a pinna 5 cent long and one inch broad below its top. bearing on each side of a broad rachis 1½ millim. broad 5 pairs of alternate half round or broadly oblong very obtuse pinnules slightly turned upwards attached to the rachis by a broad base, slightly auricle at the lower part and also slightly decurrent at the base of the point of attachement, not connected at base 2 or 3 millim. distant, crenulate all around. More distinctly at the broadly rounded top. Middle nerve none, all the veins emerging from the rachis, distant, parallel, forking once or twice. Other pinnules are about one centimeter wide at the enlarged base and one cent. long. A smaller branch upon the same specimen has leaflets longer and narrower, and the lowest elongated lanceolate deeply nearly dentate, exactly of the same form as that in Brgt. Pl 78 fig. 1. This specimen has to be figured. One of the leaflet has the veins [illegible] see p. 389 b. O. Rappt. to Odontopteris p. 470 a.

D. 1 Alethopteris oweni? Specimen Al 79; Al 20, Al 23. Al 26. represent a species with fructification. The specimens are very poor. They merely represent parts of broken pinna where leaflet appear disconnected and rounded at base. The medial rein is strong, ascending to the point. The strong thick reinlets branch only once from near the base sometimes twice and are oblique on the medial nerve. The fruiting pinnules bear a single thick round sporange placed upon the middle or at the forkt of each rein. The substance of the leaves is not as thick as in the other species. Though it appears a truly distinct species, the specimens are not good enough for a satisfactory determination. It much resembles Al. obligua Brgt. 28.7.71. See p. 394 c(2)

D 2 Alethopteris dimorpha Lesq. See U.S. fos. fl. Pl. 8 & description. Though apparently a good species may be merely a var. of Pecopteris thulletii or P. lacinata with the leaves changed by metamorphism. Two of the specimens at 25 & Al 25b represented Pl. 8 fig 1 & fig 5 are at the Museum the others belong to Amherst college.

3 Alethopteris Shaeferi Lesq. (Pecopteris). Cat. of U.S. fossil plants p11. pl 1 fig 4. Schimper Tal. Veg. p 562. describing this species as Alethopteris Shaeferi, remarks that it is very near of A. aquilina or rather identical with it. In reexamining the only specimen obtained of this species and comparing it with specimen of Al aquilina, I present a great difference: by the decurrent leaflets, distinctly undulat on the borders much shorter, somewhat narrowed in the middle and by the medial nerve which is not quite as broad. It is much like 2 Alethopteris aquilina described above 291b and might be the same except that the reinlets appear more distant and less oblique on the rachis. It should be compared again with better specimens (see mec. at 26) 7.7.1 (Al 19) is the same as Alethopteris sp. nov. (vide) fruiting. Bipinnate. pinna (bella Maum) more than one inch broad: leaflets free to the base, attached to the finely striated rachis by their whole base strong oval obtusely pointed or obtuse, short, half an inch long, 3/25th of an inch broad oblique or turned upward. Fructification marginal by thick simple veins or ribs perpendicular to the medial nerve, formed by a series of 6 to 7 small oval-elongated sporanges apparently placed on a line upon simple reinlet. A poor matter specimen which can not be compared to any other of the series. It shows little Al. oweni? as above 1. that the form of this section do not have all their species with marginal fructifications. The other side of the shale has an Alethopteris sterile which appears to be the same species. Pinnae lanceolat with narrow rachis, pinnules, lanceolat obtuse entiere, decurrent and joined together at the base, the medial rein thin, ascending to above the middle, inside branches forking once or twice. The specimen Al 37 is varnished, and the nervation is obsolete. But neither by its lanceolat obtusely pointed leaflets, nor by its nervation or rather fructification has this species an analogy with any other. 30.7.71. (see pinnae 392 b, Al 17.)

D 5 Alethopteris hymenophylloides Lesq. this report. p 393. Refer with some doubt to this species a small specimen Al 102 from Newport. Also see p. 392 c-1.

D. 6 Alethopteris spinulosa Lesq. p. 396. Represented only by a small specimen from Newport Al 102. The reinlets are obsolet but it is apparently the species. 29.7.71. also Al 116!

D 7 Alethopteris obscura Lesq. see plate 6 U.S. fos. flora for description. It is right. 29.7.71. see 392 b.-5

D. 8 Alethopteris aquilina Brgt. var. or Sp. nova. specimen Al 30. It resembles by the form of the secondary pinna Alethopteris aquilina Brgt. (refer to A. ambigua.) But the pinnae are open or perpendicular to the rachis, rigid; the pinnules generally disconnected by the rachis shorter and broader, slightly sythe shaped and the lower inferior pinnule along the main rachis is broader undulat lobed. The nervation is not quite distinct. The medial nerve is broad and the rein appear as forking once or twice. It is somewhat like Al. Grandini Brong. but still more different from it than from Al. Aquilina. 12.8.71. Al. 91 (Al 124) are referable perhaps to the same species.

D. 9 Alethopteris Serlii Brgt. We have obtained from Al Strong and from Morgan creek two valuable specimen of this species. One is a pinna with leaflet more than two inches long ~~with leaflets more than two inches long~~ and fourth inch broad. The other is part of a compound bipinnately divided pinna, the two lower pairs of pinnae are divided leaving short broad oval pinnules, while the upper part simply pinnate has lanceolar pinnules as it is generally found. The division in this species is and like that of Al. crispata as figured by Brgt. only the leaflets are broader. It is the only specimen of this species obtained with the double division of the pinnae. 13.10.71. I have seen in no duplicate of Mercuelli (1876) pinna with pinnules 5 and an half centimeters long and 12 millim broad, while a pinna of Al 392 of Lacue specimen has short, half round or broad oval pinnules, least long 6 millim broad and the terminal leaf

A. crispata name sent to Brgt.

Alethopteris vide Bry. Tabl. des genres p. 15

D 1. Alethopteris lonchitica Bryt. Veg. foss. pl. 128. Specimen Al 97 from Mazon creek is exactly the species figured by Brongniart loc. cit. But it is peculiar that I can not find neither in Brongniart nor in Schimper a mention of this peculiar form referred by the name at the bottom of the plate to Alethopteris lonchitica. Is this a new variety is this a species. Alethopteris Sternbergii Goppert Bryt foss. 295 as figured by Sternberg Flor. der Vorw. 2 p. 21 tab. 53 fig 2 has some likeness to this variety or species; but the leaflets are shorter and less pointed. As much as can be seen by our specimen the nervation is like that of Al. lonchitica, simple and forked veins alternating, mostly two forked veins separated by one simple. 27. 7. 71. ~~Sept 3944 (1) Aranbigua.~~

D2. Alethopteris Serlii Bryt. We have in the museum a splendid specimen of this species Al 5. it is part of a penna with pinna curved downwards about 1 foot long.

D3 Alethopteris Pennsylvanica Bryt. Penn. Geol Rept. Bryt 1864 Pl. 11 fig. 1 & 2. The description is about right as well as that of Schimper Tal. Veg. p. 562. Schimper says that it resembles Al. Grandini Bryt. But it is far different, the leaflets being proportionally shorter and broader and not narrowed in the middle. It may be a variety of Al. lonchitica but is not Grandini. 27. 7. 71. It may be that the veins and veinlets are more deeply and distinctly marked than in Al. aquilina indeed the thick & strong nerve so striking in Owen's and other species.

D Alethopteris Owenii Bryt. Geol Rept 2 p. 309 tab 2 fig 1. See my description figures which are correct except that it is not said that the veins and veinlets are oblique on the medial nerve or obliquely curving to the borders as it is seen by the figure. Schimper compares it to Alethopteris lanigeroides Rum. a species of which I have a mere sketch and which from its appearance very different. 27. 7. 71.

5D Alethopteris aquilina var. Bryt. = Al. ambigua Specimen Al 32. are doubtfully referred to this species as a var. The stale is covered with separate linear pinna, three to four inches long with with oblong obtuse or obtusely pointed leaflets either joined or disconnected at base, mostly perpendicular to the rachis with an odd terminal leaflet connected with the two upper leaflets of the pinna attached at its base. The texture of the pinnules is thick, forming at the surface a coaly pellicle which obscures totally the veins and veinlets. Medial nerve very broad ascending nearly to the point, the veins appear divided as in Al. aquilina Bry. This species is abundant at Duquoin and other localities of Ill. and generally recognized by a flattened margin encircling the borders. But as yet I am not quite certain that it is the same as the European one. The pinna and leaflets are shorter and narrower and the thick cuticle is not mentioned by European authors as Bronguiart Veg. foss. p. 286 says in comparing it with Pteris aquilina: "On ne peut pas douter que ces plantes ne fussent extrêmement voisines; car outre la grande analogie de formes, l'aspect des pinnules très convexes, à bords recourbés en dessous à nervure moyenne très marquée & d'un tissu qui paraît épais & coriace, indique encore une plant analogue avec Pteris de cette section". This form has sometimes as large pinnules as A. aquilina or A. Davreuxii the nervation however is always obsolete.

D4 Alethopteris Massilionea Bryt. is considered as Schimper, Tal. Veg. p. 561 comme une belle espèce. See for description Schimper loc. cit. Geol. Rept. Ill. vol. 2 p. 438 Pl 40 fig. 1 to 4.

D7 Alethopteris Conrad Bryt is considered as Owenii. In comparing my specimens of this species which are very broken and obliterated with those of A. Owenii I find very little difference between these species. They may be the same, though in the first species, Al. Conrad the medial vein is thin scarcely marked; the veinlets undulate-lobed, scarcely connected as have veinlets in Al. Owenii the leaflets are more entire connected and marked by a deep and often thick medial nerve. 27. 7. 71.

8. Alethopteris rigida sp. nova. Bi-tripinnate. Primary pinna ovately ovate. Secondary pinna alternate, oblique ~~elevated~~ with a broad straight rachis, leaflets linear narrow, obtuse or obtusely pointed disjointed to the base, decurrent on the rachis, undulately lobed on the borders, often narrowed in the middle, medial nerve well marked ascending nearly to the point veinlets forking once, rarely one of the branches forking again, obsolete by the thick texture of the leaflets very oblique. The leaflets are inflated at their base on both sides of the medial nerve as if they were bearing a glomeration of sori or fruits of an oval inflated shape. The specimens Al. 34 & the most of the specimens from Newport are obliterated and distorted by fire but it is easy to recognize the original forms from which the characters are drawn. The nearest relation to this species is Al. Grandini. 28. 7. 71.

Odontopteris Schlotheimii, Brgt.

Veg. foss., p. 256, pl. 78, fig. 5.

Rarely found in the concretions of Mazon creek, but abundant in the roof shales of the coal at Morris. The frond of this fern is very large, at least tripinnately divided; the alternate secondary pinnæ linear lanceolate, two inches long or more, and more or less deeply and regularly cut in alternate round, oblong lobes, or in oval-lanceolate obtusely pointed pinnules, varying from one-fourth to half an inch long. The veins and veinlets, with the disposition and divisions as marked in Brongniart's description, are thick, parallel, and generally forking once. In the large leaflets there is a medial depression looking like a medial nerve, the veins generally branching from a medial point. Though somewhat obscure, the specimens or this species at Morris are easily identified by the reddish-brown color of the epidermis.

391b. 1, 2, 3, 4, 5, 6, 7, 8 391c 1.

Genus ALETHOPTERIS, Sternb.

This genus is admitted, for the disposition of the fronds and for their division, as it is characterized by Goppert in his Systema, p. 175, and for the position and the form of the fructifications, as modified by Geinitz, in his Verstein, p. 27. It therefore contains not only species whose fructifications are marginal and continuous, but species also bearing in some division of their veins, or between them, round or starlike groups of sporanges like those of the genur *Asterocarpus*, Gopp. As the fructification of some of our species is unknown, or is not clearly seen through the substance of the leaves, some are admitted into this genus from mere analogy in the divisions and in the form of their fronds, and in their nervation.

Alethopteris Mazoniana, Sp. nov.

Pl. ix, fig. 1 to 8, and Pl. xiii, fig. 5 and 6, fruiting.

Frond evidently large, many times pinnately? divided, dichotomous at the end of the divisions;# pinnæ long linear, tapering slightly toward the points, either pinnately or bi-pinnately lobed; lobes oblong entire obtuse, joined near the base and per-

Main rachis broadly ribbed in the middle or grooved marked throughout with narrow equal striæ.

dendicular to the rachis, or longer broader linear obtuse regularly undulate, lobed on the borders, and more or less distinct and distant to the base. Medial nerve thin, but deeply marked; veins of the simple pinnules rather curved upwards, forking once only at the middle; in the undulated lobed leaflets, one of the veins ascends to the sinus, and is twice forked upwards.

The divisions of the frond of this species appear to have been opposite to each other, and distant, at least in the upper part of the frond, as it is seen fig. 7, representing a specimen which at first seems to belong to another species. As the nervation, the broad deeply grooved rachis, and the form of the pinnules are the same, it is evident that it merely represents the upper part of a frond or of a pinna, whose ramification is either in the whole, as in the *Gleichenia* of our time, truly dichotomous, or pinnate and dichotomous, as in some of our species of *Pteris*. The fructifications of this species as represented pl. xiii, fig. 5 and 6, would rather refer it to the genus *Gleichenia* or even *Polypodium*, than to *Pteris*. They appear like round, oval, enlarged sori, placed along the borders on both sides of the leaflets, between the branches of the veins, as seen fig. 6 enlarged. The outline only of the fructifications is observable through the substance of the leaflets in the form of an oval ring, depressed in the middle, indicating perhaps the point of attachment of an indusium.

This fine species has as yet been found only in the concretions of Mazon creek, where it is tolerably abundant.

Alethopteris crenulata, Brgt.

(Fruiting) Pl. xiii, fig. 14 and 15.

Though the nervation of this fragment is scarcely well enough preserved to permit the ascertaining of its disposition, it is evident, from the form of the pinna and of the leaflets, that it represents a fruiting branch of this species. The leaflets united at the base, regularly crenulate around, with the borders apparently reflexed, are marked near the margin by two rows of scars of round sori, each placed in a curve of the crenulation, as seen fig. 15 enlarged. The medial nerve, like the veins, are obsolete, and the details of the nervation could be somewhat distinctly observed only on one of the leaflets. In comparing our figures with that of the sterile parts, published vol. ii of this Report, pl. 39, fig. 3, the essential characters are seen to be the same. This spe-

1. Alethopteris Mazoniana Lgx. Corneth! ~~lobes~~ surface of the lobes thick, inflated, smooth, somewhat coriaceous; lobes &c. perpendicular or slightly oblique. 20.6.71. The lobes are generally of such a thick substance that the veinlets are scarcely seen through the specimen except being marked by a mere depression. From this species should be separated as new: Specimen Al 44 & Al 50 with longer narrower secondary pinna ~~rachis~~ rachis narrower, deeper half round, leaflets shorter more distinctly separated though united near the base, leaflets irregular in length shorter linear lanceolate obtuse, marked by a distinct nervation. Medial nerve no thicker than the veinlets: veinlets simple or forking once, turned upwards especially the three lowest pairs which follow the margins of the leaflets in curving along them. The upper ones are scarcely curved or arched backwards. see p. 3925.2 - (Rem that A. Mazoniana has sometime the leaflets pointed see

2 Alethopteris longifolia Brgt. The form of specimen Al 29 from great Kenawha River & the Al 118 of Nebo Ohio considered as var. of this species should, I think be separated as species not only on account of the broader leaflets but especially from the very thin more curvy approaches veins which are perpendicular to the medial nerve. The division of the veins is the same. These specimens should be compared with a number of others of the same sort. As for Alethopteris grandifolia Newb. examined from a large number of specimens presented to the museum by the author of the species, I do not see any difference from A. longifolia, not even enough to make a variety of it. 10.8.71.

3. Alethopteris Massiliona Lgx. Al 94 & 94 b. Doubtfully referred to this species differing as it does by ~~the veins at the bases of the leaflets~~ the thin flexuous medial nerve and the decurrent base of the primary veins. Should be compared with better specimens. 10.8.71.

4 Alethopteris (Callipteridium Emerson) species nova, Fugitiva. Specimen Al. 79, 80, 83, 86. Only broken pinna of this species. Pinna linear lanceolate? Pinnules slightly oblique, disconnected, attached to the rachis by a rounded base or slightly decurrent base (rounded upward, decurrent downward) sometimes say the shape, ~~especially long and narrow~~ 10 to 12 millimeters broad 3 to 4 millim. oblong obtuse, entire; medial nerve thin, ascending to 3/4 of the leaflets and there abruptly disappearing in branching into veins. Veins oblique forking once near the base with one of the divisions forking again, generally the upper one, thick, distinct. Fructification marked by two rows of sporangia upon each side of the medial nerve, appearing oval in form or laterally compressed. On account of the broken specimens the species is not as yet satisfactorily known see below and Pecopteris Mellonii?? see better spec.

5. Alethopteris obscura Lgx. This, I think should be considered rather a Callipteridium. The nervation, the position and union of the leaflets being the same. The nervation as it is marked in my figure Foss. pl. A 5. fig 3 is not exact for all the leaflets. Generally the primary vein is not decurrent upon the secondary rachis and descends straight upon it as in my figure Geol. Rep. Il 20, 1a and there are two side veins one ascending to the sinus, one simple the second between this and the medial vein ascending higher and divide lower down. The lower branch simple the upper one forking again. There is not in my plate Il 1. to. Il 5 a small paper indicating the true nervation. 11.8.71.

6. Alethopteris geminata? spec. nova? Name can be changed. var of A. Mazoniana. Simple pinna lanceolate tapering pointed in outline 15 cm. long 3 cm. broad at base with a concave median ~~rachis~~ rachis, ~~two~~ pinnately divided leaflets oval oblong, obtuse pointed or oval-lanceolate obtuse, opposite or alternate either distant or at least disconnected or separately two by two connected to the middle, indifferently turned upwards or downwards mostly perpendicular to the main rachis, texture of the leaflets apparently thick, surface convex and border ~~left~~ curved downward; medial nerve strong, ascending to the top, veins alternate distant, forked once from the middle, the two branches either turning upwards. This species is a very beautiful, distinct and remarkable one without analogy to any known as yet from the carboniferous measures. The oval large leaflets either widely distant from each other or connected by about the middle, their form oval elongated, & the lowest pinnules being very small; all the characters are at a variance with other species & mainly A. merely resembles A. Mazoniana in the nervation. 12.8.71.

7 Alethopteris (oreale? = Emerson) (Dorneck) spec. nova. A mere part of a fructifying pinna fol. 37. Pinna linear apparently long the specimen shows the lower part of one, is 3 inch long without diminution in the length of the pinnules. Pinnule oval oblong, obtuse 3/4 of an inch long 3/10 th. in inch broad, opposite, rounded at the corners, attached to the rachis by their narrowed base marked with a thick medial nerve ascending to the point and bearing on each side of it horizontal groups of sporangia forming continuous rows from the nerve to the margins, close to each other and covering the whole surface of the leaflets. The specimen is varnished and therefore the

characters are not very clear. On the reverse there are branches or part of pinnae of the same species, evidently a Alethopteris, bearing leaflets round in the upper part of the base, decurrent at the lower part, lanceolate oblong obtuse rounded with media veins ascending to the point and secondary veins nearly perpendicular to the rachis twice forking, and close to each other. It was found by Moore in connection with Dicranopteris Moori and I have seen at Prof. Andrew specimens referable to this species and found in Monroe Co. Ill. in connection with a Dicranopteris like Moori, merely differing by the absence of leaflets attached to the main rachis. (3.10.71).

D1 Alethopteris hymenophylloides Lesq. From Mazon Creek, Strong's specimens. We have at the Museum three specimens. Al 139, Al 140, Al 141. referable to this species or perhaps to A. Mazoniana. These represent the point of a lanceolate or linear lanceolate pinna to pinnately divided in two first with secondary divisions nearly perpendicular to a broad winged or flat rachis double perrowed in the middle bearing pinna linear, from two to three inches in length [illegible] of an inch broad pinnately or equally divided in round lobes or round leaflets united to near the point attached to the rachis by a broad base but not decurrent on it but rounded above and below; the inferior lobes slightly longer and separated to near the base. In the more divided lobes or pinnules a medial nerve ascends to the top and is pinnately divided in veinlets forking from the middle; in the less divided and nearly entire secondary pinnae near the point of the pinna the veins go from the secondary rachis to the margin, forking once. The texture of the leaflets is thin, not inflated as in A. Mazoniana, the rachis is of the same kind and breadth as marked in my figure, this report pl. 79 fig. [illegible] [illegible] not turned upward as in A. Mazoniana but curved or arched and forking nearer to the base as in A. hymenophylloides pl. 10 fig. 1. The specimen Al 140. is fruiting. The secondary pinnae are more oblique upon the broader winged rachis, the lower ones bi-pinnately divided (the pinna is thus tripinnately divided) the secondary divisions being short (scarcely) oval, pinnately divided in round small pinnules separate to the base, in ascending the pinnules become united to near the point forming still higher small entire oblong obtuse pinnules or secondary pinna pinnatifid lobed. The texture of the plant is still thinner than in the former. The nervation totally obscure to the eye to being fruiting, the surface being marked by round sporangia placed on both side of the medial rib of each pinnule. The points marking sporangia are proportionally large seeming to be divided in five starlike groups of soi as in Alethopteris Mazoniana. The two first specimens are placed with A. Mazoniana, this one with A. hymenophylloides.

D1 Alethopteris Mazoniana fruiting. From better specimens Al 132 & Al 133 from A. Strong, the fructification of this species is better determined than from my figure in this report. In the large leaflets there is along the borders and on both sides of the medial nerves two rows of round sporangia, 8 to 10 on each side, divided in five obtuse lanceolate soi attached to a round central point. ❀ forming a star or with equal rays or with rays elongated toward the medial nerve ❀ in specimen Al 131 the sporangia cover the borders of the leaflets from the base to the point. in Al 132 the point only of the leaflet is marked by sporangia (3.10.71) Their relation of position to the veins is not seen. Specimen Al 142 has the surface, epidermis destroyed and the nervation very clear. It shows that the division of the veins is regular there forking but once except the inferior vein of the upper part of the leaflets which forks twice, once near the base and once from the middle all the divisions being simple. It also indicates that generally the veins and their divisions are slightly arched but that at the base of the leaflets they sometimes turn upward over ascending along the margins. — Les fructifications ou cells spic. comm. aussi celles de Gonopteris emarginata ont la même forme que celles qui ornent la figure de Dicranopteris (alethopteris) plerosiana Pl 32 fig 5 a. Il semblerait donc que les sporanges des espèces de houille sont à même forme. See p. 39 3b. (B)

D

D 1. Alethopteris Helena, sp. nov. CB. 42. Described from good and numerous specimens from Helena. I have now a number of fragmentary specimens sent from the lower coal measures by Mr Worthen N. 1. to 5. They all represent separate ultimate pinnæ very much like those of Alethopteris serli. They differ however by the pinnules narrowed on the upper side toward the base, more distant decurring along the rachis by a narrow border, less oval lanceolate pointed or obtusely pointed and by the nervation which is at a slightly more acute angle of divergence, and the veins usually all forking once and sometimes twice. The terminal pinnule is linear lanceolate tapering to an acumen or acute. This is evidently a good species but as it is generally the case my draughtsman has not represented it rightly the pinnules of fig 1. and of fig 2 descending more toward the midrib of the pinnule underneath. Compare N. 1, at least a few pinnules. Al.

D 2. Among the specimens from Helena coal mines there are two No. 43 which I referred to Alethopteris lonchitica and which may be different, the nervation being closer and more oblique to the rachis, not reaching only to the base. The has distant leaflets, acute as in Brgt. Pl. 84 fig 3. The other has the leaflets enlarged and united above the base as in fig 1 of the same plate. The specimens are too imperfect for sufficient comparison as said above the veins appear more numerous and are certainly more oblique to the middle vein, the nervation being like A. Helena. I believe that they truly belong as a rare Alethopteris Helena for I have from Alderson Tenn. a number of broken small specimens where the character of close nervation, acute distant leaflet etc are blended with those of the same type as I have described and figured them. The description should however remain as these rarer specimens of which I should preserve specimens. Compare specimen. They other represent Pecopteris oblique Brgt. Pl. 143. but not Pl. 143 a in A. Helena the veins being perpendicular to the rachis. Al.

D 3. Alethopteris serli Brgt. is in number of specimens in Mr Hansfield's collection. It is clearly distinct by the very thick midrib of the leaflets, the secondary veins thin or thick. Simple or once forked from the middle or lower in right angle to the midrib. The only difference is in the size of the leaflets which are mostly shorter, narrower. Al.

D 4 Alethopteris sp. nov.? Ultimate pinna (spec. No 1561.) long linear slightly narrower toward the base and also toward the point (broken) Pinnules oblique on a broad angle of divergence separated to near the base where they are slightly decurrent and join by a broad obtuse or acute rachis, lanceolat, acute more or less scythe shaped or curved inwards, thick or coriaceous the lower one more obtuse at the point and more open; middle nerve thick half wound, according to the point, veins about in right angle to the midrib very distinct and thick, dichotomous, for the lower ones forking at the base and both branches forking once again near the border. The middle ones forking once or twice, one of the branches forking again, the upper ones only forking once. This pinna is much like Al. agustina as fig. by Brgt. Pl. pl 90, differing however by the lanceolate pointed leaflets. The author does not speak of the coriaceous substance of the leaves but he says that the veins are deeply marked. The character of nervation is also well described and like in this pinna as he says: nervulis bifurcatis vel ternis alterisve simplice approximatis valde notatis. This appears therefore to be a mere variety. - Presented by M. Wheatcroft - This species is very rare in the U.S.

see p 393 b. 2

3936 Ephemeridies gomonteriae Pl. 4 fig 3.4.

(1). 1. Alethopteris spec. nov. A specimen No 101 from Cannel to a mere lanceolate pinna, bipinnately divided - secondary pinnae or rather pinnules near abruptly narrowed under or narrowed to the point, joined at or near the base, decurrent upon the narrow rachis, pinnately lobed, the lowest one 5 to 6 pair, the upper ones short entire or merely crenate, lobes divided to the middle, dentate crenate, set with a middle thick nerve, alternately pinnately branching with branches simple very oblique or very slightly turned inside each entering one of the teeth. Terminal lobe short obtuse. The lower lobes have each three pair of veins, none going to the base of the pinnae. The nervation is about that of Goniopteris. The rachis is apparently slightly marginated or with a membranaceous narrow border. This

at right angles to the rachis obtuse

(2). 2. Alethopteris aquilina, Brgt. pl. 1571 of the same locality a 1561 is also a var. of A. aquilina. The leaflets are less acutely pointed and the nervation and form just like those of A. Davreuxii Brgt.

(3). 3. Alethopteris Mazonianae Sigg. As I supposed it, we only have seen before parts of large pinnae, either lower or upper pinnae, probably lower ones. I have a splendid specimen from Mazon Creek No 1642 given by Thomas showing the top of a pinna triangular in outline, bipinnately divided in its lower part in horizontal linear obtuse secondary pinnae; subdivided in short vertical oblong very obtuse pinnules, united below the middle, thick inflated, obscurely veined, the middle vein marked merely by a depression, the lateral veins oblique, of the same character and degree of divergence as in the large leaflets and simple a fortiori once near the base. The lower secondary pinnae are 6½ cent long, one centimeter broad, only, the pinnules being only 5 millim long, the secondary rachis being little the first distinctly channelled. These pinnae are close parallel but not imbricating, rapidly decreasing upward in such a way that the ninth in ascending is only two cent long, merely undulate on the borders and the upper ones are here entire, mere pinnules little thicker of the larger pinnae as fig 9 pl 4. This upper part has then the appearance and the character of a Pecopteris. I have one of those pinnae No 1643 with simple leaflet separated to near the base which measures 16 cent long with leaflet variable in size from 11 to 15 millim long linear obtuse very entire. Another specimen No 1644 is a small pinna like that of Pl X fig 5 with close oblong obtuse leaflet deeply marked upon the stem wrinkled bearing at the base of the leaflet and a vein of the midrib a large oval sorus like those of fig 5 and the nervation of Alethopteris Mazonianae. I therefore believe that this specimen as also fig 5 of Pl. 10 represent the fruiting parts of this species as some of the leaflets have two sori (2) one upon the other on the same side of the leaflet and as fig 5 of Pl XIII has the sori large and placed at the top of the leaflet only this also appears to represent the fruiting part of that A. Mazonianae. A specimen of Shony shows distant leaflets, obtuse crenate along the borders, the upper ones merely joined at the base, the other disjoined and deposit.

cies is generally rare, and its mode of fructification has not been observed before.

It occurs in the concretions of Mazon creek.

ALETHOPTERIS HYMENOPHYLLOIDES, Sp. nov.

Pl. x, fig. 1 to 4.

FROND large, tripinnately divided, with primary and secondary pinnæ alternate, turned upwards, ovate-lanceolate in outline, decurrent in a narrow-winged rachis; secondary pinnæ or pinnules either entire, short oblong, obtusely pointed, joined at the middle in acute sinuses; or longer, divided nearly to the base, ovate-lanceolate and pinnately cut into regular obtuse lobes with obtuse sinuses. In the short divisions, the medial nerve only is distinguishable; in the larger ones, the veins, though obscure, appear pinnately branching from the medial nerve in an acute angle and forking at the middle. But for this kind of nervation, this species should be considered as a *Hymenophyllites*.

Mazon creek; in concretions of clay iron ore.

ALETHOPTERIS INFLATA, Sp. nov.

Pl. x, fig. 5 and 6.

NOTHING has been found of this species but the fragment figured here. It shows part of a linear pinna, gradually tapering to the point, divided into broadly ovate, or ovate obtusely pointed lobes, enlarged and united near the base, marked in the middle by a short thick nerve pinnately divided by five or six pairs of arched veins forking once. The fructifications are marked by oval inflated large fruit-dots, placed at the base of the leaflets, one only on each side of the enlarged medial nerve. The surface covering these inflated fruit-dots is wrinkled above, and around them, as seen in fig. 6 enlarged.

In considering the form of its fructifications, this species should be separated as the type of a peculiar genus.

Mazon creek; in concretions of clay iron ore.

Alethopteris Hallii, Sp. nov. Page 394 b 1

Pl. x, fig. 7 and 8.

Frond bi-pinnate; pinnæ perpendicular to the straight round main rachis, linear, alternate, narrow, close to each other, apparently short, merely cut on the borders by obtuse narrow lobes, either emarginate or square at the top, separated by short obtuse sinuses. Veins and veinlets deep and narrow, the primary ones ascending to the middle of the sinuses and forking twice upwards as seen in fig. 8, enlarged.

This species is closely related to *Alethopteris serrula*, Lesqx., Penna. Geol. Report, p. 865, pl. xii, fig. 1, differing from it by its shorter, broader pinnæ, placed close to each other; by its more obtuse lobes, and by the primary divisions of the veins, ascending to the middle of the sinuses, and not to the point of the lobes. Though in both species the borders of the pinnules are apparently reflexed, these differences are too marked to be considered mere varieties of the same species. Nevertheless, it might be possible that the specimens from Illinois represent a sterile frond, and those of Pennsylvania fruiting branches of the same species.

Mazon creek; in concretions found by Mr. M. S. Hall.

Alethopteris erosa, Gein.

Verst., p. 29, Pl. 32, fig. 7–9.

Pecopteris erosa, Gutb. (1843.)

Numerous and large specimens referable to this species have been found by Mr. S. S. Strong, in the roof shales of the coal at Morris.

The American plant merely differs from that of Europe by the longer divisions of the three-pointed lobes, and by the much longer pinnæ. The same fronds, or parts of fronds, bear sterile and fruiting pinnæ; those especially in

× 1. Alethopteris Hallii Lesq. The museum has a very fine specimen (Al 145) of this species which is distinct. It is a whole pinna oval elongated in outline, [illegible] the base, the focioles [illegible] the longest of these pinnae [illegible] the middle [illegible] the base, the largest is only one-fourth of an inch, the third in ascending 6/10 of an inch. The [illegible] are preserved [illegible] the [illegible] for the other species [illegible]

each specimen (Al 146) from Yorkshire has got a [illegible] as [illegible] but the specimen is too small for satisfactory determination. 27.10.71. See 1b.

2. Alethopteris erosa. [illegible] the museum has a [illegible] specimen showing [illegible] and fructifications found. The species is well described and figured [illegible]

× 1.b. Alethopteris Hallii Lesq. Specimen (Al 165) of Throng is fine, the nervation and borders of the leaves are preserved. Should be figured or at least for wood cut.

3. Alethopteris hymenophylloides, Lesq. In the cabinet of Mr Throng I have a very fine specimen of this species. It represents a pinna some what broader than the one fig. X, fig 1, five centimeters broad, the preserved part about 10 cent long. The nervations is quite distinct and just as I have figured it.

4. Alethopteris ambigua sp. nov. see Description C.B 139. The description is accurate. Remark that in the upper or lateral pinnae as in fig 3 of my plate of the species where the pinnules become very small. The veinlets become crowded less distinguishable and apparently twice forked. They are also more inclined. It is however extremely difficult to see the point of attachment of the veins and I believe that those which appear twice forked, the upper branch is simple and attached to the rachis and not to the upper division of the vein. The ~~area~~ nervation of the large pinnae is exactly matched in fig. 1a.

5. Alethopteris Dournasii, Brgt. N. 114 of Butts. Has two pinnae (ultimate coccidents) referable to this species of Brgt. One is more fragmentary 1 inch broad with lobes oblong narrower above the sinuses slightly enlarged below the obtuse point joined by an obtuse sinus quite near the strong rachis. The other is large, pinnule 13 millim. long oblique more oblique than in the smaller pinna also enlarged at or above the middle obtuse, deflexing near the base into an acute or somewhat obtuse ~~[illegible]~~ lobe. This however is not the essential character which is marked in the ~~oblique~~ veins, obliquely diverging from the midrib which though not broad is clearly marked and strong from the base to the point where it divides in two veins branches once. The lateral veins branch once ~~at~~ or above the middle or twice, once at the base and both branch or a single only branching again near the border. The substance of this species is thick. The epidermis forced on a pellicle of coal. The pinnules in ascending become more obtuse and the terminal one which is broken is apparently obtuse. The species might be identical with A. Owenii, but as far as I can see from the figures the leaflets in A. Owenii are less oblique, comparatively longer and more acute, and undulate. The difference is however not great.

5b. This is positively A. Owenii, as the specimen 114 has on the reverse a pinna exactly like fig 1 of plate II of the Butts Report. This distinct from Dournasii by less oblique more pointed leaflets, lateral veins more oblique and diversely veined, one being a midrib above.

394c

D 1. Alethopteris lonchitica, Brgt. var. A large pinna represented in two specimens Ma 212, the lowest representing the lower part of a primary pinna 19 cent. long, the upper representing apparently the upper part of the same pinna. 23 cent. long. Between them there is an intermediate portion not found which should have been as long as 20 or 30 cent. for the upper end of the rachis of the lower part is seven millim. broad when the lower end of the upper part is only three millimeters thick. The secondary pinnae also of the lower part are much longer, fourteen centimeters or more while the lower pinnae of the upper part are only eight centimeters. Therefore the whole pinna measured at least 70 cent. long. The characters of the species agree well enough with those applied to A. lonchitica and to the figures also. The ultimate pinnae, at least the upper ones are like those of Brgt. pl. 84 fig 1, ~~being~~ being short linear lanceolate open but curving upwards with short decurrent obtuse or obtusely pointed leaflets joined ~~at a~~ at a short distance from the rachis ~~&c~~ with the terminal one short, lanceolate obtusely pointed, one and an half cent. long, not linear but lanceolate and much shorter than generally the case in specimens of other species. As generally in the genus the pinnae become entire toward the top and rapidly decreasing to the terminal leaflet; first they are undulate three cent. long and the 6th pair above or under the terminal one is only 8 ~~cent~~ millim. long. The terminal leaflet is bitten at its base but does not appear longer than those of the lateral pinnae. The pinnae of the lower part have the pinnules longer, comparatively narrower, separated ~~to~~ near the base and undulate. In all the nervation is the same; the midrib is stiff, of the same strongness to near the point of the pinnules where they abruptly disappear. The secondary or lateral veins are stiff, very distinct, either forking from the base or simple. In the variety they are more generally simple, two or three simple veinlets between those forking. But also two or three forking veins follow each other. The veins are more thin than in A. serlii and not so close.

D 2 Alethopteris Owenii. There are some specimens of this species in the collection of Gurley's. Some large pinnae with pinnules obtuse, oblong smaller but with the appearance of A. Sullivantii show exactly the nervation. It is obliquely with the appearance of A. Sullivantii and less obtuse at a more obtuse angle of divergence than in A. Sullivantii and less obtuse than in A. serlii with more distant veins generally forking once near the base and on of the branches also above the middle decurring to the midrib as marked upon my figure but midrib either thick & compressed on the lower surface or thin upon the upper surface only. Sp. 79 In large pinnae the ultimate pinnule is short triangular or oblong obtuse.

D. 3. Alethopteris Helena. A. There is in the cabinet of the Agricultural College of Ohio a splendid specimen of this species from the Sacket Coal (Subcarboniferous below the Maxwell limestone = of the Chester limestone of Illinois. It is covered by three parallel pinnae 20 cent. long and distant about 4 cent. The secondary pinnae are in right angle to the primary ones which measure 3-4 cent and are about as long as long. The ultimate pinnae are broadly lanceolate, and apparently long none being preserved in the whole. The pinnules are more or less undulate, generally larger in the middle and the nervation as I have described it very irregular, the middle vein thick. The lateral ones either forking twice or twice sometimes only once near the base, the two branches being simple generally undulate but not joining in their undulations.

Dictyopteris

Plenty of specimens from Alabama, now with mucronate rachis; the base of the branches is slightly lobed, mostly shipping.

[illegible] specimens, both forms, simply veined, veinlets bifid, separated at base [illegible] is another [illegible] the same [illegible]

[illegible] evidently [illegible] species. 8.11.71. — [illegible] seen from a small branch [illegible] of the large specimen 8.8.? [illegible] is the same as specimen [illegible] of [illegible] from [illegible] except this is exact, Brongniart's [illegible] [illegible] See p. 399 : 5.

D. 1. Alethopteris ~~Lockii~~ Sellimanni or squamosa? This species is in very large and numerous specimen in Lesley collection, from Wallsbarrow. The specimen 70 cent long has pinnæ at least 40 cent long and at least 20 cent wide with rachis 2 cent broad. When deprived of the bark there are most or nearly 10, regularly and evenly striat with sometimes obscure point marking impression of hair of the surface bark. Upper the bark the striæ are less deeply marked though regular and the point marking the base of hair quite prominent and distinct. They are distant and scattered 1 to 2 mill. round oval. The coaly pellicle of the bark is nearly ¼ mill thick. The nervation is sometimes obsolete, but also sometimes very distinct. In the long leaflet at the upper part of the pinna the veins are three forked or more. In the small ones they generally fork twice, once near the base and another near the point. The lower leaflets are always more or less enlarged lobed at the base.

D. 2. (Alethopteris) ~~Sphenopteris pseudotalifolia~~ Sphenopteris nervosa sp. nov.? See name. In Prof. Smith's specimens which I considered as S. nervosa, there are two. Sm 11a & Sm 11c which I think should be separated and constitute a different species. Sm 11c is a large one, representing a tripinnat frond at least. The frond is diversely crushed and its pinnæ and pinnules scattered. Its form is not seen. The primary rachis is thick, flattened, eight ~~to~~ 10 millimeters broad, its middle part, five millimeters, narrowly lined convex with two flat smooth borders two millimeters broad. The secondary rachis, four and a half to five millimeters broad basilar, its middle part lined convex with one millimeter thick and borders flat one and one half or nearly two millimeters broad; the tertiary rachis is two millimeters thick with the same character of a middle convex core with flat borders (wings) and enlarges on both sides up and down in joining the border of the secondary one; the secondary pinnæ are broad, nearly in right angles to the primary ones, 14 to 18 centimeters broad and apparently lanceolat. The tertiary pinnæ also at an open angle of divergence are linear ~~regularly~~ gradually narrowing toward the top, a linear lanceolat more rapidly narrowing toward the point, seven & cent long. bearing large alternat pinnules inclined upward; pinnule large, either shorter, two centimeters long in the middle of the pinna, one cent. broad, oblong obtuse, or the lowest one on both sides up and down the rachis lobate at the upper and lower part, of the pinna but without lobe only on the lower side toward the rachis, all joining the rachis by a broad base, decurrent in forming the flat border of the tertiary rachis; the pinnules are longer, lanceolate pointed, two to two and one half millimeters long, pinnately divided in short obtuse lobes turned upward and disconnected to below the middle

To 396a.

the upper part. They are scarcely lobed, and covered by groups of sporanges, apparently confluent, and of undeterminable form. Prof. Geinitz figures and describes them as star-like.

Alethopteris cristata, Gein.

Verst., p. 29, Pl. 32, fig. 6.

Pecopteris (Diplagites) cristatas, Gutb. p. 396 a (3)

We have only small fragments, which, by the size of the pinnæ and by their divisions, are referable to this species. As the nervation is obscure, it cannot be positively seen whether they do not perhaps represent different parts of a frond of the former species. The European specimens, at least so far as they are figured, leave us in the same doubt about the value of the species.

From the shales of the Morris coal.

Alethopteris muricata, Gopp., Syst.

Pecopteris muricata, Brgt.

Hist. veget. foss., p. 352, Pl. 97.

Good but small specimens of this species have been obtained in the concretion of Mazon creek. It appears to be rare in the western coal fields.

Alethopteris Pluckneti, Gein. p. 395 < 395 c.

Verst., p. 30, Pl. xxxiii, fig. 425.

Nothing proves better than this species the insufficiency of our classification of the fossil plants of the Coal Measures. First, a *Felicites* for Schlotheim, it has been a *Pecopteris* for Brongniart, an *Aspidites* for Goppert, and now an *Alethopteris* for Geinitz. The form of its pinnules, especially those of the lower pinnæ, seems to force its admission into this genus. Some good specimens have been obtained from the shale of Morris, especially part of a tertiary pinnæ, bearing large leaflets with a broad base, lanceolate pointed, scythe-shaped in form, with the borders divided by alternate obtuse lobes, whose surface is

generally convex and polished. This form is the same as that published by Geinitz, being in all its parts larger than the common one generally found in the eastern Coal Measures.

Alethopteris spinulosa, Sp. nov.

Pl. xi, fig. 1 and 2.

Frond broad, bi-pinnate; primary pinnæ apparently long linear slightly tapering toward the point, divided into alternate broad, half an inch long, oval leaflets, joined above the base, cut at the obtuse top in sharp spiniform short teeth, separated by obtuse sinuses; main stem round, regularly and narrowly striate; secondary rachis straight and flat; medial nerve thick and enlarging toward its slightly decurrent base, with five pairs of alternate veins slightly curved upwards and forking at the middle.

This fine species has no relation, even distant, with any other published as yet from the Coal Measures. The veins and veinlets are not deep, but very distinct by their black color, as seen in fig. 2, enlarged.

From the roof shales of the main coal at St. John's, Perry Co.

Alethopteris falcata, Sp. nov.

Pl. xi, fig. 3 and 4.

The specimen figured represents a part of a simply pinnate frond, or of a pinna with simple leaflets attached to a main broad smooth rachis, by their whole unconnected base. These pinnules, about two inches long, are linear-lanceolate obtusely pointed, scythe-shaped and entire. The veinlets perpendicular to the half round medial nerve, are very close to each other, very thin, either simple or forked from the base.

On account of its broad curved rachis, of its long nearly linear leaflets attached to it by their whole base, especially of its obsolete nervation, the vein-

These pinnules, either simple, undulat or pinnately lobed, have a strong middle nerve decurrent at the base, passing to the top with thin lateral veins forking once or twice, carrying to the border in an acute angle from the middle nerve, the lowest emerging from the broad decurrent base and not from the midrib. On the ~~top~~ under side of the leaflet the veins are very thin and scarcely distinct, on the upper side also very thin but often inflated or tumescent as in Pecopteris nervosa. The substance of the leaves is however not as thick as in this species not coriaceous. From the different character the decurrent rachis and decurrent leaflet or pinnules from the form of the pinnules as also from the thin veins, this species is apparently different from P. nervosa. The rachis of a sterile frond joins the larger or anterior one in enlarging the border of the convex rachis and therefore the borders appear as three wings, for the middle or convex part of the rachis joins the other in passing through the borders or wings to that middle convex part and decurring into it. This is the same with the pinnules which enlarge on both sides and are joined often at a distance of one centimeter by the winged border. This species therefore should go to the Genus Sphenopteris. For examining the descriptions and the figures of all the authors, Brongniart, Lindley & Hutt. Schp. Geinit. where this species is figured, I find in all the characters as described and different from this one. It is related to the Sphenopteris latefolia and a. adifolia of Presl. See Sphenopteris pseudolobifolia p. 410a(5)

1. Alethopteris spinulosa Lesq. The leaflet or pinnule of this species are very variable in form. Cl 102 a specimen from Newport show part of a penna with secondary pinna oblique to the flat rachis and pinnules close same position and about same outline as in my figure but somewhat more acuminate or tape pointed and marked at the top by a few acute teeth sharply pointed or spinulose. There is not great difference from the figure except in somewhat longer more acute leaflet and less numerous more irregular teeth.

2. Alethopteris ~~[illegible]~~ Emmersoni? Sp. nov. A species represented by Fm 4 - 9 with 9 fine fertile pinna. The species in its large form is intermediat between A. Sellii & A. Sullivanti. The leaflets are smaller than in A. Sullivanti generally obtuse and shorter than in A. Sellii with the midrib very strong, abruptly terminating near the top as in A. Sullivanti and the veins a little more oblique than in A. Sellii but very close generally forking once from near the base, the branches parallel. The nervation is generally indistinct or obsolete on account of the thick epidermis. But it is clearly seen on some specimens showing the under part of the leaflets Fm 7. and is as described above. The fertile pinna has alternate lateral pinna from a very thick primary rachis the secondary rachis also thick, the pinnules either disconnected or joined at the base, the pori in parallel close rows slightly oblique to the midrib, apparently a compound of closely aglomerated small pori in lineal rows covered by a thick epidermis. The upper part of the specimen is sterile and though the leaflet are small they conform to the characters of the large one. This is therefore a fertile Alethopteris. The pinna are sometimes small with small pinnules like Pecopteris as in the upper part of the figure specimen. See p. 396 b 2

3 ~~Alethopteris~~ cristata Gein. A good species well distinct by its nervation, the lateral nerve being pal marked and and the branches simple or furcate diverging into the lobes as figured by Geinitz and described by Schimper who considers it as a Sphenopteris with right. See Carnuta Fm. Mahoning

D. 1 Aethopteris Gibsoni, Lesq. Gibson specimen No. 6 from Danville, Grap. Geol. Pl. Only fragments of pinna. Lower pinna simply pinnate or linear obtuse one cent long 1, 2 & 3 millim broad, joined at the base or near the base in obtuse angle, midrib thick abruptly terminating at a distance under the point. veins nearly in right angle simple or forking once from the base. Upper pinna alternate distant either simple, the terminal ones or pinnately lobed in half round very obtuse pinnules with same kind of nervation, pinna in right angle. Border of the pinnules reflexed covering sporanges which when erased show between each vein four point as marked fig 6 a & 7 a. the borders are reversed but no sporanges are seen. Species comparable to A. brevis Weiss. Pl. 11 fig 1. but not undulate on the border. and with veins alternately forking and simple, not all simple as in Weiss. — From Gibson specimen now sent from the Agricultural College the species is then very distinctly recognizable and seems to be A. brevis Weiss. see p. 397 c (2).

D. 2 Aethopteris Emersoni, sp. The Agricultural College has a very large specimen which bears some fertile separate leaflet of A. Emersoni with large pinna of the species which I considered a A. Milleri. In this the veins are very distinct and generally forking twice ~~||||~~ about little thick. It will be necessary to reexamine that species from St Clairville and see if there is not a difference. — From comparison with Emerson specimen the sterile pinna of the College is not A. Emersoni but really Dicksonites Milleri or Polymorpha. That of Emerson has the veins as described simple or once forked generally obsolete or indistinct, the midrib very thick and in the pinna with small leaflets, the veins very oblique somewhat unequal simple and curving inward as in Goniopteris, either simple or forking from near the base. The fructification are of the same character as those of Anisopteris as figured by Göpp. Genera III pl IV.

D. 3 Aethopteris lonchitica ~~[illegible]~~ Lesq. Sp. No. 528. with many other represent part of a polypinnate frond. of rest large size. The primary rachis of which fragment only are seen is 6 millim broad, the secd rachis which is pinnate is three centimeters at primary division of pinna slightly 60 cent long placed either in ~~right angle or curving upward and forward from a rachis 1½ cent~~ about 1 parallel and close with a rachis of about 1 cent broad, secondary pinnae close, contiguous along the border in right angle to the rachis, either curved upward or down 16 to 24 cent long, the pinnules in right angle being 2 to 2½ cent long as the width of the pinna toward the base is about 5 cent. leaflets or pinnules slightly turned down at the extremities parallel mostly touching at the borders in the upper part they become more distant and more pinnate so they are generally linear obtuse. Nervation simple or the veins forking sometimes once near the base and then curved by a coalescing with midle. Quite different from Aethopteris ambigua, especially by the large size of all their part but most similar by the character. Describe it and make comparison to the species.

D. 4 Aethopteris [illegible] as figured in Cat. of Illin. is represented by two fine specimen [illegible] pinna 14 cent long terminal, 8 cent broad at the base [illegible] 20 cent [illegible] rachis of the primary pinna [illegible] 1 cent broad [illegible] the secd rachis [illegible] 1 cent broad [illegible] very [illegible] inserted [illegible] very obtuse or half round [illegible] face of the leaves [illegible] midrib

1. Alethopteris serlii. Specimen 107 of Prime. Is the part of a pinna, near the top with the lower leaflets 6 [illegible]

2. Alethopteris Gibsonii Lesq. from 396 b (1.). The specimens of the Agricultural College from Pomeroy are very large one of them 50 square cent. and show the various forms of the species. A part of the stipe upon one of the specimens measures flattened 8 cent. broad. It is easily recognized by its thick coaly epidermis irregularly lined, the epidermis easily detached being 1/4th of a mill. thick. The primary pinna very long, none preserved in its whole length. linear lanceolate, with broad rachis 1 1/2 cent broad toward the base, first 7 mill in the upper part. Lower secondary pinna oblique, rapidly parallel distant three cent at base. With broad rachis flattened, 5 millim at the base still more than one mill under the small half round or three-fourths terminal pinnules. Tertiary pinna also oblique with a broad rachis 2 mill thick and flat, linear obtuse short, the lowest 3 cent long gradually decreasing toward the top pinnate, to be or divided, pinnule short half round, the lower ones only 3 mill long and three to four mill at the base where they are united as seen in my fig. 4 & 5 pl. 28. The terminal leaf not marked in the figure 1 pl 33 orig. often comparatively large. In the upper part of the secondary pinna the tertiary ones are longer curved forward and somewhat obtuse and the tertiary ones of the same size as described rather shorter and narrower than the leaflet more and more thus near to the base in the upper part or toward the point they are very narrow and merely undulate 25 millim long 2 mill broad and those nearly terminal fifteen mill long and 2 mill broad. The undulations are marked only upon the 7 last pair of terminal pinnules as seen in my fig. 5 & 4 and their undulations preserve the pinnate disposition the pinnules merely gradually diminishing in length. Separate branches of the tertiary pinna connected at base both the figures fig. 6 show the pinnules linear obtuse. Some of them by [illegible] decurrent base. The midrib of the pinnule and the veins are as figured, broad midrib abruptly terminating in the upper part of the leaflets and the veins parallel either simple or forking one. It is difficult to separate this species from that of Weiss. A. [illegible] Dawson. The comparison of the author, however either with A. Mullerii a A. longulata of Geppert are not right. The author makes Alethopteris a genus from reflexed borders of leaflet or pinnule and also [illegible] the species only. A. confusa & A. peralonga A. Weiss. In the whole number of specimens examined, I have seen none like fig 1. of Weiss with the pinnule linear all undulate at the border. Pl. XXXIII fig 1. represents a fine secondary & tertiary pinna from the large specimen of the Ohio Agricultural College. The

borders of the leaflet are always reflexed but do not show trace of spores or of ligament.

397 b Callipteridium unequalis ~~Alethopteris~~ ~~Sullivantii~~ do. var. We have only the three fragments of ultimate pinna figured here. No. 181 & sp. 184 & 187 ab. 2 pc. one only of the last is not figured. Pinna of various size 10 cent long or more, linear lanceolate rapidly narrowed toward the point into a short obtuse oval obtuse terminal pinnule, sometimes rather linear even narrowed toward the base and enlarged near the point as in one of the figures; leaflet oblique generally in an obtuse angle (over 60°) from the broad rachis, joined at the base or more or less distant, linear to oblong obtuse, the largest one 1½ cent long, five millim broad, midrib distinct but narrow, enlarged by an obtuse channel ~~the~~ ascending to near the point; lateral nerves ~~close~~, generally distinct, curved or arched, deeply inserted toward the base becoming more and more acutely oblique toward the point, rarely simple, forking once or twice, one third of a millim. distant along the border, half winded or obtusely reflexed, not marked in the basilar border joining the pinnules. As in fig. (181). the leaflet are sometimes narrowed at the base and oval and distant. By the ~~the~~ flat channeled ~~midrib~~ borders of the midrib, the direction of the lateral veins ~~given to their~~ spread has a relation to A. Sullivantii: while the nervation though close and more intricate relates it to A. Orbiculare: The abrupt termination of the pinnae by a obtuse short pinnule is somewhat like A. Emersoni. The leaflets are of unequal length and variable in form and size. The rachis when covered with the epidermis is thicker by the decurrent midribs which distinctly pass upon it and descend ~~in~~ flexuous along it. When deprived of the epidermis the rachis is smooth. We have seen it only for the specimen of Cannelton. (Compare specimens when received. X correct.) Of this species figured pl XXXIII real number fig. 2 represents a narrow pinna with leaflet some one large near the top, shorter in the middle of the pinna joined at base. Fig 3 & 3a. a pinna with narrower longer leaflet and more distinct nervation; fig 4 top of a pinna with obtuse oval leaflet joining the first pair under it nearly at the top of the leaflet. fig 5 a fragment with oval leaflets distant and reinded to their point of attachement. Remark that the midrib is more generally narrow slightly flexuous. The broad space marked in fig 3 & 3a being rather a depression in the middle of which the true midrib is seen a marked 3a.

A fine specimen just received (Feb 9. 79) upon a pinna of a frond the three upper pairs of leaflets short entire 2 to 2½ cent long 8 mill broad decurrent the lower one becoming ~~an~~ undulately ~~pinnat~~ lobed 5 cent long irregularly lobed with short half round lobes like the fragment photographed by Lesquereux of C. sullivantii.

lets being scarcely perceivable to the naked eye, this species rather resembles a Cycas than a fern. With a strong glass, the veinlets are seen as marked on fig. 4, enlarged, and these indicate the true relation of the plant.

The specimen may represent a part of a frond in the process of unfolding its leaves, which appear as being pressed upon each other on the lower side of the rachis, and at the same time, still half uncinnate. It may also be the representative of a species in its full development. Some *Lomariæ* of our time resemble it, by the nervation and the form of the leaflets. It has no relation with species known from the Coal Measures.

Mazon creek; in concretions of clay iron ore.

Alethopteris solida, Sp. nov.

Pl. xi, fig. 5–7.

This species is, like the former, known only by a fragment of a frond or of a pinna. It is pinnately divided into narrow leaflets, attached to a proportionally very broad flat rachis, by the enlarged base of a thick medial nerve. These pinnules, a little longer than one inch, perpendicular to the main rachis or slightly turned upwards, are linear obtusely pointed, disconnected at the enlarged rounded base, and entire. They bear along the borders, at equal distances from each other, round groups of sporanges, apparently divided star-like into five round dots, as marked in fig. 7.

By the position of its *sori* and of its leaves, our species is a *Polypodium*. It resembles by these characters the species published by Prof. Brongniart, under the name of *Phlebopteris polypodioides*, Veg. foss., p. 372, pl. 83, fig. 1, and if the nervation should prove to be the same, the American species would be distinguishable only by the broad rachis, the enlarged base of the medial nerve, and the separation of the leaflets. No trace of secondary veins or veinlets is observable on the specimen, which is in a concretion from Mazon creek. Our species is also related to *Polypodites elegans* and *Polypodites Lindleyi* of Goppert.

Alethopteris Lanceolata, Sp. nov.

Pl. xiii, fig. 1 to 3.

The specimens represent two parts of simple pinnæ or of fronds, with alternate linear lanceolate obtusely pointed leaflets, oblique on the rachis, or slightly scythe-shaped, narrowed at the base to half their width, and rounded to the point of attachment to the rachis; entire on the borders and smooth on the surface. Main or medial nerve half round, moderately thick; secondary veins attached to it in a very acute angle, alternately branching from the base in veinlets curved inwardly, as marked fig. 2, the upper ones ascending to the borders of the leaflets, the lower ones becoming confluent in ascending.

Of the two specimens which have been seen of this species, and which are figured here, that of fig. 1 seems to represent the upper part of a frond, while the other, fig. 3, looks like the terminal part of a pinna, and therefore the species is apparently bi or tripinnate. The nervation resembles that of the following species, but the veins and their divisions are more oblique, more slender and of a more delicate texture.

Mazon creek; in concretions.

Alethopteris emarginata, Gopp.

Syst. foss., p. 274, Pl. xvi, fig. 1 and 2.

Pl. xiii, fig. 4.

We have in the concretions of Mazon creek many separate leaflets of the same form and of the same size as the one figured. The borders of these linear obtuse leaflets are slightly and equally undulate-lobed, as formed of pinnules connate to the top; the nervation is nearly similar to that of the former species, the secondary veins being only more open to the medial nerve, or nearly perpendicular to it, while their branches, generally more marked and thicker,

1 Alethopteris Lanceolata sp. nov. and: leaflet entire on the borders or 3986.
slightly undulate. Some of the leaflets are entire, some visibly undulate. The
main nerve is half round, marked in the middle by a narrow groove. This
character is distinctive to separate the species from A. emarginata Gopp. —
For in reinlets curved inwards: say: in very thin ~~nearly curved~~ scarcely perceptible
reinlets. Mus: specim: Al 64 & Al 74 – 20/6.71.

Ma 3946a.

2 Pecopteris (Alethopteris) subnervosa Roem. Frond bipennat; primary penna
lanceolate (two parallel, the upper part only seen) secondary pinna open the lower
ones 6 to 7 cent long gradually shorter, the upper ones only one and one half
centimeter all alternat; divided or alternat broadly obtuse lobes joined to
the middle, turned upwards, obtuse, the lower ones on the inferior side of
the pinnae slightly larger but entire, of the same form attached half to the
main rachis. Which is broad flat, three millim. in the lower part and
slightly flexuous. The medial nerve of the lobes distinct, except in the lower
inferior lobe, a little more distinct than the reins, reins on the lower side of the
lobes ~~three~~ two or three from the main rachis, the other from the midrib,
forked once near the base parallel, all flexuous first tending toward the borders
then curving inside and upwards joining the border, reins of the upper side of the lobes
the lower curving inside descending to the base of the midrib the others obliquely to the midrib
and passing to the borders, forking at the base, less flexuous only curved upwards
is reaching the borders. The venation is marked here. The figure of Roemer
enlarged fig. 11.b. Pl. XXXI is correct enough but the reins
are marked thick by the inflation of the epidermis, when
seen distinctly the lateral ones are double, forking near the
base, flexuous, as figured by Ruehl. Tal. XIII. f. 5 c. Where
he had ~~seen~~ figured the also simple copying fig. & descriptions of Roemer
substituting only Pecopteris for Alethopteris. Ruehl fig. however
shows the rachis (primary) slightly flexuous as seen in our specimen
Our specimen shows only two fragment of ~~secondary~~ pinna one of the
the 10 cent long. ~~on~~ the upper secondary pinna have the lobes in leaflets
connected more and more ~~toward~~ to reach the ~~point~~ apex and seem evidently
to simply pinnat at the top, the last pinna preserved being entire on
the borders or with the lobes scarcely indicated by undulations. The form
of the divisions a lobes has a likeness to those of Odontopteris intermedia
Ligc. and for the basilar nervation this species might rather be referable
to Odontopteris than to Pecopteris. But apply I have no ~~for~~ comparison
to the specimen obtained for Alth. for the description of O. intermedia

3 Pecopteris relutina Ligc. Ma. I. seems referable to the species. Has ~~obtuse~~
bipinnat pinna, 10 cent long with short secondary pinna 4 cent long
nearly in right angle or slightly oblique in an imbedded apparently broad
rachis with small, slightly oblique, oblong obtuse pinnules distinct to
the base, often distant and rounded at the base. Some of the pinnules
five to six ~~cent~~ millim long three ~~cent~~ millim broad are evidently villous upon
the surface, with venation indistinct; in others the surface is smooth apparently
by crowns and the reins are seen thin, curved and nearly in right angle to the
rachis, generally forking once at the base sometime the branches forking again
The broad secondary rachis ~~which~~ two millimeter indicate also a
large primary one. The base of the pinnules are also rounded to the point
of attachement as in P. relutina. The leaflets are smaller however, the
terminal pinnules the same.

(2.) Geopteris Cistiphyll. Specimen I of Mansfield shows the top of a bipinnate pinna with oblong leaflets joined at the base only disconnected from base upwards with lateral nerve bifurcating twice or once and the lower division also only once. I can not see the difference between this specimen & Geopteris polymorpha. The character of the top pinnule or the same the lateral veins more or less curved backwards, pinna short rapidly diminishing to a point. Most probably (polymorpha Dng. Pl 39 fig 1-3.

Pecopteris Aldrichii (another name) Aldrich specimens, N° 46, 248 spec).

D.3. Frond fully pinnate. The larger fragment shows a rachis somewhat thick, 5 to 6 millim, very thinly and regularly lined with three pinna (secondary) about in right angle linear lanceolat, rapidly narrowing to the point (point broader in all the specimens) Secondary rachis slightly flexuous especially in the upper part by the inflation at their point of union of the tertiary rachis both these and the former half cylindrical and minutely lined. Tertiary pinna in right angle or sometimes slightly inclined upwards or slightly arched linear lanceolat, gradually narrowing to the terminal lanceolate obtuse pinnules; the basilar or lower ones seven cent. long, about 1½ cent broad at the base pinnately alternately regularly lobed, pinnules oblong obtuse, distinct, joined at the base, the three pinnules sometimes joined on both sides and rounded or joined from the base generally distinct. Lower pinnules undulately pinnately lobed, the middle and upper ones entire oblong obtuse inclining toward the point; those of the upper tertiary pinna gradually shorter broader passing to pinnately lobed pinna similar to the lower pinnules (see plate). In some specimens the pinnule enlarged at the base are pointed and then triangular, the point being however slightly obtuse. In some others they are all distinct and distant see fig 2 & 3 a small form the pinnules thoroughly preserving the same characters become very small, 3 mill long 2 mill broad or the lower one pinnately undulately lobed as in the large form, 5 mill long & 2 broad. Substance thick surface convex or inflated, midrib thick very distinct below the base, generally forking once below the middle with a simple branch from the base or more simply forking. This species has some affinity to H. nervosa especially by the thickness of the leaves and the coarse nervation. The divisions (alternate) or pinnules however

1 Pecopteris stronger type; 1 specimen 3.306 of Morris has two broken simple pinna referable to this species. They are apparently long, one is undulate, three inches long, a mere part of the whole, with leaflets 8 millim. long in the upper part, becoming shorter toward the base, spreading perpendicular to the rachis, oblong obtuse, slightly enlarged above, distant, attached to the rachis by the base which is narrowed upward and slightly decurrent downwards. The surface of the leaflet is covered by a thick carbonaceous pericle marked by small bounds as if it had been ribbed. The medial rib is flat, broad and undistinct. The veinlets evidently rise through the pericle are very oblique broad and nearly once. 12.10.71. — In specimen of this species 4.314 show the upper part? of a frond with secondary divisions with thin pinnulets. Their ultimate pinna 3 millim. long perpendicular to obvious rachis are linear obtuse, parte 6 millim broad with a broad rachis running rachis, divided into ovate obtuse lobes, united to the middle, abruptly decreasing to an elongated nearly entire obtuse point. The epidermis is thick, the nervation obsolete, but apparently a oblique nervation either simple or forking once from an inflated medial nerve. (See page 528 of this rep. fig. 1.)

[illegible]

2. Pecopteris Miltoni Brgt. No 1566 & 67 from Salem & Sharp, Mt. below Fremont Schuylkill Co. Primary pinna large 30 cent long upon the specimen with the top and base broken 16 to 17 cent broad, rachis broad, smooth, obscurely striate. Secondary pinna nearly in right angle or scarcely oblique slightly curving upwards, much longer in the middle 4 cent, only 6 toward the base repeatedly shorter toward the top, broken, linear lanceolate gradually decreasing to the point formed of a small oval, or obtuse lanceolate acute pinnule. Pinnule longer toward the base generally joined just near the rachis, sometimes separate at the base, partly connected on the borders to the middle, oblong very obtuse broad and short, averaging 8 millim long and 4 millim broad, middle nerve thick and distinct below the point, runs in a broad angle of divergence from the midrib, curving backwards and in right angle to the borders when reaching them, forking once toward the base and both branches forking again near the border. The veins are distinct but not very deeply marked. Differs from Brgt. Schp. Artis &c. description by the secondary pinna longer and tapering pointed or gradually decreasing toward the top. The rachis in the middle is 5 millim. broad. Specimen No 1570 has a fragment of bipectinated pinna with a row of large flattened scales on the back of the midrib as figured by Brongniart.

See 3904 a. 2.

D2 - Pecopteris Mellonii. Brg. A small specimen from Mount Gap. No. 1587 represent a few pinnae of this species with pinnules broad and short very obtuse, separate to the rachis, even those nearest the base distant, as broad as long .5 mill. both ways. those of the middle are longer but also very obtuse and comparatively broad. The nervation is of the same character as that in the specimen described 399 c. ?

D3 Pecopteris arborescens. Lacw. Specimens No 167 to 170 represent a simple pinna of this species with sterile pinnules and two small pinnae fertile. The sori are in groups of 4 to 5 spores (or groups of spores) in a circle, very distinct, placed on each side of the rachis as I saw them at Mr. Remwell either upon or between the simple veins. It is impossible to see their relation to the veins which is seen from the sterile pinnae are simple. There are 4 or 5 of these sori or sporangia on each side of the midrib. ~~Would be~~ See figured, Pl. : fig 4-5, which are exact.

D4 Pecopteris platyrachis Brgt. We have two fine large specimens from Lapwell positively referable to this species or to P. arborescens to which Schimper & others identify it. No 230 represents a young pinna, with a broad flat rachis with ~~primary~~ secondary pinnae oblique short lanceolate pointed. two inches long at the base, gradually shorter toward the point, seven millimeters broad. secondary rachis flat and comparatively broad. pinnules very close and very narrow, linear oblong contiguous from the base to the point, scarcely 1 millim broad, 3 to 4 millim long, with the middle nerve distinct only. The other specimen 204 also of Mansfield is part of a larger pinna. with flat, broad punctate rachis nearly one cent. broad, secondary pinna slightly oblique linear gradually pointed, eight centimeters long with pinnules in right angle to the broad flat rachis, comparatively narrow linear oblong irregular in length, with distinct lateral veins forking. The characters are positively those of Pecopteris arborescens. the rachis however is broader and flat. This represent also P. Cyathea of Brgt. Part of this may be figured

D5 Pecopteris Sillimanni, Brgt. Specimen No 226 which has been figured more distinctly represent this species than any of the numerous specimen which I have seen from Millersburg and Cannellton. This species which is finely figured on plate has to be preserved as Sphenopteris squamosa same as published in the 4th Report of the Penn Survey. The specimen 226 represent a small part of a triangular primary pinna with secondary pinna very oblique to the rachis, linear with three or four pairs of alternate oral oblong entire lobes oblique and slightly decurrent below, disjointed, only the upper joined more or less, The terminal very obtuse. The leaflets or pinnules have no trace of nervation except the midrib which is seen clearly in a depression on the inflated surface. The surfaces smooth at least not squamose as in the Sphenopteris squamosa.

D6 Sphenopteris squamosa. There one specimen No 398 whose leaflets are inflated around on the borders as if that was a fertile part. See figure from p. 398 c. (3) more regular, more generally disjointed at the base not a slightly decurrent when united, the pinnae and pinnules smaller, regularly divided by alternate segments, the rachis evidently lined, the whole appearance altogether different. ~~Lesquereux~~ Trans C. 13 p. 410. ~~has distinct lobes to the~~

ascend to the border of the leaflets. This kind of nervation is that of Goppert's species. But in our American specimens, the leaflets are broader, shorter, and by the increasing depth of the divisions of the borders, they become by degrees cut into lobes nearly to the base, and then are undistinguishable from *Pecopteris unita*, Brgt., except, perhaps, by the medial nerve or secondary rachis, half round and not quite as thick, and by a thinner texture of the leaves. The fructification is marginal, in round distinct *sori* which sometimes become irregularly scattered by compression.

Genus PECOPTERIS, Brgt.

Pecopteris Strongii, Sp. nov.

Pl. xiii, fig. 7-9.

Frond simply pinnate or poly-pinnate, pinnæ linear tapering above to a point, slightly narrowing toward the base. Pinnules alternate, perpendicular to the striated narrow rachis, nearly one inch long and proportionately narrow, linear obtuse, often slightly enlarged at the obtuse point, attached to the rachis by their whole, sometimes enlarged base, disconnected and often distant, the distance between them being sometimes as wide as the breadth of the leaflets, becoming closer to each other towards the point of the pinnæ, where they are shorter and connate at base. Fructification, marked by scars of broad round *sori*, with a concave point in the centre, placed near the borders of the leaflets, close to each other, ten to twelve on each side of the pinnules. Their place in relation to the veins and veinlets is unknown, the substance of the leaflets being thick, coreaceous, and the nervation obsolete.

As it is seen in fig. 7 and 8, enlarged, the borders of the leaflets are slightly undulate, an irregularity apparently caused by the compression of the *sori* expanding the margin, or passing out of it, for in fig. 9 all the pinnules are entire on the borders. This last specimen seems to represent a small frond rather than a pinna, for the leaflets turn downwards towards its base, as is the case in some simple fronds of species of *Polypodium* of our time. By its form

and the position of the *sori*, our species could also be compared to *Aspidium Wrightii*, Mitt. of Cuba. Its place is, therefore with the *Polypodites* or *Aspidites* of Goppert.

The specimen fig. 7, is in a concretion form Mazon creek; the others on shale from Morris.

Found by Mr. S. S. Strong.

PECOPTERIS SQAMOSA, Sp. nov.

Pl. xii, fig. 1 to 4; Pl. xiii, fig. 10 and 11, fructif.

FROND evidently bi or tripinnately divided, triangular or lanceolate in outline, with a thick rachis, half an inch or more at its base, covered to the top of its last divisions with long, linear lanceolate pointed scales, either straight and appressed to the stem, or open and diverging all around, even sometimes appearing as dried up and crumpled as in fig. 2. The rachis of the last divisions is proportionally broad as seen in fig. 1 and fig. 4, enlarged, and is also either scaly or marked with crowded points indicating the base of the scales. Secondary pinnæ long, linear, slightly tapering to an obtuse point, flexuous or curved upwards, bearing alternate, unequal, narrow linear, obtuse, oblong leaflets, nearly perpendicular to the rachis, reflexed on the borders, very close to each other, or often contiguous for their whole length, marked with a deep medial nerve, but no trace of veins. These leaflets, generally more or less irregular in their length, have their fructification indicated by small round dots, placed in two rows, close to the borders; the dots are numerous and distinct; their relation to the veins and veinlets is unknown.

The species is quite distinct from and only distantly related to *Pecopteris platyrachis* Brgt. The specimen represented, pl. xii, fig. 4, shows a part of a frond of this species, in its process of development. The divisions appear still unopened and the outline only of the secondary pinnæ with mere traits of medial nerves, are indicated by flakes of ~~scaly~~ coaly matter.

This specimen is upon shale from the roof of the coal at Colchester; the other specimens figured are in concretions from Mazon creek.

(1) Pecopteris oreopteridia Brgt. spec. No 1562 Salem vi of Sharp Mt near Vemont. The specimen is referable to the variety described p. 402 b (1). which by its facies resembles P. arborescens but may be a new species. It represents the top of a pinna with a somewhat thick half round rachis; lower secondary pinnæ close oblique to the rachis, narrow linear lanceolate, gradually tapering to the point formed of an oblong obtuse pinnule as in Brgt pl 105 fig 3. The pinnules of the lower leaflets are short, inclined upwards, joined at a distance from the rachis, enlarged at the somewhat decurrent base or cordate-obtuse. The middle nerve is thick slightly decurrent in joining the secondary rachis and the lateral veins forking once except the upper ones which are simple at an acute angle of divergence from the mid rib, ascend to the border without curving backwards, except those of the lower pair which curve inwards. As in the form described p 406 b, the upper secondary pinnæ become simple by the gradual decreasing of the pinnules which pass to a gradually narrowed or lanceolate point with a terminal pinnule like those of the secondary pinnæ.

From same specimen No 414 represent also a large part of a pinna with ultimate pinnæ nearly in right angle or slightly curved upwards close, long linear comparatively narrow, 10 cent. long at least, only 13 to 14 cent. broad with pinnule mostly free to the base though connected on the borders or close; a larger part of a pinna of the same character as in 105 fig. 2 of Brgt with broader rachis and longer pinnæ the pinnule very obtuse and the nerve derived from near the base as in Brgt. fig 1 of the same plat. The veins of the same specimen are either oblique even at an acute angle of divergence or nearly in right angle to the mid rib.

(2) Pecopteris truncata 403 b 1 404 c 2. [illegible] 11-12 millim. broad towards the base with linear or oblong obtuse pinnules, [illegible] to the sine or gently near to the rachis, very unequal [illegible] Pecopteris or arborescens which the specimen resemble some 7 some 5 millim long. The rachis is flat broad punctate but much less so than in 6. Nilsse though the surface of the leaflet is still more [illegible] very [illegible] [illegible] At the top of some pinnæ it becomes entirely small. [illegible] specimen Ma. 204 a. [illegible] top of pinna 4 cent long [illegible] [illegible] 12 111 millim long 2 [illegible] [illegible] only 1 millim. [illegible] [illegible] [illegible] [illegible] truncate. There is a small branch part of ultimate pinna apparently fertile, [illegible] figured on pencil [illegible] 1. 1. the [illegible] appears like [illegible] placed near the borders of the leaflets and all around. [illegible] fact is with fragments of fertile pinnæ upon the same specimen. See specimen with fruit — To this I refer a fertile pinna from Carmelite Ma 294 with open linear pinnæ pinnules separate to the base inflated truncate with the form of the sori obliterated by a coaly carbonaceous matter, leaflet 3 millim long 2 mill. broad the outline of the sori is visible but not distinct.

Pecopteris Clintoni vestita Ll. N. 204 of Butts in a large number of specimens resembles P. vestita by its character, nervation, thick consistence of the leaflets with villous surface, subdivisions in secondary and tertiary pinnae with small half round pinnules etc. But the rachis is generally smooth and comparatively broader than in the species P. vestita as I have figured it. We may therefore have only two species. It is however to remark that my fig. 1 has also a broad rachis, striated and rarely punctulat and that some of our species like P. dentata seem to have the rachis either punctat or rough or smooth. This may depend from peculiar circumstance of the growth or from the age of the fragments which have been preserved. — In comparing the specimens of this 204 with those of P. Clintoni, I find them to represent the same species, mostly in small leaflets still smaller than they are in my fig. 2 of the plate of P. Clintoni or like my fig. 5 of the plate of P. vestita. The veins are forking twice, once from near the base and once from the middle or above it. It is however uncertain if the specimens where the nervation is somewhat distinct do not belong to P. vestita for their rachis is not visible I do not believe it however, for they all have the same thick coarse coaly surface. Hence both these species differ mostly by the rachis broad smooth that in P. Clintoni not quite so large and punctat or scaly in P. vestita. This species P. Clintoni has a very large frond the rachis also comparatively large and flat; one upon N. 220 measuring one centimeter in width smooth or irregularly striat.

D. 2. [illegible] elliptic [illegible] in our collection. 389 numerous specimens seems to represent the species. [illegible] detached. The largest specimen on is 30 cent long, the secondary pinnae distant, nearly upward, the upper [illegible] nearly always terminated in a virtual pinnule, pinnules oblique all separated in lateral, only attached by half the base to the one rounded to the base rarely [illegible] averaging about 1 cent long 4 to 4 millim. wide. [illegible] with [illegible] appearance, where the two lateral veins thin, close, turned or curved [illegible] the upper one, the middle one, the lower forking twice. [illegible] generally forking once from near the base, sometimes twice. [illegible] often twice. In some specimens it is quite distinct clear. [illegible] a separate one, all the leaflets have the same character of forking in the middle one and the lower [illegible] of one rows [illegible] often simple and count 7 or 8 specimens somewhat large [illegible] of the large leaflets towards the base of the pinna [illegible] one eighth [illegible] 3 of this vol. [illegible] water preserved [illegible] of the rachis [illegible] only one row [illegible] near the midrib, not [illegible] large, I think that this is their normal position. This agree well except with the species of Bunbury which is figured in my Catalogue p. 152. Compare it with P. dilatata sp. of the Penn. 1st Report.

Specimen H of Mansfield has two simple pinnae denser detached on of the leaflets [illegible] the leaflets [illegible] veins [illegible] with two rows of large spots [illegible] 12 to 21 millimeters long, rachis large smooth in middle [illegible] 10 millimeters long, embedded [illegible]

Pecopteris [illegible] Brgt. From specimens 9.11. 9.189. 9.190. 9.171 [illegible]
[illegible] of Mazon creek except the last. [illegible] large, infrimate [illegible]
pinna with inches wide. [illegible] [illegible]
[illegible] 1 4 inches [illegible]
[illegible] path [illegible] through [illegible] [illegible]
[illegible] mill [illegible] [illegible]
are marked but the leaflets are united at base.
[illegible]

2 Pecopteris hemitelioides Brgt. I put with this specimen a specimen 9943 which shows the leaflet of this texture with internal areolae distinct. It may be another species.

3 Pecopteris villosa Brgt. A specimen, simple pinna in Mansfield's collection has the rachis flat very large in thickness and the secondary pinnae short, narrow nearly at right angle, its facies resembling precisely some branches of Pecopteris arborescens. The lower and rachis are villous, the nervation totally obsolete. They seem however as forthcoming twice. It is referable to the species described as a var. of the species p. 402 (2).
Mem. I have seen at Mt Strong a splendid specimen 23 centimeters broad with secondary pinnae oblique eleven centimeters long with pinnules close 12 mill long 4 millim broad.

4 Pecopteris Murrayana Brgt. Specimen 147 of Britts is an ultimate pinna pinnately divided, lanceolate, five cent long; pinnules alternate open or turned upward, narrowed at the base, ovate lanceolate, the triangular, the lowest pinnatifid with division (6.) obtuse half round, separated to the middle, upper pinnules gradually becoming entire. The ultimate ones small round oval; rachis half round middle vein then slightly decurrent at base, lateral veins very thin obscure alternately forking. The nervation is also the form of the pinnules and lobes precisely like that of P. (Sphenopteris) Murrayana see my remark in Ill Geol. Rep. II p. 443.

5 Pecopteris crystata? Brgt. Another specimen in two parts, one fructiferous: N. 206 of Britts has part of primary pinnae apparently large, strong and linear; secondary pinnae open, upon a broad irregularly striate rough or punctate rachis, up to seven cent long, those of the fructiferous specimen shorter, linear lanceolate pinnately divided. Pinnules free and narrowed at the base in joining the broad rough rachis, linear lanceolate, about one cent. long pinnately lobed; lobes cut to the middle or to below the middle, border crenulate; middle vein thick lateral veins alternately as in the leaflets of N. 4. Three times or more in the large lower leaflets. It has the same character of nervation and crenulation of the border as P. crystata, pg. 40 Brgt. The fertile specimen which I consider as referable to this species has the main rachis still broader, rough and grooved; the pinnae shorter but pinnately divided in the same way as the sterile part the pinnules about of the same form pinnately lobed, the lobes bearing on the upper part simple or multiple groups of large sori. The characters of these are not perfectly distinct. They seem either simple and large or small and united two or three.

and one P. 11. (see P. 5 this page)

D 1. Pteris Buckland: Bryl. A specimen P. 18b from Eden v Sotterville has all the characters of this species and is evidently referable to it by form of leaflets, pinna, nervation &c. But Brongniart places it in the section of the smooth rachis, (rachis glabra) and in our species, though the rachis is smooth or even polished it is marked by warts which though scattered and somewhat distant show that it was planted by hairs or scales. The rachis is therefore slightly or distantly muricate. 11.10.71.

2. Pteris Pteridioides Bryl. Among numerous specimens referable to this species, there is one, P. 20 which distinctly shows the fructification. The whole under surface of the barren appears covered with large round sori apparently involucrum or scaly cover. When these sori are opened or have left the leaflets, the surface appears covered by minute points or excavation, irregularly scattered but close to each other. The fructification of this species has not yet been described. But as the nervation of the fertile leaflets is somewhat obsolete it is not quite certain that this is the true P. pteridioides. It might be a new species. 11.10.71.

D 2 Pteris Vetterana? Bryl. The specimen P. 17 which I refer with doubt to this species has only separate secondary pinna long (5½ inches) proportionally narrow (a little more than 1 inch) linear, tapering to a point (sharp point) with pinnules and nervation as marked in Brongniart's figure and description. But Schimper Pal. p. 509. refers this species to Pteris Defrancii, nervo medio indistincto suprabasim soluto nervis secundariis angulo acutissimo ascendentibus while in our specimen, the medial nerve is distinct, ascending to the top of the leaflet and the secondary ~~regulique nearly~~ curving nearly perpendicular to the medial nerve as indicated in Bryl. fig. p. 112 fig. 4. Our specimen is by the length and form of its pinna a well marked one. 11.10.71.

D 4. Pteris Atropurpurea (Lamb). It is represented especially by specimen P. 16 and appears identical by every character. I referred this species to my P. distans of the Tenn. Rep. But the nervation is as indicated by Humboldt and not as marked in my species. Moreover in our specimen the secondary pinna are short and not undulate as Schp. description which agree with specimen. 11.10.71.

D 5 P. Buckland. A specimen P. 11 is also referable to this species. It shows with P. 18 a slightly muricate rachis and though in appearance much like P. Polymorpha or Willdenowii, has the pinna shorter all the leaflets entire and the nervation less divided. Both species are easily confounded. 12.10.71. in 403c. 1.

D

D

D

See 401c. 2.

+P. meogteridius 401 b. 2.
P. Nathersiana Brgt. " 3
P. elliptica Bun. 4
P. hemiteloides Brgt. 0 & 401 c 2

Pecopteris Sillimani, Brgt., Veg. foss., p. 353.

Pl. 96, fig. 5

This is one of the rarest species of our Coal Measures. The few specimens which I consider referable to it, are small and incomplete; one of them is from Mazon creek, in concretions of clay iron ore.

Pecopteris Bucklandi, Brgt., Veg. foss., p. 319. see 401 b. 1 & b

Pl. 99, fig. 2.

The specimen representing this species, distinctly shows the character indicated by the author. The pinnæ are straight, nearly horizontal (four inches long with the end broken off), the leaflets oblong, somewhat lanceolate obtuse, but not quite as obtuse as in Brongniart's figure, slightly scythe-shaped outwards, etc. The pinnules are of a thick coriaceous substance, concave, and deeply impressed upon the stone.

Found in a concretion on Little Vermilion river, by Dr. J. C. Winslow.

Pecopteris Candolliana, Brgt., Veg. foss., p. 305.

Pl. 100, fig. 1.

One good distinct specimen, in a concretion from Mazon creek, while numerous specimens from the same locality have branches, with characters intermediate between this species and *Pecopteris cyathea* of the same author.

Pecopteris hemiteloides, Brgt., Veg. foss., p. 314.

Pl. 108, fig. 1.

The specimen from Mazon creek, is half a concretion, representing part of a pinna, bearing oblong, slightly pointed leaflets, disconnected at the base, with borders inflated, and a double row of large *sori*, unlike any other hitherto seen of this genus. These *sori* open by a transverse split, agreeing with Brongniart's fig. 2 A in every peculiarity of form. Our specimen does not show any trace of nervation.

PECOPTERIS VILLOSA, Brgt., Veg. foss., p. 316.

Pl. 104, fig. 3.

This species is the most abundant of all in the concretions of Mazon creek, which show it in its multifarious forms. The nervation does not appear to have been seen by European palæontologists. Brongniart does not give any details of it, and Geinitz indicates it as simple, or with veinlets forking once only, which is totally at variance with its true nature.# The concretions contain numerous parts of the plant preserved in a state of partial maceration, either with pinnæ whose substance is destroyed, and which have nothing left but the outlines of their leaflets, and the entirely free veins and veinlets; or pinnæ half preserved, one part of which bears leaflets with the villous epidermis, while the other part has the veins and veinlets free of epidermis, and quite distinct. From the form of its pinnule, the multiple divisions of its pinnæ, and of its veins, this *Pecopteris* is exactly similar to *P. polymorpha*, Brgt., the veinlets dividing once or twice or more, according to the place and size of the pinnules.

Schimper Pal. veg. p. 503 says: nervis secundariis indistinctis.

PECOPTERIS ARGUTA, Brgt. (fruiting.)

Pl. xiii, fig. 12 and 13.

The part of a pinna, as represented in the figure, bears leaflets, connate at the base, oblong, lanceolate obtuse, somewhat shorter, more pointed, and more distinct than is generally the case in sterile pinnæ of this species. But as the nervation, as well as the crenulate-toothed borders of the leaflets, are similar to those of *Pecopteris arguta*, and as these peculiar characters are not known in any other species of the coal, I consider this specimen as representing its fruiting part, which was before unknown. The *sori* appear like inflated dots placed just at the point of the simple veins or rather like conical *sori*, with the point to the inside of the leaflets and the enlarged opening outside at the point of the teeth, as marked, fig. 13, enlarged. Their form is distinct; with a strong glass they even appear filled with a pulverulent matter. According to the form and the position of these fruit-dots, the species resembles an *Aspidium*, and should be placed in the genus *Aspidites*, Gopp. Sterile pinnæ of this species are not rare in the shales at Morris.

1. Pecopteris arguta Brgt. fruitg. — A small but very good specimen obtained at Morris Ill: 19.5.71 from Lawyer P. A. Armstrong show that my description of the fructifications of this fern is not quite right. The specimen is part of a pinna bearing 5 alternate pinnae which are linear lanceolate obtusely pointed, about two inches long nearly horizontal upon the broad (1 line) striated rachis. The linear obtuse pinnules are separated to the base though their borders are closely approached. The strong simple veinlets are slightly arched in going to the border and bear close to the border each one large round sporangium which from a central depression or hole seems to have had an indusium attached by the center. This species therefore is referable to the Aspidieæ. The specimen is distinct, the sporange also well marked through the upper surface of the leaflets. The number of the veinlets is generally 8 pairs with one odd at the top. These veinlets are alternate, thick, round. (1.6.71). Mazon creek

P.S. In examining species of Aspidium of my collection, I find A. oligocarpum HB&K, A. macrurum Kaulf. A. conchodes Eato all of Cuba just like P. arguta for nervation as well as for form and position of sporanges. This species is therefore a true Aspidium! Schimper in his Pal. veg. p 521 has this species in his section of Pecopteris Aspidides. See for fructification and nervation Lastraea Dalmatica Heer in Fl. tert. Helv. Tal IX fig. 1d.

2 Pecopteris villosa Brgt. At least what I consider as the European species, has [illegible] and is then [illegible] P. [illegible]. It always differs nevertheless by the [illegible] primary [illegible] always [illegible] We have to separe into a new species the large specimen which, [illegible] P. 668, which has villous leaflets and muricate rachis. The main rachis [illegible] very broad, not quite so much ribbed or not ribbed at all. muricate, bearing short obl. & distant secondary pinnae, sometimes flexuous or turned upward, with smaller [illegible] leaflets oblong obtuse, [illegible] to the base [illegible] by a narrow band. The [illegible] of this species is far different from that of P. villosa and might be better compared to P. [illegible]. The surface of the leaflets is villous [illegible] with a thick crust. [illegible] is strong [illegible] division of the veins which are three branched at and near the base [illegible] The secondary rachis are also thicker than in P. villosa. Besides [illegible] large specimen we have [illegible] referable to this species [illegible] 8 [illegible] long [illegible] pinna has 24 inches long. The [illegible] secondary pinnae are only two inches long, slightly longer in the middle where they begin flexuous and turned upwards [illegible] to an obtuse point. [illegible] little less than one inch long, the pinnules smaller but still distinct. [illegible] is referable to the 3d form of P. arborescens as described in this vol. p. 403b [illegible] See 401a. 3.

3 Pecopteris ~~pulchra~~ serpillifolia [illegible] A small species of which we have many specimens [illegible] creek and of which [illegible] specimens [illegible] is represented by 121, 3122 [illegible] 1044 144, 3267, [illegible] 3132 [illegible] pinnae alternately divided. The [illegible] of the pinnae [illegible] oblong [illegible] linear-lanceolate obtuse, ~~wider~~. Pinnules small. [illegible] mill. [illegible] or higher [illegible] the rachis. Fertile pinnae numerous, of the same form and division as the sterile one. Fructifications [illegible] round [illegible], It is not [illegible] P. [illegible] on the whole surface. A fine species which is not related to any as yet [illegible] to Sphenopteris floricans Brgt. as figured in Sternb. See complement of description p 404b 3

402 b. Pe

D 1 Pecopteris oreopteridius Brgt. A very variable species. Among the specimens of the museum which I refer to this species, Nos. 9. 41. seem to differ in many essential points. It represents two parts of an apparently same frond. One, the middle part? has two pinnae perpendicularly attached to a broad smooth rachis, 5½ mill broad. The pinnae are lanceolate about 4 centi at base, 8 cent. long with horizontal secondary pinnae which are linear tapering to an obtuse point with small oblong obtuse contiguous pinnules, united at base, scarcely two millimeter long, with a deep medial nerve vanishing by division below the top, and oblique veinlets forking once or simple. The secondary and tertiary rachis are proportionally broad. The second part appears to be the point of the frond. It is 13 cent. long, triangular in outline, bipinnate, the primary rachis a little more than two millim. broad, smooth, with secondary pinnae alternate, becoming horizontal above, 3 cent. long, near the base, with oblong continuous pinnules proportionally narrow 5½ mill. long, scarcely 2 mill. broad, with the same nervation as in the former. Near the point of the frond or pinna the pinnae become more and more connected and their secondary pinnae are many nerved and merely equally lobed, undulate or in border. The essential difference in this specimen consists in the broad rachis and the small size of the pinnules which are much narrower than in any other form of this species. 13. 7. 71.

It has the general appearance of the small form of P. arborescens but the upper surface of the leaves is covered with a thick epidermis and the veins and their division are thin and perceptible with difficulty. One of the essential characters also which separate this species from P. oreopteridius is the obliquity of the veins which reach the border in an acute angle and not in a very open angle as marked for this species. In Brgt. description of P. oreopteridius Foss. flor. p. 317: nervulis medio vel prope basim furcatis, margine vix obliquis. For this species we should say, nervulis supra medium furcatis margine valde obliquis. A large number of specimens under as yet by me as rend P. arborescens or P. oreopteridius belong to this form. viz: P. 25, 45, 120, 41; it has to be described and published as new. But if not a new species it is a var. of P. arborescens. nervulis furcatis ramus simplicibus. See p. 400 a (1).

D [illegible] 8. 10. 71. This species is pretty well described [illegible] species, from [illegible] characters besides those mentioned above are: [illegible] the veinlets free. [illegible] represent the points of two secondary pinnae [illegible] the secondary. In these [illegible] veins are [illegible] the lowest pair [illegible] These veins [illegible] are fresh & inflated. — [illegible] the nervation at least, is the upper part of a primary pinna with secondary pinnae [illegible], slightly more oblique, the pinnules all decurrent united above the base to the [illegible] The nervation is the same [illegible] showed a triple [illegible] each [illegible] decurrent [illegible] 1882 p. 122. [illegible] with smaller 1½ cent. long, disconnected [illegible] the base which is rounded on both sides, veins forking once except the lower pair which has one of its branches sometimes forking again! At 60 still large secondary pinna with surface destroyed by maceration. [illegible] veins are forking twice, [illegible] the middle of the leaflet, [illegible] branch is divided again, [illegible] pinna with [illegible] open on one side, [illegible] on the other, through an upper part [illegible] long. [illegible] somewhat different [illegible] other. [illegible] 128. 9. 10. 115 [illegible] veins forking [illegible]

1. Goniopteris ~~polymorpha~~ Buchlandii Bryl. A number of specimens 1.88 from Eagle vein Do. represent many forms of divisions of pinnae and leaflets which are identical with those of G. polymorpha, bipinnate and pinnae with horizontal secondary pinnae from a broad slightly muricate or muricate rachis, smooth except the points; secondary pinnae 8 cent. long linear tapering to a point with pinnules contiguous, connected at base along other, somewhat turned upwards or 2-ranked shaped 7 cent. long 3 mill. broad, decreasing to the point, nearly entire or lobed by a median nerve distinct ~~reaching~~ but thin, ascending 3/4 of the leaflets; sinus oblique, dichotomous, forking with a very much [illegible] or nearly forked one. In the second form, the pinnae, pinnules, of the same sort but smaller have somewhat flexuous rachis and the leaflets narrower, less contiguous though connected at base. Further, on the upper and lower edges near contiguous (disconnected to the base as in G. polymorpha) and a 4th form of the same species all on the same stem has the secondary pinnae much shorter with short oval leaflets connected to the middle. From the nervation, the smooth but muricate rachis, I refer this specimen to G. Buchlandii. ~~By the~~ of which we know only the small fragment published by Brongniart. See this specimen G. 401 b. 1 & 8. see this page 403 c 4

[illegible]

apparently G. Buchlandii.

[illegible]

Should be figured.

2. Goniopteris polymorpha Bryl. There is still a great deal of uncertainty in this species. Some of the specimens represent with the pinnae smooth nerved forked have the secondary pinnae [illegible] to a point and therefore [illegible] that which [illegible] Brongniart's figure of G. polymorpha [illegible]

[illegible]

[illegible]

[illegible] according to the length of the pinnules which is very variable, this first form [illegible] the description of the varieties of P. arborescens of authors. — The second form has the secondary rather very broad, almost round, not flat & reed to the as the form [illegible] with [illegible] pinnae [illegible] pinnules [illegible] Schimper [illegible] p. 2811 [illegible] the first from the Gorge of Ovens opposite [illegible] between Marietta & Athens.

Beconiers ~~[illegible]~~. so 404 c. 2. quadrilobe [illegible] separated as new. The rachis are broad but as broad as in the former species, the tertiary divisions or pinnae are more [illegible] sometimes distant, rather truncat at the top, sometimes enlarged at base and slightly pointed sometimes in the small divisions, rarely oval, with the surface covered with [illegible] under the microscope mostly obtuse. [illegible] number of specimens of this form all presenting an appearance far different from that of the P. arborescens. Their pinnae elongated, truncat in outline, secondary pinnae [illegible] the rachis small, distant, sometimes separated to the base, obtuse, slightly rounded beneath at the top, resulting triangle, obviously seen through a thick coriaceous epidermis. Fructification marked by two rows of large round compound sori along the median vein of the ultimate rachis municate. By their variation these forms are difficult to separate. LR III. 71 [illegible] that species is allied to P. Stangii. And as it is mostly found at places where no P. arborescens is found or when P. Stangii is common the difference of it is more [illegible] P. to the [illegible] limits within. In the specimens sent by Worthen there is a good specimen S. 942 which appears the true P. cyathea of Brgt. see 3

2 Pecopteris lepidorachys Brgt. = P. arborescens Schp. I have two specimens S. 41 & S. 42 this last fructified from Mazon creek which by the divisions of the frond and of the pinnae, the linear form of the pinnules which are of various length and the fructification which as Schimper says it of P. arborescens p. 469. is represented by large sori which fill nearly each one the whole breadth of each side of the pinnules. This however different by the nervation which is either forcat or bifurcat and the surface covered with hairs. This form could relate to P. lepidorachis Brgt. but does not appear to go with the P. arborescens (send to Schimper). Perhaps S. 42 should be referred to the same. It is a simple pinna with long linear obtuse leaflets 12 millim. long 2½ mill. wide, free to the base which is slightly enlarged horizontal or slightly curved upward, with the surface hairy and all the veins open and forking once near the point or above the middle. I find nothing agreeing with this form. The veins are thick little inflated the point of division or forking is obscured as if the veins above were divided in spread like or hair like branches. This should also be sent to Schimper. The specimens are from Strong 1874 Sp. S. 41 & 42 are similar to P. dentata as figured by Geinitz but the rachis of this species is smooth. S. 42 b. is comparable to P. pteridica Brgt as fig. by German Tab 36. S. 40 is also of the same type. For this 42 b. compare also Pec. Candolliana in German pl. 38 as also S. 41 & 42.

3 Pecopteris arborescens? Schlotheim. The collection of New Brunswick has a fine specimen No with the characters of this species by the form of the pinnae, pinnules and leaflets. The sporange are marked by a series of holes along the midrib apparently on each side of a simple lateral vein. This not positively seen in the sporange are upon the veins or between [illegible] See page 399 (3)

Pecopteris elegans, Germ.

Polypodites elegans, Gopp., Syst., p. 344.

Pl. xv, fig. 10.

We have in abundance, in the concretions of Mazon creek, specimens which agree in every point with the figures and description of this species. Pinnæ, bearing linear leaflets, entire on the borders, round at the top, marked by medial nerves from which branch in an acute angle simple veins, ascending straight to the borders, or sometimes slightly curving upwards. But the characters here indicated are so variable and passing by such inappreciable transitions to those of the true *Pecopteris unita*, Brgt., that after the examination of many hundred specimens, it is impossible to point out a single trait which could be described as distinctive of one of these species. I therefore consider this *Pecopteris elegans*, Germ., as a variety of *Pecopteris unita*, Brgt.

Pecopteris aspidioides, Brgt., Veg. foss., p. 311.

Pl. 112, fig 2.

Found at Mazon creek; rare; seen only in two specimens.

Pecopteris abbreviata, Brgt., Veg. foss., p. 337.

Pl. 115, fig. 1 to 4.

Numerous and very fine specimens in concretions from Mazon creek are referable to this species, rather by the figures given of it by Geinitz in his Versteinerimgen, than to those of Brongniart. The secondary pinnæ are short, all equal, the veins and veinlets much inflated, the pinnules more generally disconnected f. c. f. It is altogether a different species from *Pecopteris Miltoni* Brgt., to which the German author unites it as a variety, at least, if we consider our American specimens identical, which, however, may represent a new species.

PECOPTERIS DENTATA, Brgt.

Veg. foss., p. 336, pl. 124.

A fine species found in large specimens in the shales of the coal at Morris, and also in the concretions of Mazon creek.

PECOPTERIS FLAVICANS? Presl.

Sphenopteris flavicans? Presl.

Sternb., Vers., vol. ii, p. 127. Pl. xxxviii, fig. 1, *a*, *b*, *c*.

From Mazon creek also, and in concretions, we have obtained a number of specimens of a species which appears closely related to this species, if it is not identical with it. They represent parts of fronds or pinnæ, bipinnately divided; primary divisions alternate, open, straight or slightly flexuous, linear, bearing alternate, oblong, short, obtuse pinnules, connate at their base, slightly decurrent, with a decurrent medial nerve; alternately branching in simple veins, two or three on each side, turning inwards in ascending or straight to the border. The fruit dots are marked in a double row near the borders of the leaflets, apparently placed upon the veins. The main rachis and its divisions are deep and grooved. But for the position of the *sori* and of the thick epidermis of its leaflets, this species could be referred to *Oligocarpia Gutbieri*, Gopp., the disposition of the deeply marked veins and the form of the pinnules being alike. As this *Pecopteris flavicans* is not mentioned by any recent author, not even by Unger, and as it is known only by the short description and the incomplete figures given of it by Sternberg, our species is referred to it with doubt.

PECOPTERIS CHŒROPHYLLOIDES, Brgt.

It is remarked, vol. 2, p. 443 of this Report, that this species was still uncertain, having been found only in incomplete specimens. It has been obtained since from the roof shales at Colchester in large and good specimens. Except *Pecopteris Cistii*, Brgt., *P. velutina*, Lesqx., *P. Newberryi*, Lesqx., all the species of *Pecopteris* enumerated in the 2d vol., have been since found in Illinois.

1. Pecopteris Huchsnetii Brgt.? from specimen P. 54 is apparently this species but intermediate to P. acuta. The leaflets are undulate on the borders as in the former species, enlarged at base, oblong, obtusely pointed, turned upwards or slightly sickle shaped. The secondary veins at the base of the leaflets are dichotomous, forking near the base and the upper division forking again; in the upper part of the leaflets they are merely forking once as in P. acuta. 12.10.71.

2 Pecopteris Clarkii Lesq. I refer to this species specimen P. 196 b from Mazon creek. It is the point of a rudimental frond or pinna with a broad regularly divided rachis in primary alternate divisions, bears also a broad rachis, turned upwards, distant from each other, alternate, opposite, closely approaching secondary pinna half an inch long, diminishing to the point, forming secondary pinna bearing close perpendicular small oval or oblong leaflets, only two millim. long, small, blunt, distinct, rising to the base in slightly decurrent and connected at base, becoming united near the point of the pinna, veins the species of the section. The veinlets are obscurely marked but evidently forked once, except that the veinlets are more distinct and deeply marked as in the specimen of P. acuta. There is no difference whatever between them. 12.10.71.

3 Pecopteris ~~[illegible]~~ serpillefolia Brgt. This specimen is evidently a different one. The description p. 402 a. 3. differs slightly and might be more extended and [illegible] time [illegible] consideration is apparently [illegible] 6:528 [illegible] 5 [illegible] the species [illegible] Fig 5 a. show the form of the secondary pinna in [illegible] position, natural size [illegible] enlarged size of the pinnule. Fructified pinnules with a enlarged portion of the same. Pinnules are longer and narrower, linear obtuse. They are [illegible] generally [illegible] at base [illegible] that the narrowness is produced [illegible] of the decurrent [illegible] the under basal [illegible] the front of the rachis. 2.11.71. [illegible] upper the secondary rachis and upper [illegible] basal leaflet the villosity appears to have been coarse and thick. The primary rachis is sometimes [illegible] or marked with a [illegible]

4 [illegible] Lesq. [illegible] 1868 Pl. 1 fig 12 [illegible] which I have never seen, marked S.S. 186. because it must resemble if not the same species [illegible] Secretan [illegible] Bull. in Lesq. vol. 18. p. 141 fig 5. p. 16 a. This also very much like a species of Eustic figured Pal 5 fig 4 & 4 a but not described in the pamphlet. The nervation of the leaves in both species is the same.

5 Pecopteris dentata Brgt. In this species the rachis is muricat in the upper part and smooth when enlarging downward or rather the upper branches only are muricated. See spec. P. 946.

6 P. microphylla Brgt. A specimen from M. Tyler McWhorter of Aledo Ill. No 8 bituminous coal measures, locality not marked, appears to represent exactly the species. It is bipinnatifid. primary pinna lanceolate 4½ cent. broad at the base and in the middle (the fragment is 10 cent. long) secondary pinna in a very open angle of divergence, linear lanceolate. pinnules alternate slightly decurrent reach in right angle to the rachis or somewhat inclined toward the point, short, averaging 5 millim long, narrow, two millim or a little more at the base pinnately lobed, lobes four pair in the longest pinnules, toward the base of the pinna 3. and the 2 pairs toward the point, lobes half round cut or divided to near the rachis, terminal small obtuse, the basilar pair on each side of the midrib larger; middle nerve distinct, at least somewhat distinct, lateral veins obsolete. This species agrees well with Brongniart's fig. & description — It is now figured, as far as it can be seen and seem to differ from Brongniart's figure by the lobes more or not as deeply separated, by the decurrency of the pinnules and also of the mid rib. By these characters it is more like Pecopteris Cheerophylloides Brgt. Pl 125 fig 1 & 2 differing much however by narrow pinnules half round lobes more deeply cut. The nervation is about the same as in this species. A specimen comes from Chester C. May be new.

apparently P. Thelinet, as figured by Gaman IV. pl XVI or new compar. of the mysteris crassinervis Gaman

D.

[illegible]

D 2. Decopteris ~~truncata~~ quadrilobata n. nov. This is the species described 403 b 1 a, a var. of D. arborescens. It is not the species and is separated under this name. I have from Strong a specimen showing the fructification of this species (No 1660) in part of a large frond which I have seen in his cabinet. The sterile pinna is 31 cent long oblong lanceolate in outline 10 centimeters broad in the middle, decreasing toward the base and taper pointed; the secondary pinna are 5 to 10 centimeters long, linear or ~~lat~~ narrowed to the point, the basilar ones open, the upper ones a little more oblique or turned upwards, pinnulae close, small, disjointed to the base, scarcely more than four millimeters long and half as broad, round truncate at the base, ~~[illegible]~~ midrib thick lateral veins totally absorbed by a thick often shining epidermis, bearing when fructifying two ranges of oval sori on both sides of the midrib, enlarged at the base, fixed upon or between apparently simple veins. The position in regard to the veins is not distinct. The fertile pinna are upon the same specimen as the sterile frond. There is in Gaman a Decopteris truncata Gaman but it is an Alethopteris, see Idg. Vol veg. 1585 (see 400 a/2)

The description for marginal and finally is wrong. See p 415 b.

1 Sphenopteris integra Gem. Specimen No 1649 & 1650 (double) from Mazon creek is referable to this species (or rather perhaps to S. vertita) by shorter broader pinnules, secondary veins merely forked and surface smooth with the rachis. The specimen represents only an ultimate pinna with long linear abruptly or rapidly rounded to or obtuse pinnules; leaflets 8 millim long four millim broad smooth decurrent and attached by the middle lower middle exactly as figured by German and described by Schimper Pal Veget.

2 Dicopteris hemitelioides Brgt. No 1661 a small specimen from Mazon creek represents an ultimate pinna with oblong obtuse slightly decurrent leaflets turned upwards and nervation exactly as in Brgt fig. 2 B pl. 108. The only difference is that from Schimper description the leaflets are separate to the base while in this pinna they are joined a little above the base or near the rachis. As I remarked in my descriptive p. 401 l. 6. the lower veins are generally turned or curved upwards, very thick or deeply impressed and little inflected or doubling near the point. (see below. 4)

3 Dicopteris asplenioides Brgt. The specimen not valable but identified with doubt to S. granulata. One specimen from Mazon Creek No 1665 agrees in toto with figs and description of the species by Brgt. The pinnae (ultimate) are however in right angle to the zigzag or geniculate rachis and the pinnules a little longer and broader. It is the only difference. The nervation is the same, veins simple in a very open angle of divergence and curving backwards. As Brongniart remarks the appearance or facies of this species is quite different from that of S. arborescens. The rachis of the ultimate pinna is broader the surface of the pinnules zigzag or not smooth, the venlet form more proteberent or thick and thus more distinct. The leaflets are alike irregular in length. I consider it a good species. Item that it is from Mazon

D 2b. Dicopteris hemitelioides Brgt. Very S. arborescens has not yet been found. Spec. No. 8 of Porter from Summit portage in a few specimens, a pinna with secondary pinna in right angle, straight, distant or separated from each other, 4 to 4½ cent long, the largest one pinnately equally lobed lobes or pinnules short oblong, obtuse, inclined toward the point or outside, 4 millim long 2 to 2½ millim broad with nervation of the species, that simple venlet nearly in right angle to the mid rib. In passing up the secondary pinnae become shorter. The pinnules united nearly to the top and finally the pinnae pass to pr. simple pinnules which are linear and gradually diminish in length toward the top of the pinna. The terminal pinnule is obtuse.

D 4 Dicopteris Clintonii Spec. nov. This species represented by spec. 109 and 109 a, b, d, e, fill one plate. It is a large fern. Frond polypinnate primary pinnae lanceolate alternately pinnately branching. Secondary pinnae linear lanceolate, obtuse, various length and width according their position, cut in alternate lobes or pinnules the inferior ones sometimes pinnately undulate lobed along the border while in the upper pinnae they are entire, all oblong or linear obtuse joined at or near their base or united to the middle or even above the middle, sometimes as in fig. 1. The leaflets are irregularly divided decurrent and united at the base or free and sometimes had distant sessile by a narrowed base simple or bilobed on both sides or lobed on one side and entire at the other longer or shorter upon the same pinna and therefore multiform. I have not observed this polymorphy in other specimens which have generally the pinnates lobed division of the Dicopteris quite regular. The surface

of the leaves is covered by a rough punctate crust or epidermis which entirely hides the veins or renders them obsolete. This epidermis easily separates in lamellae, leaving the under surface present upon the stone and distinct, but upon this also no trace of nervation is distinguishable. The enlarging part 3b & 4a shows at the nervation as far as it is possible to see it in very few leaflets and it is not quite evident or sure that it is exactly represented. The veins are alternate from a somewhat undulate midrib slightly decurrent or running to the rachis and emerge at an acute angle of divergence, forking once at the middle. By the nervation of exact and the thick punctulate epidermis, the species is comparable or related to P. rectita, the more so that the fructification is of the same character but the leaflets of the species or pinnules are broader their lobes or pinnate division also broader more obtuse, half round and the strial rachis is not punctulate nor brown. Moreover in P. rectita, the veins are always more or less distinct and more curved toward the border. In the fractory specimens, the sori are less regularly placed and less distinct in this new species. Generally apparently crowded and covering the whole surface of the leaflets of which no trace of border is seen fig 5 & 5b enlarged. Britts specimens Clinton, abounded and mixed w. P. rectita. see p 400 e. 1.

L 1. Pecopteris species, nova. Obs. P. abbreviata figured from spec. S 5455, 1654, the distinction of the leaflets as also the nervation and the fructification. In the pinnately divided frond, as in fig. 6. the pinnules attached by the whole base are decurrent at base, the lower basilar border joining the base of the ~~pinnule~~ inferior pinnule is decurrent to it, as in the enlarged part fig 6a. In the undivided pinnules the base is not decurrent and the pinnules are united at the base or sometimes to the middle gradually passing toward the point in mere undulation of lobes. The nervation is as figured. The midrib is marked by a broad depression but the distinct midrib is marked as the veins unite in the middle and decurrently somewhat separately form the depression or midrib. The lateral veins are much curved backwards and just as figured being inflated or the under lobe prominent by the deep cut of the veins. The divisions are multiple as the veins twice forked a nervation analogous to that of P. Mellini and also rare P. abbreviata or fig. 4 b Gainsby. But there is a marked difference in the very broad rachis of the ultimate pinnae and in the generally twice forking of the veins especially inflated toward the border. This inflation is not remarked either in Brgt or in Gainsby. The division of the veins is however much little that in Brgt. P. abbreviata. The fructification are unknown as yet. The surface of the leaflet is in some specimens covered by great round elevated points irregularly placed as marked fig 5 b enlarged but these points do not represent sori as they are scattered equally upon the rachis and broad midribs. His apparently near of the same division as the Mellini. The ultimate nervation is that of Pecopteris Cliftonii but it differs much by the character of the division of the frond.

L 2. Pecopteris Certa Brgt. A specimen Britts N. 146 has fragments of pinna or secondary pinnae with large oblong leaflets and a nervation similar to that of P. Citii. The rachis is not seen. [illegible] see N. 3984. 2

Genus STAPHYLOPTERIS.

Presl. in Sternb. Vers., ii, p. 174.

Count Sternberg, in his Versuch, loc. cit., defines this genus merely as: *inflorescence or fructified panicles of ferns, analogous to those of Botrychium or Anei~~ria~~.* Anemia

The only species described by the author as the type of his genus: *Staphylopteris polybotrya*, from the Tertiary of Europe, represents a small group of round sporanges. In our American species here described, these *sori* have various forms. But it is convenient to consider them under the same generic name, till their relation to sterile fronds, or their true generic affinity can be ascertained. To this genus, therefore, I refer all agglomerations of sporanges of various forms, either borne upon separate plants, or upon separate segments of a plant, like those of our species of *Botrychium*, without visible remains of leaves, or whose connection to frond-bearing leaves can not be traced, and is unknown.

No species referable to this genus has been found as yet in the Carboniferous strata of Europe, a fact which led Palæontologists to suppose that ferns bearing fruits in separate panicles did not exist at the time of that formation. From our Coal Measures, we have previously obtained only *Staphylopteris stellata*, Lesqx., Arks. Geol. Rept., vol. ii, p. 309, pl. 2, fig. 2 and 3, from the Sub-Conglomerate coal of Arkansas. The discovery and publication of the following species is, therefore, a valuable contribution to the fossil flora of the coal.

Staphylopteris Wortheni, Sp. nov.

Pl. xiv, fig. 1 and 2.

Frond bi-pinnate, ovate lanceolate in outline; pinnæ linear, gradually tapering to an obtuse point, short, one inch long near the base of the frond, scarcely half an inch near the top perpendicular to the main rachis; pinnules alternate triangular, formed of an agglomeration of three or five *sori* apparently attached to a main pedicel, but without trace of leaves. The main rachis of this fruiting segment of a fern is proportionally thick, three lines at its base, finely irregularly striate, the branches or pinnæ appearing attached rather upon it or

around it than along its borders; the rachis of the branches is also thick, smooth, and on both sides of it are attached the groups of *sori*, three to five in number, in a kind of pyramidal position, with a thick short pedicel in the middle. The *sori*, when unopened, are round, marked on the flattened surface by four or five lines diverging from the center to the circumference. Fig. 2*a*. When opened the sporanges appear placed like the rays of a star around a central point. These sporanges, oval, elongated or gradually enlarged outwards from the narrow point of attachment, deeply concave, finely striate within, are all turned to the same side, viz: the point downwards and the branches tending obliquely upwards; in that way the upper *sori* of the pinnæ have the point towards the rachis, while in the lower ones it is turned from it: see fig. 2, enlarged twice, and fig. 2 *b*, enlarged four times. The sporanges are deeply marked or excavated in the stone, which is still more deeply penetrated by the point, and this point appears, as said above, to have been attached to a common pedicel by filaments now destroyed.

Found in a concretion from Mazon creek; discovered by Mr. M. S. Hall.

Staphylopteris asteroides, Sp. nov.

Pl. xiv, fig. 6 to ~~10~~ 7 b.

Frond tripinnate, with straight alternate branches; primary pinnæ lanceolate pointed or tapering to a point from an enlarged base; secondary divisions alternate linear, merely formed of narrow, filiform, obliquely straight branches or common pedicels, bearing groups of sporanges pinnately attached to them in pairs and opposite; *sori* round at first and before maturity, opening at maturity in five lanceolate-pointed laciniæ around a central round point, and forming a star (fig. 7 and 7 *b* enlarged).

This fruiting species is still more remarkable than the former. Groups of *sori* resembling round dots, fig. 8, are seen on the same piece of shale, but on

1. Naphrolopteris species. - Specimen of Butts N: 200. 200a. Species very similar to my S. sagittatus. The sporanges are in ~~singly scattered or with a single~~ double row of separate sori born upon racemes. These are oblong, linear, obtuse at both end, slightly enlarged and truncat at the point of attachment, one centimeter long, three millimeter broad. The rows of sori are in sixteen on each side. The racemes are thick, alternately branching branchlet supporting the sporanges very short, sporanges nearly sessiles. I can not find any relation to this in the fossiles ferns of Hoother or Göppert dislike Genera has a branch of sporanges much like this one see Pl. 526. p. 103 Pl VIII a 9. fig 4.

2. In the lexicon Dictionnaire botanique de Baillon. p. 706. There are 1 sporanges a capsules bag. etc. with anelotic annulus which surrounds the complete compare this.

(1) Sphenopteris obovata Al & H. These specs of Lacon No 726, 727, 732 (specimen) agree exactly by the form obovate of the entire pinnule and also the venation & S. obovata Al & H. Ipl 109. They show only fragment of ultimate pinnae little Al. figured. The midrib is not as thick as figured in Al and the barren leaflets are sometimes lobat. The secondary nerves are all from the midrib, numerous forking, the upper ones only one. There however may be differences. Spec 732 shows the borders slightly crenat or undulate crenat in some of the leaflets. The specimens are poor and obscure. (may be S. lancedale?)

D (2) Sphenopteris gracilis Brgt. I have numerous specimens from the Carboniferous of Alberie and also of Tetlow which seen by the naked eyes appear to be referable to this species. The fragments of pinnae are bipinnatifid. Primary rachis narrow (pinnae) flexuous, half round or half cylindrical (flattened) with a narrow flat border formed by the decurrent base of the divisions. Secondary rachis narrower but of the same character, primary divisions or pinnae oblique or nearly in right angle, distant, alternate, lanceolate with 6-8 alternate pinnules also distant, oval or oblong ovate pinnately lobed, three or four lobes on each side oval, obtuse divided to near the midrib, entire or slightly undulate with a midrib either simple or forkings near the upper part. The nervation of the leaflet is obscure. The pinnules appear on both sides of their base decurrent to the rachis but not forming border; but that is the form of the rachis as the base of the pinnules is exactly as figured by Brongniart 53 and I would not have any doubt about the identity of the species if the lobes of the pinnules were not mostly all entire half round while in the enlarged fig. of Brong. they are marked bidentate (rather slightly) so the specimen has a likeness to S. mugo. But the pinnules however are shorter, three lobed mostly the lobes deeper more distinct, the rachis much narrower and smooth. Fig 2 pl. 54 is more like it than any other past of the plate suffering however by the character indicated. S. gracilis being a much more slender species.

D 3 Sphenopteris Hoeninghausi Brgt. I have two specimens from S. T. Coy. No 7 LW 14 which appear represent this species. The fragments are small, only part of ultimate pinna. The pinnules are divided like those in Brgt fig. and the lobes very inflated; the nervation is also the same. The tertiary rachis is deep with an acute channel at the base and punctulat. It may belong to the following species, which from very numerous specimens I referred formerly to S. Hoeninghausi.

D 4 Sphenopteris (Calymmotheca) Stangeri, Stur. From description & from figure the numerous specimens recently Smith and Aldrich from Alt. Seam belong to this species, rather than to S. Hoeninghausii. The characters of the rachis are the same. The primary rachis is large the surface marked by scars of scales like those of a young branch of Lepidodendron, the secondary and tertiary rachis marked in the middle by a strong keeled nerve or costa, flattened on the borders and very hirsute. The tertiary rachis also keeled but less hirsute. The species differs however from this or also from S. Hoeninghausii as figured by Brgt by tertiary pinnae straight, scarcely flexuous with pinnules longer, closer subdivided in 4 to 7 pairs of alternate lobes closer to each other but not to near the midrib, not obtuse and more resembling Brgt's figure than that of Stur. The lobes are however closer than in S. Hoeninghausii which has the pinnules of the same length. It is extremely difficult to separate this species from S. Hoeninghausii & from S. Stangeri.

1. Sphenopteris elegans Brgt. Sm. 4. is represented by some good specimens agreeing in character with Brongniart figure and description, the pinnules, lobes and division being however smaller and shorter than in Brgt figure. Ma figure of this species is accurat. The rachis is grooved in the middle and marginated as marked at the base of fig. 2 Pl. 53 of Brgt. distantly punctulate or smoth, somewhat rough. In some specimens where the rachis is more evidently rough and the division of the pinnule shorte and more enlarged to the point, the specie seems to pass to Sph. Hoenighausii with which it is mixed but which however is separated by its inflated pinnules or lobes. In this species they are flat without trace of nerves. The litteren of the form however b. S. Hoenighausii is very marked. I have kept a specimen S.M. 4 a. The specimen just back is marked the same 4a.

2. Sphenopteris Chærophylloides Brgt. The small specimen N. 74 fig. Pl 23 ee 3 appears really referable to this specie through the ultimat pinna are somewhat large. But I have ~~seen~~ from Mansfield specimens 101 a Pecopteris somewhat similar only with still larger pinnules lobe and a different nervature. See 393 e 1.)

3. Sphenopteris lyratifolia, Gopp. SS 158 pl. steril from Morris Lf. 1664 pl. fruity. nodule from Maza creek. Each specimen only represent fragment of a pinna. Pinna linear, about three and an half centimeters broad, bipinnatifid. primary divisions or ultimat pinna alternat in an open angle of divergence, short, the steril ones 1 pi cent. long lanceolate with a thick inflated rachis coming out also of the thick inflated rachis of the pinna. flattened inflated in the middle, flattened on the borders yellow: pinnately divided into subopposite three to four lobes oblong obtuse, diverging in the same degree as the pinna. pinnules serried, midrib thick decurrent at base dichotomous. branches simple or forking once. All the plant or the surface of the preserved parts covered with a thick coat of hairs rendering the surface rough, especially the under side as seen marked upon the stone after the abrasion of the thick epidermis. This also renders the veins somewhat undistinct. The parts figured (Pl. mixed) fig. 6. a & b. Fig 6 represents a specimen from Maza creek with fructification. The rachis is of the same character, only not hirsute, at least the upper part only is seen and the surface is apparently smoth, the lobes are shorte less distinctly marked than in the steril part, more numerous and the sori depond around in rows of five, start the each at the end of a lateral vein. See fig. 6. a. b. Sometimes the divisions are short and the rows of sori are merely in one or two near the upper borders. Goppert and Weiss have figured this species steril but from better specimens. Goppert in Gallenpe 344 Pl. 13 represent the species with the surface of the leaflets smoth and without trace of nerve. Weiss in Pl. 3 f. four. Pl. 3. represent the surface as yellow and with undistinct trace of veins. In both the broad rachis, the form of the pinna and pinnules the direction etc are the same. Goppert place this species in the Chærophylloides. The nervation and fructification of the Pecopteris or Cyatheites type like the other numerous species published with part. The thick hairy surface is remarked a number of species of the same type. The name has to be changed. in Cyatheites lyratifolia. Rem. that the rachis of the first figures delineated with the surface yellow. The surface is irregularly lined in the length and somewhat yellow but not distinctly so as in the steril specimen.

407 a.

D. 1 Sphenopteris nebulata, Weiss. Spec. L.P. 1651, 1652, 1653 from Mazon creek. Brong.
Fronds apparently of large size. Primary pinnæ bipinnatifid, long and linear or shorter and lanceolate; secondary pinnæ alternate, slightly oblique or turned upwards decurrent, and connected by the base forming a narrow wing on the rachis; pinnately 6-7 lobed, lobes alternate, turned upwards, divided to the middle, dentate or crenate; mediale nervule ascending to the top, lateral nervules pinnately diverging from it, simple, two or three pairs passing up to the teeth of the lobes. In all its characters this form is a diminutive counterpart of the species figured by Brongniart as Pecopteris alata Fossil. p. 361. Pl. CXXVIII. The secondary pinnæ are longer and narrower; the pinnules smaller, but the characters as described by Brongniart and especially by Schimper Tal. veg. 1 p. 411 are exactly the same. This form differs from Sphenopteris alata Gutb. and Bryt. by the pinnules or rather lobes less deeply parted, only to the middle, not even that and regularly crenate dentate at the top; the secondary pinnæ longer linear, much closer to each other etc.

D. 2 Sphenopteris Lesquereuxii, Newb. Specimen L.P. 1662 from Thorn, Mazon creek. Show curiously the color (red) of the specimen which I obtained from the Anthracite of Penna. In this pinna which shows the upper part of a frond or of a bipinnat branch, the ultimate pinnæ are about seven cent. long, inclined and also curved upward with eight to ten pairs of alternat pinnules, the lowermost slightly enlarged at the base, undulate lobed attached by half their rounded base to the rachis, the others nearly entire, attached by their whole base, even joined together near the rachis or disconnected, close some of them imbricated on the borders. Generally the borders are undulate rarely entire. The leaflets vary from fourteen millimeters long at the base of the pinnæ to 8 or 9 in the upper part; the pinnæ are therefore gradually narrowing toward the point which is destroyed in all the pinnæ of this specimen. The midrib of the leaflet is broad and distinct to near the obtuse top; the veinlets are very thin rarely discernable, distant, four to my pair, twice forked or dichotomous in the undulately lobed leaflets, forked once only in the entire pinnules, the lowest pair only of the upper branch forks sometimes once more.

3 Sphenopteris mixta, Schp. Q. Specimen from Clinton N. 108 represents it well enough and as I figured it in the plate of this vol. The pinnules are quite deeply undulate lobed as marked upon my figure, rather longer and not as enlarged at the base where they are slightly narrowed and slightly decurrent at the base, the petiole being slightly winged and not quite rounded. See fig. 8 a. where I have corrected it. The derme is thick and the veins very obsolete. The rachis are not scabrous. Even the fig. in pencil 7c. shows my reversion. When the specimens are covered with the epidermis the nervation is obsolete nothing can be seen of it. See 406 b.2.

4 Sphenopteris gracilis, Brgt. Fig. 3 of the same plate XV is represented by a large specimen N. 105b. of Britt. It doesnot appear to be the same as Brongniart. 1st. The rachis is not naked or smooth but evidently rough, punctulate. The secondary pinnæ are much longer, flexuous. The lobes extremely variable in form, as seen from my figure. In the long simple pinnæ, the pinnules or lobes are nearly round and crenulate. In others whose rachis is broader the pinnules are shorter and pinnately lobed as in my figure. This is a most polymorphous species which should be figured in forms its parts and presented in its different aspects. Evidently this is S. mixta of which I have good plates.

D. 5 Sphenopteris gravenhorstii, Brgt. A small specimen of Lacoe 365 seems referable to this species. The pinnules are narrower that and appear, the basal one at least more divided. The derme is thick wrinkled. Brgt. says not lines of the veinlets. Only a terminal ultimate pinna is preserved. may be figured. See the specimen figured from R. D. in the collection of College
See 406 c.

the reverse. They apparently belong to the same species, and seem to have been detached before maturity from their pedicels, whose remains are still marked by dark lines, fig. 8, fig. 9, enlarged twice, and fig. 10, enlarged about ten times. In this last figure dark but absolute lines are seen, apparently showing the suture of walls. In the pinnately divided part of the frond, fig. 6, all the *sori* are opened, and their envelope is still attached to short pedicels, apparently placed opposite to each other. The details of the form of the sporanges are easily recognized, but those of their ramifications, or the point and mode of attachment of the *sori* are rendered indistinct by the superposition of the groups of sporanges. The specimen is on shale from Morris, and was contributed by Mr. Jos. Even. is probably Asterocarpus Sternbergii Göpp. fig. [illegible] 1. [illegible] see figs. 5 & 1.

Staphylopteris sagittatus, Sp. nov.

Pl. xiv, fig. 3 to 5. see p. 406 & 2.

This species has a bi-pinnate frond, as seen on a specimen from the shales of the coal at Morris, too large to be figured. The divisions are alternate; the thick secondary rachis is decurrent on the main stem, which is also broad and smooth. The double celled sporanges are linear, attached by their backs, and pressed against each other in horizontal rows. The enlarged pedicel of the sporange cells is, before maturity, apparently at least, folded in the middle, and both rows of sporanges are joined together by their back, forming in that state slightly scythe-shaped cylinders, obtuse at both ends, attached to the pedicel by a dorsal membrane, and marked all around by the ring-like outlines of sporanges (fig. 3*a*). More generally the sporange-cells are open side by side on each side of the dorsal support, and the sporanges appear then in two convex rows, fig. 4 and 5. In some specimens on concretions from Mazon creek, where small branches of this remarkable species are finely preserved, the *sori* or sporange bearing cells are deeply immersed in the stone, generally leaving around them an empty space, as seen in fig. 3*b* and 3*c*; they are thus isolated and their form is easily ascertained. No traces of leaflets have been seen in connection with this species, which has as yet been obtained only from Morris and from Mazon creek.

continued pp. 419c

Genus SPHENOPTERIS, Brgt., Ill. Geol. Rep., vol. ii, p. 435.

Sphenopteris scaberrima, Sp. nov. 418c

Pl. xv, fig. 1 and 2.

Frond tripinnate, primary pinnæ lanceolate, curved downwards, flexuous; secondary divisions perpendicular to the verrucose, broad, round rachis, linear lanceolate pointed, one to two inches long, distinct and somewhat distant alternate; pinnules lanceolate acute, gradually diminishing to the point, distinct to the base, horizontal, irregularly cut on the borders or entire with borders irregularly expanding and undulating by crushed groups of sporanges or of scales; surface rugose, marked by round small convex points resembling small dots, produced by groups of sporanges placed on the lower surface. All the plant, even the thick, primary rachis, is covered with verrucose points, evidently indicating the base of scales, or hairs, with which the plant was covered, and which are still indistinctly seen on some part of the secondary branches. The frond of this species was evidently a large one, the pinnæ being more than six inches long.

The whole appearance of the plant is like that of some species of *Cheilanthes* of our time, especially of *Cheilanthes vestita*, Schwarz. The species should therefore be classed in the genus *Cheilantites*, Gopp. Nevertheless, the group of *sori* appears to cover the whole under surface of the leaflets, a position which is not similar to that of the *sori* of a *Cheilanthes*. On shales from Morris.

Sphenopteris gracilis, Brgt.

Pl. xv, fig. 3 to 6.

Frond bi or tripinnate; primary pinnæ or fronds triangular in outline, taper-pointed, slender; secondary pinnæ linear lanceolate, alternate and distant, open, curved upwards, flexu-

D. [illegible] Mr. Mackenzie has only two incomplete specimens of the species from Florida, and these from complete specimens [illegible]

[illegible] Mr. [illegible] has all the characters of the genus, and the fronds are well [illegible] in exactly accordance with figure & description of the native [illegible] in Prings native [illegible] see p. 412 c. (1)

D. [illegible] Dbl. The description and figure of this species are made from an incomplete specimen and of course must be [illegible] from Dallwill. It shows neither an entire pinna from broad to base, nor the [illegible] and length of this pinna is doubtly conjecture, probably decreasing to the front [illegible] more than perhaps [illegible] divided the [illegible] but curved upward, the lower one [illegible] tertiary [illegible] and distant, 3/4 of an inch long on the inferior part [illegible] finally divided in alternate lobes or pinnules, [illegible] rachis and unites near the base and with [illegible] teeth. Teeth are [illegible] according to each tooth, either simple or forked. [illegible] see p. 409 c. 2.

[illegible] Mr. [illegible] specimen [illegible] see p. 408 c. 46.

[illegible] Gutbierianum [illegible] specimen No. 176. [illegible] with [illegible] Decurrent [illegible] primaries divided in 4 to 5 entire [illegible] The lobes are longer [illegible] and as in his description he compares this species to [illegible] Tab. 48 & 58, [illegible] the last species which he says is larger than [illegible] The lower lobes are entire like the superior one, [illegible] see p. 416 c. 3.

[illegible] Mr. [illegible] specimen No. 64 Elm river Penn. [illegible] see report [illegible] Bourgeau [illegible] description [illegible] Bot. p. 387. see p. ~~409 c. 1~~. 417 c. 3.

[illegible] Mr. [illegible] specimen No. 102. [illegible] small but well marked. [illegible] occurring on the rachis, [illegible] at the base, three lobes, [illegible] and [illegible] on broad [illegible] [illegible] see p. 528 [illegible] ~~Compare S. M. C. Spk. flexuosa.~~

[illegible] Nicaraguense [illegible] 13.

12 [illegible] tenuifolia [illegible] specimen [illegible] see p. 408 c. 126

14 [illegible] americana [illegible] No. 8 [illegible] right

15 [illegible]

16 [illegible] intermedia [illegible] americana [illegible] Schenopteris [illegible]

17 Schizopteris dilatata [illegible] good species [illegible] see p. 408 [illegible] Lindl. & Hutch. [illegible] correct from specimen figured No. 528 fig. 1 [illegible]

408c
12c Sphenopteris pennifolia Brgt? p. 55. 44. if a sphenopteris is new. But it is more probable the mere skeleton of Neuropteris urgula. showing merely broad deep medial and secondary veins. Brongniart's species: Sphenopteris tenuifolia is well represented in S. 2016 mixed with Alethopteris lanceolata. However some of the pinnules appear entire, undivided and therefore those which are divided may be also mere skeletons of leaves. M Brongniart says that the details of his enlarged figures are not quite certain, I think that we have in this specimen the exact species of Brgt. I agree by the characters indicated by the author.

D 4c Sphenopteris (Neuropteris) acutata Brgt with 467. Here is in a Bochure of Mazon creek a very fine well marked specimen of this species no difference. See 4c.

N1. Sphenopteris flexuosa, Gutb. Frond bipinnatifid. pinna triangular or broadly lanceolate in outline short, primary and secondary rachis alate, flexuous, pinnule short, alternate distant, divaricate (very widely divergent) deeply pinnately lobed, segment linear truncate and slightly enlarged at top or obtuse, the lowest unequal bifid. This species marked by three specimens from the Woodworth mine Helena. Ala, Sm. 27. M 33 & 34 agree exactly with the description in Schp. Veg. Pal. 1 p. 389. It however differs from Gutbier's fig. of this species in Versteini pt 33. pl. IV fig 3. (not in my plate) pl ~~IV~~ pl V fig 2 by the segments longer, obtuse or slightly enlarged and truncate at the top. Gutbier does not mention neither does it figure the alate rachis. It also remarks that the segments are dentate at the top a character which is not remarked in our too small specimens. It is somewhat like Sphenopteris delicatula Brgt. p 185 pl 58 fig. 4 & 4c. differing by the broader segments especially the undulat rachis etc. But the parenchyma of the alat borders is here as Brgt. remarks of his species tenuissima reticulata. It has also some affinity to Trichomanites grypophyllus, Gopp. Nfw. pl 21 ~~XLIV~~ fig 2.

2c 2 Sphenopteris spec. or odontopteris. No 20 a short frond or pinna forking from the top of a short broad rachis 2 cent. long 6 millim. broad in two lanceolate pinna primary pinna short 4 to 5 cent long 2½ to 3 cent. broad at the base, rapidly decreasing by the shortening of the secondary pinna into a small terminal obtuse pinnule ~~[illegible]~~ with a thick flexuous rachis half round not winged; secondary pinna in right angle to the rachis short, the lowest 2 cent long rapidly decreasing in length cut in alternate obtuse or obtusely pointed oblong short pinnules apparently slightly decurrent or rather connected at or near their base with a middle nerve obscurely defined. The substance of the leaflet is thick coriaceous. Has in the outline somewhat like Odontopteris Böhmii Gutb. but the characters are obscure, even the form of the pinnules is not quite distinct and the nervation totally obsolete. ~~[illegible]~~ 20b ~~[illegible]~~ ~~[illegible]~~ the ~~[illegible]~~ ~~[illegible]~~ ~~[illegible]~~ be.

D 4c Sphenopteris cristata. The above specimen is S. 58 in my collection agreeing with Brgt figure and description except that the lobes are crenate not dentate. The specimen has fructing similar to the fructing figure in Geinitz. But this specimen does not agree well with Geinitz figure of the Neuroflexuosa as in ours the lobes are obtusely dentate or crenate. See description p 12c. 1.

1 Sphenopteris ~~pseudolinearis~~ Mississippiensis. Pl XXIII. This species is very closely allied to S. linearis Brgt. It differs essentially by the rachis, both secondary and tertiary distinctly alate, the much larger barbs, pinnæ and the pinnules evidently decurrent and forming wing along the rachis, by the much shorter, more erect less deeply divided and by the nervation, the veins being all equal, parallel and more numerous. The ultimate pinnæ of S. linearis have ~~[illegible]~~ ~~[illegible]~~ long short, two and an half centimeters long with four pairs of alternate pinnules on the terminal one, then form of the pinna is lanceolate. In Pseudo linearis the linear narrower longer ultimate pinnæ are five to 7 cent. long, with 10 to 12 pairs of pinnules more erect and more deeply lobate, with lobes divided in two obtuse points and not flat. The two lower pairs of pinnules are very small, scarcely two millimeters long and a broad while those above are 15 millim long and six to eight millim broad at the base. This species is indeed remarkable and distinct as much by ~~its~~ the characters of its leaves or its form as by its nervation. see p. 407 b.2.

2 Sphenopteris chærophylloides. Brgt. I have only figured a small specimen. Pl. XXIII e, f. 3. from Dr Brutts which shows the essential characters of form of pinnules lobes and the nervation. See the description of the large specimen p 408c (3) make it out it and remark that the specimen is too large for figure. (This is not Charophylloides but S. [illegible] see p 407 a 3.)

3. Sphenopteris regida Brgt. Ma. 87. The specimen from Mauch Chunk seems referable to the species of Brgt. though also somewhat related to what I have considered as the species in Rep. II p. 435 pl XXXIX fig 5 & 6 which, according to Schimper is not S. regida but triphylla. In this specimen there is only a branch, ultimate pinna linear-lanceolate in outline pinnately lobate, the lobes 9-10 pairs alternate open or nearly at right angle to the apparently smooth, narrowly winged rachis; pinna lobes lobed in round or obtuse divisions, separated to the middle, three pairs on each side with a broad very obtuse half round pinnule. These primary lobes or pinnules become gradually shorter toward the top of the pinna, their division shorter and more confluent the upper pinnules being therefore merely oblong obtuse crenate in the border. The lower ones are 6 to 7 millim. long the upper one only two. The surface of the last division or lobe is indistinctly marked by thick veins apparently of the same type as Sphenopteris obtusiloba but the epidermis is somewhat thick rendering the veins obsolete and where it is present effacing them altogether being covered with minute points very close to each other or hairs as remarked in Brgt fig. enlarged part but not in the description for on the contrary for the author comparing it to S. Hoenninghausii says that it differs from it by the (absence de tout écaille ou poils) while there are distinct hairs in the specimen which is then more like the specimen Vol II of the Ill. Report which Schimper Pal. Veg. p. 382 names Sphenopteris varia. In this pinna however the rachis is broader and straight not flexuous

is Pecopteris callosa Sigg. Compare Weiss Pl. 1 fig. 1 Neuropteris cordato-ovata

1. Phenopteris [illegible]? This species is represented by specimen S.S. 285 which I considered as S. [illegible] Bgt. It is a pinnate superimpaly divided pinna with a stout comparatively broad rachis, whose primary divisions are perpendicular to it, somewhat distant, linear, about one inch long, bearing alternate linear oblong short pinnules two to 4 mill. long, pinnaeos divided in three equal round lobes or rather undulations (not deep) on each side and rounded at top, decurrent on a broad straight rachis, and connected at base. Midrib nerve undulat & each division remaining forking each branch going into one of the lobes and forking once [illegible] as in the figure which is slightly magnified. It resembles Sphenopteris mixta [illegible] of this Coll. But the secondary rachis is thicker, not at all sinuous, the leaflets broader not pointed, the main rachis indented on the borders flat in the middle &c. It may be a var. but the general appearance is different. 12.10.71. Other specimen for ex. S.S. 54 show the secondary divisions of the rachis straight and comparatively thick and pinnular leaflets like those of S. mixta. It may be therefore a var. of this species. Compare Rem. This species after reexamination is referable to S. Callosa Sigg. Ill. Geol. Rep. Vol 2 Pl 35 fig 1 & 2 p. 442. The species is very variable in the size and form of the leaflets which are generally undulately lobed on the borders but sometimes entire. By the thickness of the rachis &c. the species is far different from Sphenopteris mixta to whom it resembles merely by the form of its leaflets. In specimen S.S. 54 show the species fructifying. The leaflets are entirely covered with round sori whose relative position can not be ascertained; they entirely cover the surface. 12.10.71. See Ill. Geol. Rep. Local. [illegible]

Sphenopteris mixta. Bgt. From good specimen from Illinois S.S. 114, the secondary divisions of the rachis are very distinctly undulate [illegible] transversely striated &c. But the undulations of the borders are simple. [illegible] three divisions or lobes towards the point of the pinnules. The species is [illegible] the surface. See p. 407 a 3

D. [illegible] Sigg. Ill. Geol. Rep. Vol 2 Pl. 35 fig. 1 [illegible] Compare [illegible] Bgt. Tab. des Genres p. 15 Glecheniae.

D. 5 [illegible]

ous, bearing alternate divisions, cordate, lanceolate in outline, deeply cut on each side in three to five irregular obtuse or pointed lobes, as seen in fig. 4, 5, 6, enlarged; medial vein somewhat inflated like its pinnate divisions, which branch once or twice to the borders, according to the size of the lobes.

The surface of the leaflets is quite smooth. By its slender, half round secondary and tertiary rachis, and the general form of the pinnæ and of the divisions, our species agrees well enough with that published by Brongniart, Veg-Foss., p. 197, pl. 154, fig. 2. But the author describes and figures the lobes of the pinnules as being more regular, longer, regularly tridentate at the point, while those of our specimens are always either more or less irregularly cut, or entire, and also either pointed or obtuse. The difference in the form and size of the lobes of the pinnules of the same pinnæ, indicate for this species, as seen from our fig. 4, 5 and 6, a great disposition to vary, and the more essential characters being identical, I can but consider the American specimens as representing the same species as that of Prof. Brongniart.

It is found in fine large specimens on the shales over the coal at Morris.

Sp. Sp. nova? see p. 409 6.1

SPHENOPTERIS MIXTA, Schp. Pal. Veg., p. 382.

Sphenopteris sinuosa Lesqx, ined.

Pl. xv, fig. 7 and 8.

This species is the same which, from incomplete specimens, was in the second volume of this Report, page 435, considered as doubtfully referable to *Sphenopteris rigida*, Brgt. It has a tripinnate or polypinnate frond, the specimens being covered with numerous secondary pinnæ, of which one only is figured here. Pinnæ branching at a right angle from a broad winged smooth rachis, bearing alternate lanceolate secondary divisions, with a half round comparatively broad and regularly sinuous rachis. The pinnules obliquely attached upon each of its convex flexures are oval, lanceolate pointed, regularly divided on each side into three to five half round lobes. The medial vein which, like its divisions, is thin and somewhat obscure, alternately branches into each lobe of the pinnules, the branches forking above the middle. The epidermis is thick, the surface convex and somewhat rough. This species appears essentially distinct from *Sphenotopteris rigida*, Brgt., by its broad winged rachis, the form of the pinnules and of their divisions, the slightly rough surface, etc.; nevertheless there may

be some error of description or of illustration of the European species, which is marked as having its surface entirely smooth, while the figure shows it covered with points or rugose.

Abundant in the shales of the coal at Morris.

SPHENOPTERIS TRIFOLIATA, Brgt. Veg. Foss., p. 202.

Pl. 53, fig. 3.

In the shales of Colchester; found by Prof. A. H. Worthen.

SPHENOPTERIS ELEGANS, Brgt. Veg. Foss., p. 172.

Rhacopteris p 410 c.

Pl. 53, fig. 1 and 2.

Two fine specimens of this species have been obtained from the concretions of Mazon creek; by Mr. M. S. Hall.

GENUS HYMENOPHYLLITES, Gopp and auct. Ill. Geol. Rep., vol. ii, p. 436.

In preserving this genus, with its characters too vaguely defined as it is in vol. 2 of this Report, p. 436, it would be advisable to subdivide it as follows:

§ 1. *Hymenophyllites* proper, containing species with a generally membranaceous delicate frond, pinnately divided, the primary divisions alternate or dichotomous, decurrent on the rachis and ultimate lobes linear obtuse, either simple alternate or irregularly divided; nerves percurrent pinnately branching, ascending, simple in each lobe. This section contains *Hymenophyllites* and *Trichomanites*, Gopp.

§ 2. *Aphlebia*, including species with fronds of various sizes and forms, generally with a broad rachis and more or less irregularly divided, the divisions rather dichotomous or pinnatifid, entire or variously laciniate lobed, the lobes sometimes enlarged and recurved; veins parallel and numerous from the base of the fronds, dividing in fascicles from the rachis in each primary division, and passing by subdividing, as simple veinlets to the point of each lobe. To this section are referable the genera *Aphlebia*, *Schizopteris*, *Rhodea*, *Pachyphyllum*, etc. auct.*

*W. P. Shimper, in Pal. Veg., makes for this section a new genus, *Rhacophyllum*.

see 1b below

see p. 4 line 3 b

see p. 4 line

2. 1b. ~~Dryopteris~~ Phenopteris ~~obtusiloba~~ latifolia Brgt. (see N. p. 385a(2)) The specie as figured by Brong. p. 157 fig 1 to 4 and by Goppert Genera Lic. 324 pl. 14 fs 5-6 is represented by a few fine but good specimens from Alabama S. M. 24. The specimens are small just like those figured by the European authors and with exactly the same characters; leaflets slightly decurrent, narrow rachis scarcely winged &c. Goppert in Genera l.c. cit. p. 174 says that it is very common in the coal of Silesia and has fronds 1 to 2 feet long and rachis one inch thick. But he does not indicate any characters different from Brongniart description.

2 Phenopteris ~~latifolia~~ Aspidiopteris latifolia sp. nov. (see plate) SM. 116. is much like the forme S. latifolia. Tripinnate. Primary rachis broad, 1 centimeter. Primary pinnae very open like the secondary ones; large lanceolate in outline; secondary pinnae alternat, at an open angle of divergence even in right angle or reflexed, linear-lanceolate having distant alternate pinnules, ~~the lowest~~ all decurrent at base on a winged rachis, the lowest one broader irregularly pinnately lobed, with the lower lobe enlarged, the upper one equally lobed with five obtuse lobes and a terminal more acute one, upper pinnules entire lanceolate obtuse. — The division of the pinnules and of the pinnae also is apparently the same as in Sp. latifolia. The general characters of forms and nervation are also of the same type. There is only an essential difference in the broadly winged rachis, the marginal membrane being always broader than the half-winged rachis and the pinnules being also and all double in size of those of S. latifolia. In the specimen as figured the part as shown the upper surface of the leaves is polished and the veins inflated. All the

5 Pinnae

The balance of the specimen shows the pinnae as the same upper surface, veins and with the specimens from Alabama. What is here the veins are inflated. I think it is a good specie.

410 c. 1 Rhacopteris, Schp. — See description of the Genus Schp. Vegét. Col. I p. 481

D2. Rhacopteris elegans, Schp. (Ult.) Asplenites elegans Ult. Sphenopteris asplenites Gein. Comparing the specimen sent by Southwell from the Subcarboniferous or Precarboniferous of Ill. with fig. of Geinitz Verst. Bd XXXI (17) Pl XXIV fig 6 and with Schimper's description in Paléont. Vol. p. 482, I can not see any difference. Rachis flat, grooved in the middle. frond pinnat; pinnæ lineal-lanceolat long, pinnules alternate fixed to the border of the rachis, not decurring erect or open erect, close, contiguous by the borders, rhomboidal oblong narrowed to the base, more or less deeply cut lobat (dissectes) veins dichotomous flabellat from the base, straight, 2 or three in each lateral lobes. Schimper says that the lateral lobes are merely bineyred (binerules) and bidentat at the apex, and the lobe terminal with three veinlets and three dentat. — In specimen of Southwell is wanished and the point of the lobes not very distinct. They appear generally as having three veinlet and three teeth at the apex of the lateral and also of the terminal lobes. Geinitz description p. 17, agrees better with the specimen of Illinois. I have no doubt that it represent the same species.

D. 3 l. Sphenopteris obtuseloba Brg. Specimen N. 94 b of De Butts or represent apparently ~~(Rh. obtuseloba)~~ ~~(Rh. obtuseloba)~~ ~~irregularis~~ irregularis ~~exactly~~ though small specimen of this species; in this the leaflets are oblong obtuse, pinnately once or twice lobed with round obtuse lobes, the lower lobe not cut or notched but equal to the middle one. In this the nervation is distinct enough and like that of S. latifolia. The other specimen N. 94 has its pinnules also oblong obtuse ~~to~~ pinnately bilobed with broad obtuse lobes, the lower one broader but not notched and no trace or slightly any trace of nervation visible and exactly like S. trifoliata Brg. as figured Pl 53 fig. 3 & 3a. I believe that this should rather be referred to S. trifoliata than to S. obtuseloba. These two species are very like the same. In the form the lobes are not as deeply parted as in Brongniart's figure. See C. M. p. 39 & 140 D. Fig 7 of Pl XXIII ee represent the specimen 94 which agree exactly with Brongniart fig. 2 description of S. trifoliata in his Pl. 53 f. 3 & 3a. Remark however that this (according to Schimper) is not the true S. trifoliata of Artis which indeed differs much and which has not been seen as yet in America specimen N. 94 b of Butts is the same species and form a S. M. 24 Pl XXIII f. 6. as for the nervation it is however obsolet the veins being replaced with a coating of coal and obsolet and at other visible and of the same character as in the last figure.

We have therefore S. trifoliata, Brgt. not Artis and fig 6 is Sphenopteris obtuseloba or latifolia. Brgt. is the obtuseloba. I have numerous specimen of Prof. Smith for Alabama. Fig 2 represent the species Sph. obtuseloba with whole small pinnules and its nervation a S. trifoliata with pinnules exactly like Brongniart's fig 3 but with the nervation of fig 2 a which is S. trifoliata. These specimens

#1 Both these specimens 1649 & 1670 represent the same species apparently a form of Pecopteris Muricata, Syl. 1650 & 1651

1 Sphenopteris species nov. ? No. 24 1649 & (1651?) from Mazon Creek represent a fine a bipinnatifid pinna with lobes or pinnules decurrent and joining a narrow wing along the main rachis. lobes oblong or rather ultimate pinnae oblong lanceolate abruptly cut at the top, divided in alternate lobes or pinnules 6 6 7 pairs ovate or oblong decurrent to the broad flat midrib of the pinna, joined near the base, three or four dentate on the borders. veins thick, parallel, decurring to the base of the pinnule dichotomous, the middle somewhat more distinct and dichotomous alternately. The nervation is somewhat like that of Pecopteris nervosa, but the mid rib less distinct, sometimes not at all and the borders of the lobes are evidently dentate. No 1670 is more opaque and it is not certain if it represent the same species

2 Sphenopteris minta a sp. nov. No 1674 & 75 counterpart from Mazon Creek see note at top. a small pinna four centimeters long only bipinnatifid. Pinnules alternate 12-15 pairs along a broad zigzagging rachis separated or distinct, enlarged and joined at base, lanceolate lobate with three pairs of alternate obtuse short lobes on each side an a terminal one obtuse pointed. much like fig. 5 of Pl. 39 of the Ill. Rep. Vol 2. but the pinnules slightly narrower, the lobes more distinct, the terminal one slightly longer. I can not be separated hower. The nervation is distinct upon some of the lobes of the pinnules whose veins inflated appear to have had the surface of the epidermis erased and destroyed. It is marked upon my figure of Pl 39. the middle nervi alternately branching each branch entering a lob and dividing dichotomously in two or three divisions reinlets according to the upper or lower position of the lobes. There is in the specimens of J. T. Southwell a very small fragment No 4 which is part of an ultimate pinna with five pinnules each side, on one side evidently lobate, three obtuse though that lobes each side of the mid rib; the pinnules on the other side shorter entire enlarged at the base with none or only one lobe each side.

3 Sphenopteris (Trophyllopteris sp nov) ~~This a Trophyllopteris specimen~~ See Pl. 23 fig 7 & 8 Syl. 1652. Cremopteris pinnatifida have from Haddock Coal, S.S. 68. of the Museum a fine specimen of the species agreeing exactly with the figured as above from Alabama. The form of the pinnules is the same. From the lobes at the base, they become entire, merely enlarged in the middle toward the point of the pinna. They are decurrent upon the ultimate rachis which is thus alate or narrowly margined. The primary rachis is marked as that of the plate by short cross wrinkles which upon the back appear ~~both~~ in all larger specimens of the veins are as marked upon the figure but are much closer placed. A good fine species. Trophyllopteris. Trophyllopteris? Cremopteris? free at Hartford

4. Sphenopteris placida (Crepin.) I find this species in poor specimens though recognizable in Crepin Description etc. a small pamphlet in my coal pamphlets. This plant is in Belgium from the Psammites of Condroz Devonian superior where Palaeopteris hibernica & Chondrites antiquus have been found. He finds there also a Rhetorphiton condruseorum. qui ressemble aux de Dawson Thelocaulon bacillaria Psammite redatre plus ou moins micacés & schisteux. This description could apply to the stone where these remains have been found by Ashburner with the exception of stems. See Catalogue Pa. 23. The specimen is broken and small an fragment only can be seen. The Rachis is thick. finely striate branching in right angle as in fig 2 of Crepin & the pinnules or lobes divided as in fig 3. The stem or rachis in Crepin's drawing is also striate. Alkenas identical. This rachis is equally striate or lineat on its smallest and largest branch Pa 24 has narrow rachis from less than one to two millimeters broad quite flat, nothing like grass blades. Pa 310 has in the upper side fragments of stems referable to this and on the reverse a large apparently bandlike stem of a frond. This nearly 1 cent broad toward the base and has positively the same characters as the Rachis Pa 23.

D

D

D

D

5 Sphenopteris microlob. Gutb?

Sa Spinner — I have it. Comparable to S. Gravenhorstii Brgt or gracilis Brgt —

Sphenopteris microphylla Gutb. Very much in the size of the pinnules and in the length of the division — also agree in the manner

§ 3. *Schizopteris* proper, to which belong the species with a frond generally laciniate, or cut in linear erect or curved divisions, sometimes enlarged at the top, marked with thin parallel veins ascending from the base of the frond to the top of the lobes without branching, being split in fascicles with the divisions. To this section belong merely the genus *Schizopteris*, as characterized by Prof. Brongniart for his *Schizopteris anomala*.

It is difficult to separate these sections in genera by reliable and permanent characters. Some of the species which are considered as *Schizopteris* by authors, as *Schizopteris adnascens*, Ll. and Hutt, for example, have the nervation and a mode of division of their fronds similar to those of some *Hymenophyllites*, while species referable to this last genus have, with a regular mode of division a nervation by disconnected fascicles of veins, like species of *Aphlebia* and *Schizopteris*. This is the case with our *Hymenophyllites splendens*. The plants of the two last divisions are little known, their apparently soft tissue having often been destroyed by maceration. I have described and figured here some remarkable forms, especially from the concretions of Mazon creek, whose study may throw some light upon the nature and conformation of these singular vegetables.

§ 1. Hymenophyllites (proper).

Hymenophyllites alatus, Brgt.

Veg. foss., p. 180, Pl. 48, fig. 4.

This species is mentioned in the Ill. Geol. Rep., vol. ii, p. 437, as presenting some characters at variance with the European one. Good specimens of it from the concretions of Mazon creek, show it to be identical.

Hymenophyllites tridactylites, Brgt.

Veg. foss., p. 181, Pl. 50.

Good specimens of this fine species have been lately procured from the roof shales of the coal at Morris, by Mr. S. S. Strong.

Hymenophyllites trichomanoides, Brgt.

Veg. foss, p. 182, Pl. 48, fig. 3.

A small specimen from the same place as the former.

Hymenophyllites myriophyllum, Brgt.

Veg. foss., p. 184, Pl. 55, fig. 2

The straight, strong main rachis and its branches, like the form and divisions of the leaflets, entirely agree with the author's description and figures of this species. Some of the terminal divisions of the pinnules appear on our specimen as slightly inflated at the point. It is not possible to see whether this swelling is caused by fructification, or by the remains of some part of the half destroyed epidermis.

Roof shales of the coal at Morris, contributed by Mr. S. S. Strong.

Hymenophyllites Schlotheimii, Brgt.

Veg., foss., p. 193, Pl. 51.

This species should be placed in its natural order after *Hymenophyllites tridactylites*, Brgt., but our specimen, a very fine one, is described here from the remarkable likeness of its divisions when deprived of their epidermis, with the former species. Except a few entire leaflets which have preserved their integral form, the whole specimen represents merely the veins and their divisions, without any substance of the leaflets attached to them; in that state, the species could easily be confounded with the former or considered as a new one.

From the same place as the former, and due also to the successful researches of Mr. S. S. Strong.

Hymenophyllites delicatulus, Brgt. Specimen 55 & 2 [illegible]

Veg. foss., p. 185, Pl. 58, fig. 4.

This species, also from the shales of Morris, could be admitted, by some of its parts deprived of their epidermis, as identical with that of the same name of Sternberg, which has been considered as a *Cheilanthes* by Goppert. The thin membranaceous substance of the pinnules in our *Hymenophyllites*, is generally partly or totally effaced by maceration.

1. Sphenopteris trudactylites Bgt. Pl. XXIII ee fig 4 & 5 fruiting. The species is very common in the low coal. We have it from the sandstone in Mercer Co. Ills. nut conglomerate and also in the specimen of Indian & Coy. The specimen figured here are from Butts, Clinton Co. 63 & 63a. To Brongniart's description add that of the fruiting part. As in the sterile frond, the rachis are minutely pendate comparatively thick, the pinnules divided in opposite lobes marked by an agglomeration of small round spores, closely grouped and pressed upon another as marked in the enlarged figure a & b. This species is therefore referable to the cryptogramma as seen in Hooker Pl. III fig 29. The spores are often single, sometimes 2, 3, etc. being very irregular. (see Pl. 42 fig 6a) from that the enlarged fig 6a where the lobes of pinnule resist and the rachis is rather ~~the reverse~~ generally ~~marked by the pinnules, but also terete. In fig 4, the pinnule on most, they are~~ see p. 412 c. (A)

2. Sphenopteris Butts: Sp. nov. Clinton Mo. N. 99. 100. 101. & (71a) Decipinnately divided pinnae linear or lineal-lanceolate with a thick rigid or squarrose rachis; secondary pinnae linear lanceolate, gradually tapering to a small truncate or bidentate leaflet, open, nearly at right angle to the rachis, short, 1½ to 3 centimeters long and narrow, from to seven millimeters broad toward the base, pinnule short, half round, irregularly five to seven dentate on the border, separated to near the base when they join in decurring open, nearly in right angle to the midrib; nerve alternately dichotomous forking three or four times in ascending, the divisions excurrent to the point of the teeth. In specimen N. 99. the surface of the leaflets is rough without trace of veins, marked with round flat dots, irregular in their distribution more marked on lines on both sides of the secondary rachis or mid rib and apparently representing fruit dots. (? The same applies only to this specimen) The fertile pinnae are mixed upon same primary pinnae with sterile ones even some pinnules of a sam secondary pinnae appear fertile and other sterile, these showing distinctly the nervation. In some pinnules where the coating of coal surface is casually removed the points or spores appear placed just upon the point of forking of the veins. Sp. N. 71. appears to belong to this species. The leaflet however are but distinctly dentate on the border; the mid rib or secondary is much thinner, flexuous and the primary one is also much narrower flexuous and without any trace of veins or dots. The surface of the leaflets is also smooth. This may be the sterile part of the species. This seems related by form and character of fructification to Sphenopteris mapte as figured pl. 23 d & d.

3. Hymenophyllum Virginii Schp. Veg. Gal. Pl. XXVIII figs 4-7 A specimen No 1641 from Mayo Creek represents this species. It agrees exactly with Schimper's figure. It is however broken the form of the fructifying leaflets and the division is as in Schimper's ~~marte~~ compare in description of H. inflatum.

412c.

N. 105 of Butts All these in S. mixte.

1. Sphenopteris (Scupteris) Cristata Brgt. Supremately divided, primary rachis flat, ~~narrowly margined by the decurrent pinnae~~ length with secondary pinnae. Here nearly in right angle or slightly oblique are long linear gradually tapering toward the point, in this fragment they are 9 cent. long, two centimeters broad toward the base, but only three millimeters broad toward the top where they are flexuous or flagelliform with a convex ~~the~~ rachis pinnulet as the main one; pinna divided in alternate that ~~lobes~~ pinnules open or slightly turned upward, linear oblong obtuse, narrowed at the base of the upper side, decurrent at the other divided in three to five alternate lobes which are short, tridentate or rather three crenate, the teeth being obtuse ~~pro~~ on account of the border which appears to be reflexed. The ~~primary~~ nerves are pennate, one for each pinnules, the nervilli tripod. This fragment is corresponding entirely with Brongniart description and figure, he however does not mention the pinnulet rachis the secondary rachis are stronger than marked in Brgt. and the teeth have more obtuse. Rem. This can not be S. cristata Brgt. as the pinnules are decurrent and forming borders along the rachis but this specimen appears still referable to that formerly called S. gracilis - see 407a 4. Brongniart describes the pinnules and figures them as narrowed at the base on both sides. Then - I have received still another specimen with the same characters as indicated above which can not be considered as S. Cristata. The lateral secondary rachis are much thicker than in Brongniart species. All this in Sphenopteris mixte as figured in my plate. It may be different from what Schimper has taken for the species but it is the same in my plate.

D 2. Sphenopteris irregularis, H. Specimen N. 25 of Butts is a splendid specimen of this species. It has the lobes or leaflet of the same size as figured by Geinitz, H. 23. also of the same form and character than S. trifoliata Brongt. with leaflets varying from one to eight pairs in number generally three, sometimes only one or in S. trifoliata Brgt. The nervation is very obscure on account of a thick coating of coaly matter forming the surface of the leaflet which were evidently covered with short hairs or villosa. In the leaflet where this coating is destroyed the nervation is exactly as marked in Geinitz in his enlarged fig. 4 a. with the terminal pinnules pointed. This specimen exactly represent upon the same pinna Sph. irregularis as described by Schimper & S. trifoliata of Brgt.

D 3 Sphenopteris acuta Brgt. Spec. 112 of Butts, a small piece in Sandstone represents perfectly this species as figured by Brgt. and Schimper's description. This species is very near S. latifolia of Brgt which is upon specimens from the Whetstone quarry of Cox and. have the same appearance and characters as this, the lobes being merely slightly more obtuse. I have figured a specimen

D 4. Hymenophyllites stipulatus Gutt. see specim. Em. 1. from H. Claus vill. It has a small fructified branch and seems to represent the species. There is however no primary rachis and the pinnules are not seen. Can not be described without figure.

D. 5 [illegible] Specimen of it [illegible] show the same [illegible] [illegible] fructified deep sorus sometimes [illegible] sometimes distant [illegible] specimen in special is certainly a good one. Upper leaflets marked in [illegible] to figure. But there are marks around the approximate [illegible] in the interior of the sori between the [illegible] [illegible]

D 6. Scupteris Murrayana Brgt. I have said Ill. Rep. vol. II p. 443 that there were specimens for Moore referable to this species as figured by Brgt. I find another in the same collection. N. 728 which is quite as evidently identical

with Prof. fig. & description as those of Moore. The fragment or specimen represents part of a bipinnate frond of Pecopteris 5 to 6 cent. long and as broad, broken at the top and the base. Primary rachis rigid, not alate or winged 1½ mill broad. Pinnæ about in right angle or slightly oblique variable in length from 3 to 3½ cent. linear lanceolate, 12 mill broad at base gradually narrowed to a small obtuse terminal leaflet, bearing 8–12 pairs of alternate pinnules, oval in outline sessile or rather slightly decurrent and joined at the base by a narrow margin, pinnately three or four lobed; lobes short obtuse entire midrib pinnately divided, each division entering one of the lobes forking alternately twice or thrice in the inferior larger lobes. I can not see any difference by which this specimen could be separated from P. Murrayana except by the narrowly decurrent base of the pinnules which are therefore joined to each other at the base. If it could be figured and described as Pecopteris Murrayana or another new name. The veins and veinlets are very distinct. See Schimper Vol. III p. 470. see also this Vol. p. 419c 2.

1 Sphenopteris (Diplothmema) subgeniculata Stur. Two specimens from Aldrich No. 57 represent apparently this species as figured by Stur pl. XII fig. 10. The largest specimen is tripinnately divided. Primary rachis rigid, straight, not flexuous except slightly so near top, 1½ cent long 6 mill. broad at the base scarcely two mill broad at the top where it is broken, flat irregularly obscurely striate. Primary pinnæ in right angle long, linear, distant, the longest 6½ cent where it is broken, more or less flexuous in turning to the base of the pinnules or ultimate division. Pinnules alternate 5 to 6 millim distant, free or adnate at the base alternately, the lower forking pinnately divided; division or lobes 4 or cent wide, the lower forking four times, the upper ones twice, the terminal simple, all the divisions linear obtuse, either entire or the lowest one sometimes emarginate or forking at the top. The secondary rachis is 1 mill. broad, turgescent in the middle; the base of the tertiary division is of the same width, slightly dilated in the middle, the quaternary all the divisions inflated in the middle by one (single nerve) surface opaque or rather wrinkled and granulose. This form is slightly larger than that figured 10 of Pl. 12 of Stur; all the other figures represent the species with narrower nearly filiform divisions. All the lobes are distinctly obtuse. The pinnæ appear to have been large and broadly lanceolate. The part preserved is 12 cent broad. All the primary pinnæ exactly in right angle to the common rachis while the secondary ones or pinnules are more or less inclined upwards. The secondary rachis is flexuous. Compare the specimen with the figure 6 of 7 of Pl. 61. (not definitive No.) and correct description.

2 Sphenopteris pentaphylla Roem. Podcont. Pl. XXXI fig. 4. Ma 27 & Ma 223a represent finely this species in two good specimens. The author p. 181 says nearly of the nervation that it is indistinct. The substance is thick, uneven, the epidermis rough. Even when destroyed the veins are scarcely seen, their passing from the base towards the point of the pinnules forking in the middle, three apparently from the rachis not joined at their base nor decurrent in the figure they appear joined. But this is marked only in the lowest lobe; in the middle one they join the rachis. The pinnules are cut nearly to the base in two or more generally three pairs of second lobes disjoined near the base but often connivent or even imbricate with lower; pinnules 6 to 8 millim long oblique,

D. H. splendens? var. I have specimens from Clinton under No. 92 which have all the characters and the appearance of the species. The lobes are only slightly more obtuse and the derma is rough not polished through a thick and easily detached as in the specimen from Morris. It appears like scaly. The rachis also. These are flat slightly tumid or inflated in the middle. This is exactly a type of division of frond to the Hymenophyllites (Aphlebiæ). The primary rachis is thick but flat. In one of the specimens which should be figured, it is four to five millimeters broad strongly veined by parallel nerves which separate in an acute angle of divergence from the main rachis to form alternate branches or pinnæ which are very oblique. These are alternately divided in pinnules forming to the rachis by a broad base and nearly in right angle to it, oblong in outline, three to five alternately lobed the lobes rarely entire mostly bi or tri short lobed very obtuse marked in the middle by an undivided nerve with simple division passing into each lobe.

D. Hymenophyllites expansus, sp. nov. Species represented by No. 39 of Lacoe collection a mere fragment figured. The nerves are very thick or rather broad, coherent, resembling stems and branches, dichotomously divided, all the divisions followed in their length by broad expansion of foliaceous tissue, terminating in a point at the top of the veins or above the end of the ultimate divisions. The figure represents exactly the specimen. I do not find anything to which this might be compared but Trichomanes felix formis Gutb. which has a very distant relation indeed, the surface of the foliaceous expansion being smooth in our specimens and punctate in that of Gutbier and also the small specimen figured in Geinitz Pl. XXIV fig. 13 a Hymenophyllites furcatus, a mere branchlet which can not be referable to this species and differs from ~~any~~ as this here described by its narrow flagellate lobes.

D. [illegible]

from 413 c. 2 - inclined upwards, the midrib of the pinnules ~~turned upward~~, broad and flat, deep toward the base, the ~~fibres~~ also inclined upwards very often half round with a tendency to decurring to the point of connection. The fragment of primary pinna appears lanceolate, the lateral or secondary pinnæ about four centimeters generally narrower in the upper part where the pinnules become five lobate then three lobate, the penultimate and ultimate lateral, broadly oval obtuse, with one slight marginal lobe on the lower side and the ~~broad~~ secondary rachis terminating the pinnæ continuing naked 1 millimeter broad 5 millimeters long to an abruptly rounded apex, as in the top of the pinnæ of Sphenopteris species to which this species is ~~closely~~ allied by its general character, thick epidermis and mode of division. This goes to the Dr. Goldenberg's of Stur.

HYMENOPHYLLITES TENUIFOLIUS, Brgt.

Veg. foss., p. 190, Pl. 48, fig. 1.

Well characterized by its straight broad rachis, the position of the pinnules, the narrow lobes, etc. The epidermis is also partly destroyed.

Roof shales at Morris; a small specimen.

All the foregoing species of *Hymenophyllites* are described as *Sphenopteris* by the author.

HYMENOPHYLLITES SPLENDENS, Sp. nov.

Pl. xix, fig. 2*a* and 2*b*.

FROND tripinnatifid; primary pinnæ at a right angle to the flattened main rachis, broadly lanceolate in outline; secondary pinnæ alternate, narrowly ovate-lanceolate, oblique decurrent on the flexuous alate rachis, alternately two or three lobed on each side, the lobes divided in two or three lanceolate, somewhat obtuse teeth. Veins in fascicles from the base of the secondary pinnæ, separating in each lobe, one of the divisions ascending to the point.

The surface of the whole plant is polished shining, of a reddish brown color. This species resembles the variety of *H. furcatus*, Brgt, called *H. membranaceous*, by Gutbier, which is common enough in Pennsylvania, especially in the upper part of the sandstone at Pottsville and Mauch Chunk. It differs, however, essentially, by the thick substance of the leaves which easily separates from the stone, by much thicker veins, merely approached in fascicles but not united at the base of the secondary pinnæ, which are longer, narrower, more equally and pinnately divided in lanceolate pointed teeth.

This species appears intermediate between *H. furcatus*, Brgt., and *H. stipulatus*, Gutb.

Abundant in the roof shales of the coal at Colchester and Morris.

Hymenophyllites inflatus, Sp. nov.

Pl. xvi, fig. 6.

A tripinnately divided part of a frond, with primary divisions broadly oval in outline pinnately cut into alternate obovate obtuse inflated lobes, either simple or parted again in short obtuse divisions; nervation obsolete, the veins apparently branching in each division of the leaves, and simple.

This species is intermediate between the two sections of *Hymenophyllites*, having the mode and regularity of division of the first, the thick inflated leaflets without distinct nervation, like some species of the second. It is distantly related to *Sphenopteris Rutæfolia*, Gutb., Verst., p. 42, pl. x, fig. 10 and 11, from which it differs by the form of its more elongated, narrow, inflated pinnules, by the obsolete nervation, etc.

From the roof shales of the main coal, Duquoin.

The specimen is a large piece of shale covered with fragments of the plant, none larger than the one figured. See H. Weissii Schp., Gal vol

§ 2. Aphlebia.

Hymenophyllites adnascens, Ll. and Hutt.

The two specimens figured, pl. xvi, fig. 7 and 8, from the roof shales of the coal at Morris, exactly represent the species of Lindley, as it is figured and described by Geinitz, in his Versteinerungen, p. 20, pl. xxv, fig. 7 to 9. But I cannot recognize an identity between the plants represented in these figures. The one, fig. 8, of ours, has the lower divisions short lanceolate obtuse, irregular in their directions, with thin parallel veinlets, and the upper ones narrower, curved, marked also by thin parallel veins branching into each lobe; while the other, fig. 7, has dichotomous or forking, linear, narrow branches, without trace of veins or veinlets. The first of these forms agrees with the description and figures given by Lindley, vol. 2, p. 58, pl. C and CI, who compares the plant to some *Lygodium* or *Hymenophyllum*, but I am disposed to consider the other as a peculiar species. Our fragments are nevertheless too small to allow a precise and satisfactory description. Prof. Lindley considers his species as a climbing fern, twisted round the stem of a frond of *Sphenopteris crenata*, to

1. Hymenophyllites adnascens ? Ld. & Hutt. I have referred to this species specimen 1 p 1. from Fottrell. It represents a branch which for the size, the mode of division of its pinnules, their length and lanceolate pointed form is exactly like the fig 13 Pl. XXIV of Geinitz Versteinerungen: which he admits as a branch of Hymenophyllites furcatus. The nervation is also about similar to what is marked by Geinitz except that in his fig: the secondary nerve is simple from the rachis while in my specimens, at least for the lower lobe, four parallel secondary nerves go out of the main rachis, ascending at first parallel and just further up entering one of the segment of the lobes. No tertiary veins of the upper segments forth from one of the secondary veins, following the parent vein at first parallel and then separate in entering one of the segments as seen I. 528 fig 14 enlarged part. I consider this as a true Ophlebia from the parallel secondary veins as also from the pointed form of segments and also as a separate species. If Geinitz specimens represents the same, he has not seen the nervation as it is. It could be called Ophlebia nervosa. I. S. T.

2. Ophlebia irregularis Germ. Vert. Versteinerungen lib: 5 tab 24. Germar a publié cette espèce d'après Versteinerungen d'Wettstein Dechantitten des mines, trouvé à Sans localité & enlèvement des formations houillères, et enlèvement le même. It can be compared to O. adnata but the frond is large, the divisions irregular in their length, more of branching and directions. This somewhat obscure, or coarse black micaceous shale. Much branching from the base in linear irregularly curving divisions which branch dichotomously irregularly, the ultimate divisions becoming narrower but not pointed. No trace of nerve is observable. In the point of branching, the segments are sometimes inflated at least slightly as and never so much as in Germar figure. The ultimate divisions appear obtuse, but not inflated. I. S. T. It rather resembles a fucoides than an Ophlebia.

3 Hymenophyllites Gutbierianus Ung. as described by Unger and figured by Geinitz: see Ung. Genera p. 132: laciniis pinnulisque secundariis alternis, linearis-lanceolatis acutis, simplicibus bifidisve, we have only one specimen 1 p 18 referable to this species. It is easily distinguished from H. Clarkii by more narrow, acute pinnules, thinner leaves, etc:

4. Hymenophyllites lactuca, H. Gutbierianus Ung. H. Clarkii Sig. These species are closely allied but distinguishable by apparently constant characters. The first has a tuft or wad stem which show the parallel nerves of leaves and which is often wrinkled across, repeatedly divided, the primary division either alternate or opposite, oblique to the primary axis decurring upon it or formed by enlargement of this axis; the segment or ultimate division are narrow, either obtuse or acute. H. Gutbierianus has a more or less compact stem bearing opposite or alternate linear lanceolate pinnae with lanceolate slightly obtuse division. H. Clarkii has scarcely any stem, appearing like a creeping or perhaps slightly climbing plant bearing long leaves cut in various ways with the division always very obtuse. These leaves are thick, coriaceous thicker than in any other of the two former species. I consider them a reliable species. In Gutbier Versteinerungen H. lactuca is represented as Fucoides crispus p. 13, Pl. 1 fig 11. – H. Gutbierianus is evidently Fucoides crenatus ibid loc. cit. p 14, Pl 1 fig 14. and nothing in his description and figure is comparable to H. Clarkii.

5 Hymenophyllites villosus sp. nova. (Fucoides foliaceus Gutb ? Vert. p 11, Pl. 1. fig. 3, 6, 7, 8 & 13.). Repeatedly divided. Primary axis thick, nearly

one inch wide, scaly? [illegible] marked with pits, scattered, somewhat large points; primary divisions large, distant, oblique alternate, nearly [illegible] divided. secondary divisions [illegible] opposite or alternate oblique or open and at right angle to the secondary rachis. broadly lanceolate in outline, nearly irregularly bipinnatifid lobes alternate divisions more or less curved and obtuse. The surface of these divisions or of the leaves is thickly hairy or at least covered with very crowded points resembling the glandular points of Allacopteris and of hairs. The secondary rachis scarcely half as large as the primary and are marked in the same way and with more distant and deeper points too, as the primary rachis. In H 84 the short thick hairs of the surface are well distinct. I refer to this H 35, H 36, H 81, H 87, H 35 H 90 H 86. H 87 which still have stems and more secondary pinna H 83 H 85 H 82, H 37, H 38. Upon H 90 which has a broad stem with a mere tertiary branch the scales of the rachis are well seen. They appear at least 1/20 of an inch long, flat & linear, obtusely pointed. The surface resembles is represented in Gutbier loc. cit. Pl. 1. fig 13a. He names it Trichomanites estimatus; therefore our species appears to be the same as his. But he has not seen any specimen with primary stem and his lesser specimen is figured apex in some point. Especially he does not mention the permanent hairs of the secondary pinna and marks as pointed the ultimate divisions which are rather obtuse. In this species the nervation is distinctly seen. Branches seen going out of the broad secondary rachis, pinnately dividing in each to be where the branches (not forked) outer each one of the ultimate divisions, opening to the point. The division of the veinlets is rather by separation than by true branching. — Specimen H 91. 92. 46. represent a variety of this species with more complete tertiary pinna, more numerous nervules, very narrow divisions. In these specimens the nervation is still better marked than in the former. His comparation to fig 3a further on at.

26 Hymenophyllites elegans sp. nov.? It may be a mere variety of the former. Primary pinna broad, lanceolate in outline, rachis round, straight or flexuous, pinnately and distinctly branching in nearly opposite secondary lanceolate pinna being in right angle to the rachis or slightly oblique and curved downward, pinnately divided (pinnately) in opposite distant open lobes pinnately cut in alternate obtuse linear simple divisions. The facies of this species or variety is quite different from that of the former, all the divisions in three different degree primary, secondary & tertiary being very distinct. The surface of the stems and leaves is the same scaly rugose as in the former. One of the specimens H. 39. is remarkable by its tertiary pinna or lobes being linear, longer, pinnately cut in short nearly opposite entire simple very obtuse lobes marked at the point by a hollow resembling a receptacle of seeds. Notwithstanding these differences, all these specimens of the two last species may represent the same species. H 87 is perhaps referable to this rather than to the former but the ultimate divisions are buried in the stone. 19.5.72.

7 The specimens of our small but distinct is referable to Thimpen's species Mucosphyllum flabellatum. If the name should be changed my Tachyphyllum was good enough. see sp. H 113 upon. An 7. from Marsillon C.

28 Hymenophyllites mollis? or flabellatus Sitzg a nodule H 16211 has the appearance of mollis but has evidently veins like H flabellatus. It may be of the same type as the two following ones which should be drawn.

1 Hymenophyllites ? ficoides or H thompsi L & 1681. nodul from Mazon creek. a pinna curved falcat with mixed branches curved on one side branches inflated. their ends coming into connection with those of an opposite pinna. whose branches are directed in the opposite way. May be a form of H thompsi. not describable without figure. Another specimen L & 1682 seems to be a incipient stat of the same resembling that kind of mushroom under bar of a bigellow which I have named Rhizomorphe bigellowi. This is the more remarkable that a large specimen L & 1683 has exactly the appearance of a fungus of the stem stand be carnose or fleshy cut by the middle and showing its internal organism. All this should be figured and studied.

2. Hymenophyllites (spec. nov.) dichotomous L & 1684. A fragment of Hymenophyllite with primary rachis in stem 5 millim broad, alternately branching or dichotomous little branches oblique, nine cent. long their stem or rachis half as large as the primary one, gradually diminishing upwards, in dividing alternately in branches or pinnules which are shorter and divided in the same way in alternate lacinia. Form is not very distinct appearing as linear pointed. The lower pinnules have two or three of their divisions cut in, the upper ones appear much longer. The rachis is prominent. The lobes as seen from the counterpart which I do not have, are obtuse. Comparing H. which I have figured now an similar to the Nothing like it in Gutbier. Its two obscure and fragmentary interpretation between this form and H. ficoides.

3. Hymenophyllites fibriforme (H. ficoides) Gut. (Racophyllum Schp. L & 1685 from Mazon creek is exactly this species as figured by Gutbier Pl. fig 7. With lobes somewhat enlarged as the species is figured in Schimper Atlas under the name of Racophyllum fibriforme syn. of asplenium Gutbierianum (nov.)

4 Hymenophyllites unfolding? Bodies in L & 1686, 1687, 1688 nodules covered by a tubercle from which some tops of leaflets like H. flabellatus are coming out. They are all obscure.

5 Hymenophyllites flabellatus? sp. nov. Among the specimens brought from Mazon creek and which I have for examination is one representing a kind of oblong body with surface somewhat like H. mollis from the top of which come out filaments or divisions like the leaves of Neuropteris coarsely veined. It might be young development of H. flabellatus.

6. Hymenophyllites inflatus, Lesq. I have a specimen which shows the lacinia either round and inflated as in my figure and apparently linear at the base. Stone has another specimen with all the lacinia very obtuse as in my figure.

7. Hymenophyllites (Rhacophyllum fibriforme Gut). I have three specimens of this species, at least as it is figured on Gutbier Pl. 1. fig 3 which appears to be intermediate between this and Asp. lactuca. The specimens are from D. Brett N. 107. B.C.D. show flat branches coming out of an apparently broad flat stem, they are alternately divided in lacinia which by subdivision are bifid toward at the point, the lobes acute lanceolate flexuous more or less long acuminate. This can not be the same as the rare Gutbierianum. Schimper atlas pl. 48 fig 4 shows the two third of leaves together, the ultimate lacinia are much longer in ours 1071B shows a large frond of it apparently attached to the rachis of a Pteris.

D 1. Hymenophyllites fimbriatus Lesq. Tachyphyllum fimbriatum in Rep. of Geol. Survey of Penn: P. 863, Pl. 8, Fig. 2. Nothing to add to the description of this species merely to correct it for mode of branching indicating a form dichotomously divided. The veins are finely distinct, as in the point of each lobe and evidently have the same mode of divisions as in the Hymenophyllites. Universally I affine Lesq. Fig. 1 is a mere variety of this species: I have not seen any of the specimen of D. insculptum but that which is figured in the report and which was given to Lesq. but it appears to be a good species. Fig. 1 fimbriatum, the surface of the leaves is smooth though the borders are fimbriate by scales or hairs.

D 2. Hymenophyllites membranaceous. Lesq. (No. 106. 3 specimens from Butts) Pl. fig. 1. 2 Fronds ~~leaves membranaceous~~ large, flat alternately divided in large branches divided at the top in irregular lanceolat acuminate points generally short. The primary divisions are slightly turned outside and upwards separating from each other by oval sinuses. All the parts or all the body of the plants are regularly veined in simple parallel very distinct veins. Forking once in entering each one of the lobes or divisions. The nervation has somewhat the character of the foliaceus species. But the species greatly differs by its membranaceous and coriaceous substance, the mode of its division &c. a very fine species. see below 2 C

D 3. Hymenophyllites crassiusculus (may be Hymenophyllum Magoriana?) &c. Hymenophyllum ~~subtilus~~ Lesq. Pl. fig. 4. 5 No. 107. a. of Butts. & No. 1684. Rachis round and thick. Ovate and indistinctly punctate, dichotomous branches short dichotomously divided in short narrow ultimate divisions forking at the top in short pointed lacinia. The stem is more distinctly defined than in H. filiformis to which it is however related. It is flat upon the stone as if by compression. However fig. 5 which is from Clinton is flat and the surface does not show any trace of the or punctate as therefore this may be a mere variety of that H. filiformis. I however doubt it and separate it accordingly.

D 4 Hymenophyllites hamulosus (No. 60 Butts). Pl. fig. 3. I find this branch too large and too particularly divided to refer it to H. adpressus. The stem is comparatively large, the division dichotomous at a broad angle of divergence from the main rachis, the ultimate divisions forking nearly in right angle, gradually diminishing to a filiform point, hooked.

D 5 Hymenophyllites? fucoides. Pl. fig. 6, 7. & No. 1681. & 1682. The filaments are represented a little too thick upon the figures. They are simple, filiform or rather vermicular, slightly inflated at the obtuse point coming out in fascicuals from an amorphous base, tending to ramify to one side and there the branches attached to a kind of squamiform or hirsut rachis curve downward. Fig. 6 which is copied from a good specimen seem to represent two branches of the same fascicule opposite and their divisions curving forward each other. The plant seem to have an analogy of character with Fucoides Caudagalli figured ~~at the same~~ from Stevens. These two specimen from Morris may represent something like H. Stevensii.

D 2! Compare this species to Rhabdophyllum pachyrachis of the Trias in Heer Fl. Tos. Helv. Pl XXVI f. 5. in Lithe A

which it is evidently attached, while Prof. Geinitz thinks that it is fixed in small bundles to the stem, like a parasitic plant. The State Cabinet at Springfield possesses specimens of a large fern whose stem, like that described by Lindley, is bordered by bundles of leaves of the same *Hymenophyllites*. The specimen is obscure, and it is not possible to decide how they are attached to it.

Hymenophyllites lactuca, Gutb.

This species is more rarely found in our Coal Measures than its near relative, *H. Clarkii*, Lesqx. The State Cabinet has a very fine specimen of it in a concretion from Mazon creek. It is distinguished from *H. Clarkii* by its broad enlarged fronds and narrow laciniæ. These fronds or rather pinnæ, on one side of the rachis, which are only visible in part, appear placed in a row, like the alternate divisions of a fern. As the epidermis of some of these pinnæ is destroyed by maceration, the veins and veinlets are distinct, and are seen passing in bundles from the rachis, separating more and more in curving into each division, to end by a simple veinlet, ascending to the point of the acute ultimate lobes.

Hymenophyllites arborescens, Sp. nov.

Pl. xvii, fig. 1.

Stem long, (the specimen, though broken, shows more than one foot of it,) straight, about one inch broad at its lower end, two-thirds of an inch at its upper part, marked in its length by obscure lines apparently formed by bundles of veinlets and alternately divided in thick oblique branches, more or less regularly and deeply lobate; lobes alternate, simple and linear elongated, or bi-trifid, of various lengths and obtusely pointed.

The divisions of this plant are rather dichotomous, like those of species of *Lycopodiacea*, than pinnatifid like those of ferns. They are merely a continuation of a main axis thrown out in various directions. The substance appears to have been a compound of cellular soft tissue, intermingled with bundles of continuous vessels, forming veins or veinlets, and, by mere separation, ascending to the last divisions of the frond. There is no trace of branching of veins,

but merely of divisions of fascicles of vascular tissue. The species, in its general form, resembles *Schizopteris pachyrachis*, a species of the Keuper.

Found at Morris on a large piece of shale, and kindly presented by Mr. Jos. Even.

Hymenophyllites Clarkii, Lesqx. 9.414.4

Pl. xvi, fig. 1 and 2.

The description of this species is given in vol. ii of this Report, p. 438, pl. xxxix, fig. 7, from a small specimen. It is abundantly found in the concretions of Mazon creek, and, though very variable, preserves the characters which separate it from *H. Gutbierianus*, Gein., viz: its broad, round, or very obtuse divisions, and the great thickness of the leaves, which were evidently hard and coriaceous; for they are not flattened on the stone as in *H. Gutbierianus*, but enter it, and mark on it a deep impression, as a hard body only can do. Of the two remarkable specimens figured here, the first appears to represent a plant with a long twisted or climbing stem. The principal axis is round, grooved, and has its surface roughened, and marked with points or scars, as if it had been covered by hairs or scales. As the stem of the second specimen, which seems to represent a young plant evidently of the same species, is smooth, these points may be the scars of rootlets or suckers, serving as adhesive agents to help the climbing process. The young plant, fig. 2, has a short stem already curved or twisting, and at its base, some filaments resembling rootlets. It would, therefore, be rational to conclude, from these specimens, that the plants which they represent were attached to the ground or to some soft substance, like decayed wood, by rootlets, but were at the same time climbing plants. This would explain the position of *H. adnascens* upon the broad rachis of some ferns.

Hymenophyllites Gutbierianus, Ung. Gen. and Spec., p. 132.

vol. p. 414. 3. 9. 414.4

The true species, as figured by Geinitz, is in the State Cabinet, in specimens from Colchester, found by Prof. A. H. Worthen.

1 Hymenophyllites Claudii. Lesq. There is in the cabinet of M. Strong a splendid specimen of this species. It measures 23 cent long, 16 cent broad, the frond having a distinct and distinctly striate rachis 13 millimeters broad with alternate decurring pinnæ like in pl. XVI of this report, but longer with obsolete nervation. Rachis punctate in the upper part. The same collection has H. gutbierianus as large as the former but the pinnæ are longer, narrower with narrower flat not inflated subdivisions which are linear obtuse only at the point and distinctly nerved.

2 ~~Hymenophyllites Claudii. Lesq. Lacoe specimen 683. Has [illegible]~~

3. Hymenophyllites Rhacophyllum (~~publication~~ punctatum) pl. 21 f. 7. or another name spec. 694 of Lacoe. Has the greatest affinity to H. flabellatum. Bars broad apparently subcordate gradually enlarging upwards ~~and~~ flabelliform; bordle nearly equally divided in short obtuse oblong or linear lobes separated by sinuses either pinnate all along & the deep or diverging from each other veins distant seen only by humecting the specimen when epidermis becomes pellucid. dichotomous. The veins and their division are more one or rather generally two millim distant. It comes from the red sandstone Gilletts Summit Mt Rosencrans. This is same as Cyclopteris Brongni var. perpetua Dawn. Dergna plants of Maine p. 463 pl XVII/6.

4 Hymenophyllites Claudii. Lesq. Lacoe specimen 683a. shows part of a pinna of this species with 4 secondary pinnæ ~~sessile~~ sessile and attached to the rachis. The rachis is apparently concave or flat and smooth; the pinnæ 1½ cent distant, sessile by a base slightly decurring half a cent broad at base, 2 cent long enlarging upwards to oval 1½ cent broad in the middle, irregularly lobed and cut lobed as in this specimen with other lobes inflated at their apex surface punctulate or rough. This specimen and other which I have seen of the same character prove that these rhacophyllum are neither the primitive stal or bastard aves of ferns nor parasites upon them. The specimen should be figured for another vol.

416 C.1.D. Sphenopteris macilenta? Al. & H. No 500 is a fond ultimate pinna of this species at least by all its characters except by the nervation which is totally obliterate. The pinna is 9 cent long, alternately pinnately divided, inferior pinnules bilobed, lowest with the lobe reniform, more or less deeply cut, about equal, pinnules decurrent to the broad rachis by the base narrowed to about 6 mill broad which the pinnules measure one and a half centimeter between the bordes of the lobes, being a little longer than broad. On ascending the lobes become less marked and the pinnules more oblique or less reniform become oblong or obovate nearly entire, smaller the upper pair being connate to the terminal pinnule which is small, ovate, obtuse. The substance of the pinnules appears thick the surface slightly rough no trace of veins is discernable even the midrib being merely indistinctly deposited in one or two of the pinnules by a depression. Lindley & H remark that the venation of this fern should have been very thin as the veins are distinct only in the middle. Geinitz shows the veins. We may trace here the upper surface of the leaflets with a thick epidermis or have a different species though the shape of the leaflets is exactly as figured and described by Al & H. Geinitz's fig. of this species are more irregular than our plate.

2. Sphenopteris or Neuropteris sp. nov. — No 514 is perhaps referable to the above species it is also an ultimate pinna 6 cent long with alternate pinnules nearly in right angles: both lower ones one and a half cent. long oblong, contracted at the middle and then lobed at the base, (B) which is cordate; the upper ones entire, oblong obtusely pointed a less obtuse than the lower ones. All have a broad midrib enlarged at base and apparently the lower leaflet are attached only by the enlarged midrib, the upper ones are sessile by a broad base and near the apex they become joined or connate to the middle and apparently decurrent. There is no trace of lateral veins the surface is little inflated and distinctly granulose and some of the leaflets have a border or margin all around. I find nothing to which I could refer this species except as a marked variety of S. irregularis.

D 3 Sphenopteris Gutbierana. Geinitz. As figured by Geinitz (see p. 408 & 5 H fig. 5 & 22. p. 120 this vol) should be described may be here remarked that no trace of nervation is seen that the lobes which the figure call teeth are more deeply cut, all entire not dentate as the lower lobe in enlarged figure of Geinitz Pl. 23 fig. 10 a and both slightly obtuse or in their whole size narrowly oval being somewhat narrower at the base which reach to near the rachis. Can not be compared to S. flexuosa of Al & H. See also description of Geinitz & compare.

D 4. Sphenopteris tridactylites. The specimen 13 from which the figures are made show the pinnules are first nearly sessile and in right angle the rachis not measured. Sometimes the pinnule an indent appears and their lower base is then slightly drawn along to the rachis but soon enter it and do not form margin. Brongniart says rachis ribbed under. They generally appear so but when looked with a somewhat strong glass the large rachis primary or secondary are punctulate (or distinctly and distantly so). Geinitz in his enlarged fig. 13 & 14 shows the pinnules decurrent which is not exact. Sphenopteris quadrifoliata. Pl. XI fig. 3 of Gutb. qui non rappel pas a les [illegible] plate fig 5 qual nomm quadridactylites which he consider as a variety.

D 5 Sphenopteris Gravenhorstii. Brgt. Brutt. N. 118 & 514 Fragment of a large pinna, the secondary ultimate pinnæ of one side only being present. Pinnæ long lanceolate curved upwards opposite pinnately divided in alternate pinnules, lobes divisions oblique to the rachis linear-lanceolate obtuse pinnately lobed, lobes oblong or ovate obtuse not deep, separated to near the midrib, venulate lateral veins medial vein pinnately divided, each division entering one of the lobes entire or subdivided in two or three branches each one entering the left lobe of the lobes. It is a remarkable fact that in some the upper pinnæ or even in those of the base the pinnules near the tips or in the middle have the epidermis destroyed by maceration these pinnæ then exactly represent Sphenopteris neuropteroides Brgt. fig. 2 a of the same plate 55 where S. Gravenhorstii is represented. The lower pinnules

the nervation without epidermis is so divided exactly as in Brgt specimen, the lower pinnules forking at the base and the division forking again once or twice, the upper pinnules with rarely forking twice and the upper most one. This specimen has the lobes somewhat shorter and more obtuse than Brongniart. I see however no distinction marked enough to separate it.

1. Sphenopteris Sphaerophylloides. Brgt ?? new! Leaves tripinnatifid, rachis straight rigid comparatively thick (Brgt says Stach. gracilibus flexuosis). pinnas and secondary pinnae linear lanceolate (more like the matted Brgt), secondary pinnae deeply pinnatifid, ~~entire~~ pinnulated (not contracted) (albeit less deeply cut). not decurrent at their point of union with the obtuse rachis (they are acute in Brgt), the lowest sessile, (not decurrent) not rachis marginated, as says Brgt), ovat, obtuse, regularly Crenato lobate, ~~the lobes very~~ or cut in short, obtuse, mere undulations. primary nerve in each lobe forking flexuous alternately forking erect division entering one of the teeth or and forking at the top. Sori very small round puncture the epidermis placed between the forks of the last division of the lateral veins.

Hendy

2. Sphenopteris Stipulata Gutb. S.S. 184 Top of a tripinnatifid leaf. Primary rachis comparatively broad, rough or punctate. pinnae in right angle or slightly inclined upwards long, linear lanceolate, from 6 to 7 cent. long. pinnule also in right angle to the secondary very narrow rachis ovat or oblong obtuse, sessile not decurrent, ~~alternately~~ 7 to 8 millim long alternately deeply cut in four or six pairs of ovat or round lobes separately the near the base, either entire or crenulate at the top sometime marked with two or three short obtuse teeth, small teeth, the lower pair longer or more prolonged. No trace of nerve or vein can be discovered. For the form of the pinnae and the shape and position of the pinnules the specimen is like the fig. of the specimen in Rochl. Pl. XVI f. 6. But the lobes are not always exactly round or broadly ovat as Rochl marks the in enlarged f. 6 a. but some of them are obscurely undulate dentate or crenate at the top like the fig. in Geinitz Pl. XXV f. 3. But the lobes are more distinct and more numerous than in the three fig. of Geinitz being generally in 5 or 6 pairs with top leaflet of the same shape as the lobes only smaller

3. Sphenopteris (Cremopteris) linearis Brgt. Leaves tripinnate primary rachis broad 4 millim narrowly striate primary pinnae oblique curving back. long, linear lanceolate with a narrow distinctly striate rachis one millim to broad half round. secondary pinnae oblique the upper ones nearly erect, alternate, linear lanceolate in outline with alternate pinnules erect decurrent, rhomboidal or cuneiform in outline (from to five pairs) cut in cuneiform lacinias once two or each side,) (blunt or truncate at the top (compare for this description of Brgt better than Schimper) veins dichotomous flabellate close and parallel. The only difference between the specimen and that figured under this name by Brongniart is that the secondary pinnae are more open or less erect or in Brgt figure and the pinnules also especially the lower ones not seen by Brongniart equally open the upper one only being erect. But the pencil outline has seen only the upper part of a primary pinna while our specimen represents the middle or the base of the pinna, one of which is attached to a fragment of broad rachis is eleven cent. long to the part where it is broken and where the secondary pinnae though still of the same length are scarcely shorter, 2½ cent long, can already much more oblique than the lower ones. The rachis (secondary is slightly flexuous the epidermis of the upper surface rough the veins being not as distinct as on the lower surface. The specimen was communicated by Prof Lafford for the Ithaca Sub-component of Tennessee

4. Sphenopteris Sphaerophylloides ? Brgt. S.S. 109, 1550, 1551. Is this specimen which I considered as P. murrayana Brgt. Leaf bipinnate or tripinnatifid primary secondary rachis rigid, narrow comparatively narrower than in No 1. of this box, ~~secondary~~ primary pinnae very long, nearly in right angle. The specimen represents two nearly whole 16 cent long

to 417b

Del 1. Hymenophyllites Thalliformis Lsqy. The specimen in the Museum: H. 48 is from Morris and somewhat differs from the one figured in this report Pl XVII, Fig 3. What seems to be a thread in the Colchester specimen which belongs to Springfield, is in this tree: a branch of Hymenophyllite like H. Gutbierianus with evidently wheel lanceolate pinnae and from the same stem as from its base three branches diverge and seem to come out as of a common point of origin. The specimen is not quite distinct. One of these bearing branches is imbricate as in the branches which simulate compound leaves of young rachis of ferns.

Del 2. Hymenophyllites Stronzii Lsqy? Spec: H 100. As in the one figured in this Report Pl XVIII Fig 1. The form of the button like branche or stem it division are not definit. His rounded oval appearing like a compound of linear ~~lanceolate~~ pointed leaves coming out from a common base. These leave which have a medial nerve may belong to the first developement of an annularia. Another specimen with a button of about the same form indicat a compound of narrow leaves or scales surrounding a piece of branche marked with points and may be only a broken part of some villous or scaly rachis of fern. Both specimen are referred with doubt to this species which is still an uncertain one. It is however clear that H. Stronzii can not be referable to Hymenophyllites.

Del 4a. From 417c. Linear (two other specimens represent fragment of pinna, shorter and lanceolate) 3 to 4 cent. broad. Secondary pinnae slightly oblique, parallel, close but not imbricat linear lanceolat (the apical pinnule very small ~~with~~ obtusely pointed) pinnately more or less deeply lobat, lobes oblong ovat, obtusely pointed, cut to the middle in acut sinuse, incline upward, sparingly obtusely dentat, lateral veins decurring in forming the secondary rachis, pinnately forking 3 to 6 times according to the size of the lobes and their teeth entered to each ~~of the lobes~~ one of the division of the veins. The specimens agree well with Brongniart Pl 125 fig 1 differing however by the generally rigid rachis, and the larger size of the pinnule and of the lobes. The nervation is the same. The lobes meet less deeply cut veins ~~to one~~ or scarcely to one half. and the split not decurring generally in right angle to the rachis. This represents the American form of the species. No 1, 417c might be taken for a fertile part of the same. The whole plant is however more rigid coriaceous, the veins ~~two~~ ice or three all forking at the top and the teeth not marked, half round ~~more~~ undulatus where the subdivisions of the vein does not indentat. Should be separated and named

Del 3 Sphenopteris ~~Schlotheimii~~ Gutbierii? Ongt? S. 57. Frond oblong, top ~~broad~~ ~~broad~~ deltoid, bipinnat. Primary pinnae long lanceolat slightly inclined. 4 pairs, the lowest one 3 ½ cent long the upper 2 ½, pinnately alternately divided, pinnules pinnatifid or slightly oblique the lowest one 2 millim long 7 to 12 pairs, gradually shorter to the terminal small ovat obtusely pointed pinnules pinnately lobed, lobes cut to the middle the lower one three nervulation four dentate, the middle one bidentate the upper entire, lateral veins pinnately branching from the secondary rachis divided in ~~four~~ three ~~two~~ or two branch ~~accurates~~ in ascending each branch entering one of the lobes. From the former species this differs just by its ~~size~~ small size in all its part, the decurring base of the secondary pinnae forming borders along the rachis, the more distinct large teeth. From Brongniart species it differs merely by the lobes less deeply separated and the teeth shorter. The nervation is about the same, differing by the branche being merely from above the middle according to the shorter lobes which ~~do~~ not being divided as low ~~have~~ no inferior teeth, there being mostly at the top except in the lowest pinnules. I consider it as a rare variant that in these three forms which should be described together there is a great conformity of character and that they may represent parts of a same species.

Hymenophyllites thallyformis, Sp. nov.

Pl. xvi, fig. 3 to 5.

The specimen here figured, represents only part of a frond, which, in its whole, appears to have been large and roundish in outline, with undulate borders and undulate rugose hairy surface. From the emarginate border of the frond, protrude cylindrical branches, either erect or creeping, whose form is totally different from that of the frond. These branches, half an inch thick, are covered with ob-lanceolate, obtuse scales or leaves, narrowly striate, as marked, fig. 4, enlarging upwards and closely imbricate. As the scales are mostly crushed upon each other, it is not possible to see if these stems are fruit-bearing, like the branches of a *Lycopodium*, or are merely the base of the stems of some fronds of ferns, and thus only a different representation of the same organs of the plant. The specimen is good, the various parts of the plant are distinct, and the connection between the branches and the frond is evident.

This kind of development may be compared to that of the *Marchantiaceæ* and of the *Lycopodiaceæ* with the fronds of the first, and the fruiting-stem of the last family of plants. I suppose that the fragment, represented fig. 5, belongs to the same species. It is apparently the plant in the first development of its frond. The specimen, fig. 5, is in a concretion from Morris; the other is on shale from Colchester. The same species has been found also on the shales from Morris.

Hymenophyllites Strongii, Sp. nov.

Pl. xviii, fig. 1.

Stem half an inch broad, erect, undulately veined or striate in its length, bearing alternate leaves? covered with long thick hairs or scales, diverging all around. It is not possible

to see the form of the leaves or divisions, which may be merely part of branches. On the left part of the specimen the stem is smooth and has the appearance of a stem of some species of *Hymenophyllites* of this section; on the other side, which is unhappily broken, the borders are fringed with long straight hairs, appearing to come out from another part of the stem. From this it is hardly possible tc decide if the specimen represents a true *Hymenophyllites* or merely some disconnected part of a Lycopodiacæous plant.

In a concretion from Mazon creek, collected by Mr. S. S. Strong.

§ 3. Schizopteris.

Hymenophyllites mollis, Sp. nov. p 418

Pl. xviii, fig. 2 to 6.

Leaves or fronds formed of groups of thin filaments, emerging from a common support, apparently parasitic, enlarging in growing up or by grouping together, and by compression taking various forms; the laciniæ or filaments are generally united together without distinct nervation.

This is still one of those singular plants of the coal epoch which baffles every attempt at analysis, when one is trying to compare them with representatives of our existing vegetation. This kind of vegetable is doubtfully referable to this section of this genus. Fig. 2 represents a kind of tubercle, resembling a piece of decayed wood, with traces of an axis in its middle and irregular cavities, bordered all around by a short fringe of these filaments which appear as growing out of it in an incipient state of vegetation. These filaments represented separately, fig. 3, are like linear, thin, short, obtuse laciniæ, united together and without nerves, or with thin parallel veinlets. In fig. 4, these filaments, much elongated, are separated in the middle and near the base in various ways, appearing to come out from a mere point and to enlarge in ascending. In fig. 5, the point of attachment of the whole group of filaments is well marked, and from it, the laciniæ seem to be attached or to grow upon one another like the subdivisions of a kind of *Fungus*. Fig. 6 represents a group or a heap of these filaments which appear attached and growing upon each

1. Hymenophyllites mollis Lesq. Nothing new to add to the description except that specimen H 66 seems to represent a pinna with a prominent vein and laciniæ primarily recurrent to it, arising downward and more or less disjointed near the point and sometimes from near the base. Specimen H 94 has somewhat the same appearance while specimen H 34 show a mass of mixed broken and crushed filaments apparently of the same species. 20/5.72.

2. Hymenophyllites mollis? Lesq. Specimen H 99 represents a very divided and irregularly so apparent basilar frond, round in outline, cut on the border, which is like a compound of crushed linear laciniæ emerging from a stem or root ½ inch broad ~~and can app~~. If a stem, the laciniæ are superior to it like the rays of an umbella or pressed upon the ground and the stem emerging from the middle. The laciniæ are united, apparently striated and nerved and thus resemble this species; but the consistence of the leaves appears thicker.

3. Hymenophyllites? Rhacophyllum flabellatum Ung. A good specimen in no bulk from Mazon creek answers exactly description & figure in Schimper's Pal. T. 1. p. 687 & 48 f. 8.

4. Hymenophyllites (Rhacophyllum Sch.) ~~linearifolius~~ filiformis Gutb. ~~tenuis~~ ? ~~sp. nov.~~ (change name) – Main stem (above) 3 mill. broad near the base flat narrowing upward & cent. long dichotomous in its primary secondary and tertiary divisions, primary divisions long with 5 to 6 alternate branches, secondary divisions which also branch once or twice. All the divisions are linear but narrowing upward and therefore the ultimate divisions are simple filiform and short. The surface of the stem and divisions is narrowly striate or by parallel veinlets which by separating form dichotomous branches. The species is represented by S. 70. and P. in 1874 appears to be the same as Fucoides filiformis of Gutbier a good species.

5. Hymenophyllites trichophyllus sp. nov. Lacoe Spec. 549 bears three pinnæ or pinnules singly attached to the border of a leaf of Cordaites or to a very narrow rachis underneath the border. These pinnules 5 to 6 cent distant appear like bundles of veins deprived of their epidermis, base of the bundle 4 to 5 mill. broad, filament round capillaform, diverging fan like, forking once with near or at a distance from the base, then simple flexuous in various directions, some short some long, the longer one measuring four to 5½ cent long, mixed in the upper part in ~~flabel~~ flagellate fascicles preserving the same thickness all the length from the base to the top. This specimen is very remarkable and shows scarcely nothing which might be compared to it except perhaps the branch figured pl. 12 fig. 4. This would be about the same if the nerves were all naked, deprived of epidermis, in longer fascicles flagellate or mixed at the top and simple from the base or from the middle. The same character is observable upon fig. 5 of the same table. Another specimen of Lacoe 548 has a large simple pinna or pinnule 4½ cent long, two mill. in broad at the base, gradually enlarging to 2 cent broad toward the top, veins or fascicles of veins inflated flabellate dichotomous, all curving or bannerlike to one side from above the middle. In the upper part the fascicles of veins divide ~~and are mixed~~ some thin, intermediate to stronger ones. The laciniæ ~~be coming~~ separate and filiform at the top ~~or near the end of the~~ should be measured for figures – see over

1 described and figured for Mr. Hopkins under Rhacophyllum veinii or Rhacophyllum bellerianum

This species can not be compared or referred to a fern, on account of the difference of the thickness of the fascicle of veins. They are indeed all equal in the lower part and the dichotomous division of the same size but in the upper part the fascicles are evidently seen as composed of flexuous fibres or rivulets which do not anastomose, nor divide but become separated in their length and either parallel or more or various directions like bundles of hairs.

Dec (1) Sphenopteris Dubuissonii Brgt. Stb. 145 Butt. Leaves bipinnate, pinnae slightly oblique or in right angle, long, flexuous? brother secondary pinnae small oblong-lanceolate pinnately deeply lobed in four pairs of nearly round lobes, fruiting with a terminal pinnule of the same size and shape, veins scarcely distinct. ~~[illegible] and as many lobes of the lobes, there are division of the veins and branch entering~~ the lateral ones forking on each side and branches entering the points of the teeth. See Brongniart. The description is exact and the specimen perfectly concordant. The specimen however is much brother more of the primary pinnae being pinnated whole.

Dec 2. Sphenopteris tenella, Brgt. not mentioned by Schimper. Butt. N. 152. Leaf bipinnate. primary rachis strong, comparatively broad, rugose striate. secondary pinnae linear lanceolate narrow turned upwards somewhat flexuous pinnately divided in distant groups of pinnules distinct the pinnately lobed in 3-5 pairs of ~~simple or~~ linear slightly obtuse lobes either simple or the ~~lowest~~ frequently once marked in the middle by a ~~small~~ depression or medial nerve, all the lobes erected ~~and~~ or turned up in very acute angle of divergence. The form has some relation to S. tridactylite and at first I considered it as identical with this species but the lobes are much longer generally simple, even the lowest, slightly ~~and~~ larger in the middle in form. Brongniart specimen is not very certain as it is made for the communication of a drawing. It is not mentioned by Schimper hence it is difficult to ascertain the degree of relation of the plant. It has some likeness also to S. acutiloba of St. appearing like the figure in Schimper atlas pl. XXVIII f. 2 & 3. But in this species the lobes are acute while in our specimen the positively blunt obtuse or slightly larger than the base. As seen by the enlarged f. c of Ster. Pl. Helv. Pl. 1 f. 2 the lacinia or lobes are also sometimes linear obtuse. But the mode of division appears different, the lobe pinnule being less divided as in St. acutiloba. — Rem. This is rather S. lanceolata Gutb. as figured in Geinitz Pl XXIV f. 4 and must be described such remarks that it has a likeness to S. tridactylite but pinnules longer, lobes also longer either entire or merely emarginate at the top. The pinnule has a deluted axis with a midrib or rather a depression as in fig 4a of Geinitz. Make description from my specimen and from Gutb. figure Pl. V f. 12. which perfectly correspond. Schimper remarks that it is very near S. acutiloba which is right.

1. Sphenopteris crenata, Al Hult. Tripinnatifid. Primary ~~pinna~~ pinnas apparently large; rachis subcylindrical. Primary pinna open nearly in right angle; the lower rigid linear lanceolate, all equidistant, parallel; secondary pinna narrow linear lanceolate equidistant, open either cut in alternate pinnules free to the base ovate acute, crenulate on the border, or merely divided in larger pinnules which represent in the upper part of the frond: ultimate pinna the secondary divisions and are lanceolate alternately obtusely lobed or deeply equally crenate; secondary veins pinnate to the lower lobes only forking in the middle ones, simple in the upper. In the tripinnatifid specimen each pinnule has a medial nerve flexuous and pinnately divided with simple divisions. In the bipinnate branches top of the tripinnate ones the lobes are more deeply marked and the pinnately medial nerve has its branches pinnately divided in the lower lobes, bifid in the middle, simple in the upper ones as said above. The secondary pinna are 11 cent. long and two centimeters broad distant two and a half centimeters. This species may not be that of Al Hult. who have not indicated the nervation. It is much like Pecopteris serrulata, Daws. Geol Survey of Canada 1871 Pl XVIII f. 2017–2019. Agrees well with Schimper's description.

2 Sphenopteris pseudo-Murrayana. Sp. n. In the collection of M. Harvey of Atlanta there is a large number of specimens referable to this species from the Pottsville. The frond is upon large rock placed on the under surface of the lower near the base of the lobes evenly or frequently distinct for this Pecopteris Murrayana.

3 Sphenopteris species nova. Four Harvey specimens 3, 4, 7, 14, 18, 42. Frond only preserved part bipinnate. Pinna nearly in right angle, somewhat flexuous, long and narrow; distant; pinnules alternate, small, ovate angular, narrowed to the decurrent base, thick coriaceous. Upper to five lobed; lobes more or less distinct, or longer, obtusely dentate; veins very thick the middle one forking into each lobe and forking again in entering each of the obtuse teeth. This species is related to Dasmopteris macrostachyl. Pl LIII Ath. f. 6, 7. by the form of the lobes but the nervation which is extremely thick is far different of the hymenophyllites type. The pinna are narrowly winged to the base of the decurrent lobes which are generally distant. Thus be figured.

5 Sphenopteris sp. nov. Harvey spec. 39, 39. Has great analogy to Ph. Pseudo Murrayana but positively differs. The rachis of the primary pinna is debile; the secondary pinna flexuous pendent, ~~the pinna~~ with pinnules or lobes distant and distinct to the base, entire or scarcely crenate, obovate or oblanceolate curved ~~the~~ backward; the veins are ~~stronger~~ more, very distinct. The fructifications are not distinctly seen.

6 Sphenopteris spec. nov. Harvey spec. X 32, 11 47. A remarkable fern which resembles an Oligocephyllum. The rachis is dichotomous compound of distinct parallel filaments; the pinna (ultimate) are oblique, poly pinnately lobed or subdivided in alternate linear or oblanceolate lobes, each segment bearing at their apex large oval sporanges apparently composed of three or four sporanges placed upon another. The pedicels of the sori are comparatively long bristled a curved down, the sori pendent very distinct. I know nothing comparable to this species which is very distinct except perhaps Sphenopteris Bromii, Geol Pl XXIII f. 15.16.

Suppl. to Asterophyllites

D. 1. Asterophyllites foliosus. Ll & Hutt. A number of specimens N 736 of Lacoe discovered under the Conglomerate near Pitt to show the species from a large stem about 10 cent broad to the small branches 2 to 3 millim. Stem and branches distinctly striate, striæ flat or furrows flat with a narrow sharp crest, all very narrowly reticulated: articulations distant, more or less inflated (inflation seen especially in the branchlets) flat indistinctly marked with smooth tubercles, internodes distinctly striate striæ sharp narrow rounded in width, ramification in right angle, primary branches 2 cent wide with articulations 12 cent distant; secondary branches 5 millim broad or thick with articulations from 4 to 6 cent distant. Leaves on branchlets of a 3d order in whorls of 8-12 leaves flat lanceolate acuminate, narrowed gradually from the middle to the point of attachment, comparatively long, 12 cent in the lowest largest whorls, rapidly diminished in length towards the upper part of the branches; midrib broad, generally flattened rarely distinguishable. Geinitz has given a good and fine representation of this species with which our specimens are perfectly concordant. Pl XVI fig 2 represents those we have from the conglomerate N 736. Geinitz fig 1 has its representative in fig 2 of this pl which I have referred to A. calamitoides Schp on account of broader leaves. Fig 4 is represented by the long ears of Spec. 731 of Lacoe which though narrower are longer than those figured by Geinitz. The shale 731 from Ontario mine is covered with a dozen of these cylindrical ears all about in the same direction or parallel. They are 8 millimeters in diameter, flattened and compressed into the walls of the stem, 14 cent long somewhat flexuous with truncate scars (those in Geinitz are acute, recalling the form of those of the ear figured upon plate fig. 14 (proximal) differing from those of Geinitz by length, and transcal scars being also slightly narrower. The scars become at the top indistinct by compression in most cases at least. I believe however that they are distinctly or positively truncate or obtuse conical or rather obtuse. As Schimper separates the ears of A. foliosus from those named Calamostachys type figured in Sternberg II. pl XV fig 3, by their longer axis this species is also different from Calamostachys Calamites foliosus by longer ears exactly cylindrical and by bracteiform. Even that the species does not warrant the annulcaltes or the branches Stems of Asterophyllites foliosus. In Schimper the species Asterophyllites foliosus is referred as Calamites Cist.? It seems different. I should like to see larger specimens of the species. The scar leaves seem distinct. Compare the Calamostachys described above & Pollmania elongata Ruck figured in Ruckl pl. VII fig 1.

D2. Asterophyllites tabifolia, Daws. Annularia Dawson Schp. Vol 1 p. 359 Specimen N 52 of Aldrich. This is indeed the same as figured by Dawson and which Schimper takes as an Annularia. The substance of the leaves is rather membranaceous than coriaceous; very slight, blades 6 to 8 in a whorl, unequal broad in the middle narrowed to the base, gradually acuminate lanceolate, acuminate (sharp) to. The whorls branches are rather in right angle and this is indeed a annularia. Good species. Schimper description may be required. The costa however distinct lower the base is rather effaced from the middle upward

other like parasitic plants, the whole by compression being crushed, forming a kind of flattened ball. In all these varied appearances of the same plant, no distinct trace of a true nervation can be seen. The lines marked on the figures, exactly as they are perceivable on the stone, are more or less inflated in places, and can be considered, as well as the borders of the filaments, as true veins. They do not branch, and are mostly parallel. They may, nevertheless, represent the parallel groups of vessels which characterize the species of this section of *Hymenophyllites*. The substance of these plants was evidently soft, for the specimen fig. 6 represents a compound of many of these leaves appressed and crushed together, and the impression is merely of a thin surface.

All the specimens figured here have been found in concretions at Mazon creek, and nothing except *Schizopteris anomala*, Brgt., is comparable to this kind of vegetation.

Genus Pachypteris, Brgt.

Frond simply pinnate or bipinnately divided, bearing upon the same horizontal plan, opposite entire coreaceous pinnules, with a medial nerve, or without any trace of nervation, narrowed towards the base, not joined to the rachis. The peculiar disposition of the lobes or leaflets of these plants, is similar to that of the pinnules of some ferns. The genus was established by the celebrated author for two species of the Oolite of England.

Pachypteris gracillima, Sp. nov.

Pl. xix, fig. 6 to 8.

The specimen represents only simple branches or simple pinnæ, bearing on each side, but on the same plan, opposite very oblique, linear, oblong, obtuse, narrow leaflets, joined by their base to the enlarged border of the rachis, or of a medial nerve, and thus appearing decurrent upon it. The substance of the leaflets is thick, coriaceous, without any trace of a medial nerve. Fig. 6 shows, apparently, a peculiar kind of ramification by innovation.

The specimen from which the figures and descriptions are made, is on a large piece of shale whose surface is covered by a quantity of simple branches

of this plant. They are placed without any kind of order, crossing each other in various directions, as if they had been strewn on the stone, and therefore the kind of divisions marked in the figure, and abnormal, if this plant belongs to a fern, may be merely caused by the casual superposition of two branches joined by their bases. The form of the leaves, their peculiar position along the stem on the same side of it, resembling the divisions or lobes of some ferns, and their mode of attachment, indicate the close relationship of this plant to those published by Prof. Brongniart as *Pachypteris*. In some of our branchlets the basilar prolongation of the pinnules along the rachis? of the pinnæ has become detached by compression, and they appear in that way as bearing, at the base, a long, linear auricle. The pinnules are a little enlarged to the very obtuse point, as seen in fig. 8, enlarged four times, and in fig. 7, enlarged twice.

On shale, from Morris, collected by Mr. Jos. Even.

LEAVES OF UNCERTAIN OR UNKNOWN AFFINITY.

Genus CORDAITES, Ung.

Ill. Geol. Rep., vol. ii, p. 443.

Cordaites angustifolia, Sp. nov.

The roof of the main coal at Duquoin and St. Johns is in places covered to a thickness of six inches to one foot, with remains of flat, narrowly equally striate, long linear leaves, one to one and a-half inches broad, which, as yet, have not been found in connection with any stem.

From their linear form and from the narrow striæ marking their surface, I refer these leaves to the genus *Cordaites*, Ung., being unable to see the characters which separate these ribbon-like leaves into two genera, viz. *Cordaites* and *Noeggerathia*.

Noeggerathia Gopp. The difference between Noeggerathia and Cordaites is marked in Geinitz p. 40. Three specimens of ours from Mons, Di
Cordaites angustifolius Lgw. (I have examined again these leaves from Valenc. Allen Tremont Lg. 1582 are the same species as those which I have given a plate in Di 400 of the catalogue of Cambridge. These leaves are half embracing a stem of about ~~three~~ one and an half centimeter in diameter, the inferior one open in right angle to the stem, the superior one erect, forming a cleft at the top, exactly linear, as far as can be seen from the numerous fragments which I have examined or very gradually enlarged upwards, from 12 to 15 millim broad, one of these fragment, 9 cent. long is 8½ to 9 millim. in the narrower end, enlarging to 10 millim. at the other. The surface is distinctly lined, the lines or striae so well marked that they may be counted with the naked eye generally equal, half round or other, from 3 to 4 in one millim. distance without any intermediate lines. This character is however deceptive as the distance between the lines is sometimes locally modified and on after erosion of the epidermis, the surface appears nearly smooth or without striae marked only by undulized, extremely fine lines. This however is not of general occurrence. Dawson has a Cordaites angustifolius in his pamphlet on the Fossil plants of the Devonian and Upper Silurian formations 1861. The leaves are much narrower, one tenth to one 4th of an inch broad. The one figured, a fragment pl. XIV. fig. 165 is 3½ millim. at one end and 8 millim. at the other, the fragment being about 6 inches long. The figure the striae equal but does not mention their distance. From measurement of the enlarged part they are doubly as distant than in our species or sig the two millimeters. Gopp. Fossil Flora Tell. Some fragments without any description merely of space. The figures still some fragments without any description merely respecting that they may be the same or different. See description of Nicholson Wheltham p. 359. where this is described twice. See this vol. p. 361 (2) Gp. 359

This form appears to be identical with Noeggerathia palmaeformis Gopp. as figured by Geinitz p. 42 pl. 22 fig. 7. The surface or epidermis is cut in right angle to the veins by very small undulations forming according to the description of Noeggerathia by Geinitz parallel ridges the cells in the fine Gelatinous epidermis. But this is a true Cordaites, not a Noeggerathia for it agrees in toto with specimen Di 4. of the Museum. The leaves in Geinitz figure are also crowd in right angle by those scars resembling the cats of whose origin is not yet recognized. I have these leaves from Clent Mo. No. 114 b. of Britts where show the point of attachement b. a. a. b. like this but somewhat larger as the leaf is larger from a to a the distance is right, from b to b. above the point of attachement it is eleven millim broad or larger than on the figure and the leaf gradually widens so that at 11 cent. meter from its base where it is broken, it is 17 millim. wide. Another half close and parallel to this is all along of the same width 17 millim. while still another on the same specimen has its nearest point of attachement 7 millimeter broad is 15 millim. wide above the curve b. b. gradually narrows above to upwards up to 13 millimeter. The width of these leaves and their widening or gradually narrowing upwards is not a reliable character.

2. Cordianthus (simplex?) or another name. No. 2. a splendid specimen sent by M. Mansfeld could be named C. Mansfeldi representing a large flattened stem, three cent. broad or more with a comparatively thick ~~cortical~~ coal coloured nearly smooth or irregularly lined till the under surface which is also striated across. bearing irregularly placed long racemes from five to 7 cent flattened linear a little more than one millimeter across flexuous very thinly lined in the length bearing mostly one sided three four involucrate buds or

or receptacle, scarcely two millimeters long, one and a half mill. broad, born upon short branchlet 2 millimeter long at an acute angle with the main pedicel. The scales appear to be three or four, closed together forming thus a small bud as seen in the figure. The point of attachement of the main pedicels to the large stem is marked by an irregularly oval (mostly inequilateral) small scar. I consider the stem as representing or bearing male flowers probably of Cordaites borassifolia very abundant at Cannello, two fragments of which fig 4 are upon the same specimen (see rectification p. 429 C (1a)), fig 2. would represent the fruit bearing bud, mostly Cordianthus Bacciferus i. G. & E. p. 26. Fig 3 seems to represent a different species, the bud and scales being longer and narrower. The leaf of Cordaites (Borassifolius) f. 5. measures 6 cent. width in the middle and measures about 100 cent in length, the interrupted space between the two fragment figured being 30 cent. The primary veins are distant three or one millimeters or 1/30 of a millim. I find as confirming the opinion that fig 2 and 2a of my plate represent the fruit bearing part of that Cordianthus, a large number of specimens of C. bacciferus found by Mr Mansfeld at Cannello in connection with C. masculus. These are borne upon pedicels straight or flexuous all the fruits sessile, with a bractea under them usually as I have figured them. The scales covering are imbricated or just as marked upon the upper bud of fig. 2. C. bacciferus has the main pedicel comparatively thick like the male flower, flexuous and early deciduous sometimes three feet also. A fine specimen 163 b. has a branch or pedicel rooted, the bud bearing at the top a bundle of young or undeveloped buds of the species. The base of the branch or pedicel is 2½ millim broad very gradually narrowed to the base of the fascicle of buds where it is 2 millim. The buds are quite close 3-4 on each side forming like a small ear two cent long. The spikelets are each separated or undulated by the bractea. This is quite distinct from the male flower of course and shows that they ~~models~~ represent two kinds of organs. This stem N. 2. bears obscure scars of leaves having the form of a crescent with the points downwards, about 1 cent between the points placed nearly in quincunxial order, distant one centimeter and half all. The bark of the stem is nearly smooth or thinly irregularly lined at least half a millimeter thick; the scars of the flowering pedicels are nearly distinguishable.

See that these male flowers of Cordaites represent well enough Zoroaster of Dawson as fig. in his Devon. pl. p. 214 fig. 292-34.

1. Sphenophyllum Moorii sp. nov. Stem simple, straight, cylindrical, equal 3½ mill diameter, undulately equally ribbed, closely articulated and equally so, all the articulations upon a branch or stem more than 4 inches long, being only 2 millim. distant; marked at the articulations by 8 deep round oval scars of leaflets which are alternately placed in each articulations, the small ribs or spaces passing from one above to one lower scar between the scars of intermediate articulation see p. 528 c. fig. 16. Leaflets horizontal, entire, obtanceolate, pointed at base and separated at the point of attachment to the stem, 7 mill. long; entaxed upward see fig. 16 p. 528 very deciduous, smooth or without traces of rank and veinlets. The few leaflets which can be seen are somewhat buried in the stone and indistinct. They appear however as I have figured them. No species of Sphenophyllum has leaves of this kind free at base, entirely separated from each other with articulations so closely approached to each others. It is to be remarked that all the specimens obtained of this peculiar species are exactly alike. It should be separated in a peculiar genus, and rather referred to Conifers than to Equisetaceæ; I think. (24. (5. 72.) referable to Schizoneura?

Rem: on our Species of Sphenophyllum after comparing my description to Schimper's Tal. — All are right only Schimper considers Sphenophyllum emarginatum Gert. as Sphenophyllum erosum L. & Hutt. and separates them rightly from S. Schlotheimii including with it as a variety S. saxifragæfolium Germ. — He admits my sp. bifurcatum but supposes that it may be identical with Sp. saxifragæfolium. I have seen (Feb. 75) from M. Dos Sullivant a small specimen of Sphenophyllum emarginatum with ears, or fruiting ears mixed with sterile stems. These ears are very narrow about 1 cent. including the open spreading bases or half a cent. for the narrow stem and the nutlets which are proportionally large, 3 millim. opposite or all around the stem and filling the whole space between the articulations. As far as can be seen, the bases under the nutlets are of true Sphenophyllum character only not somewhat deeper. It may be my Asterophyllite ovalis but the leaflets are broader and round and the stem narrower.

1a. Sphenophyllum Moorii. See the structure and character of Calamodendron in Brgt or Grand'Eury Mem. p. 11.

2. Sphenophyllum Schlotheimii? Brgt. Ma 106. is an obscure specimen of Sphenophyllum with large rachis, 2 mill. articulations close 6 to 8 mill distant with short reflexed leaflets rounded at the top, distant veins no more than 12 on the borders. The large stem the rounded leaflet and distant nerves seem to refer this to S. emarginatum but the leaflets are entire and rounded at the top. For the large stem and the narrow obtuse leaflets they agree with S. Schlotheimii, as figured by Schimper Tal. veg. pl. 26 fig. 21 the fruit-bearing stem; but the whorls are close. Matte 2 a var of S. Schlotheimii

3 Sphenophyllum longifolium Germ. I have a fine whorl of 6 leaflets L. 1631., 2½ cent. long from the center where the leaflets are connate. They are cut in the middle to half their length decreasing to the border with 16 distant and distinct veins at the borders, these being the dichotomous branches of two or three primary veins at the base of each leaflet, which divide in ascending. This specimen is a true representative of Germ's figure & description. A small specimen representing leaflets of smaller size, fourteen to sixteen millim long is referable to this species on account of the distant that veins 15. at the borders which are slightly reticulate. This however might be S. Schlotheimii L. 1639 another specimen has the leaflets 16 mill. long, proportionally large, 21 to 24 veins at the borders which are reticulate but not scarcely emarginate should also be referred to S. Schlotheimii. Nos however very large. See fig. p. 532. 7. for crenate denticulate borders. Sacoe Greenman N. 191.

1. Sphenophyllum cornutum Lqx. The characters and remarks on this species as given here are correct. We do not have any specimen of this species in the museum except one very incomplete and obscure see below 1b.

2 Sphenophyllum bifurcatum Lqx. Compare Geol. Rep. Ark. and also Schimper. The species is certainly a distinct one. All the leaflets are deeply bifurcate; first ~~upon~~ cut in two to near the base with diverging lobes ~~with the lobes~~ divided to nearly their length in two entire linear pointed segments. Each of the divisions is marked by one simple vein which unite above the sinus and each one has a separate vein in reading the characters p. 526 fig. 15. The stem is proportionally broad, deeply equally striate in half around smooth narrow ribs.

1b. Sphenophyllum cornutum Lqx. One specimen from Morris, sp. 69 evidently represents this species, though the divisions or lacinia are only 4 for each leaflet. It has the same broad base, broad stem, thick smooth cuticle &c. Specimen sp. 46 shows also a few leaflets lacinate at the top but the divisions are short and pointed as in a form or variety of Sph. emarginatum Brgt. See Geinitz fig. 6 pl. 21.

3 Sphenophyllum emarginatum Brgt. & Sphenophyllum Schlotheimii Brgt. Germar in his flora unites both species; but it does not appear that he is right. We have from divers places, especially from Morris a large number of specimens of Sph. Schlotheimii in the Ottawa district under the name of S. emarginatum and we may infer that we have from Morris the very large specimen which has all marginal shoots, emarginate leaflets with one vein to each wedge. I have seen what Schimper and other authors say on the matter. 21/5/72.

4 Sphenophyllum longifolium Germ. Of numerous specimens from Newport and Wilkes barre comparing charts, figures, descriptions of Germar and Geinitz the specimen sp. 75 from Carbondale comes closest to a Sphenophyllum with the description of this species but is obscure and therefore uncertain. Appears to be from a low coal and is rare in our coal measures. 22/5/72. See p. 421 c.

5. Sphenophyllum saxifragaefolium Ger. There is in the collection a single specimen evidently referable to this species. It is from Mazon Creek agreeing exactly with fig. 10 tab. 20 of Geinitz in Ge.

6 Sphenophyllum oblongifolium Germ. Three small specimens from Burnt Branch in Kansas, very small. The specimens represent evidently the German species. The usual powers of the specimens of this and the former species.

7 Sphenophyllum? Asterophyllites ovatus Lqx? From the specimen sp. 13 and 50 both from Marion coal near Mazon Creek the species seems to belong rather to an Asterophyllites. The specimen has a small nutlet attached around and a crack and appearance surrounded by narrow leaves, rounded ears, curved spikes as figured in Germ. rep. pl. 1 fig. 2. and which therefore look like ears of Asterophyllites. These small specimens besides fragments of leaves of Sphenophyllum insaxifolium Germ and may therefore belong to this species, but the ears much smaller and narrower than in German figures and the bracts of the leaflets is longer and lobe and not shorter in German. Specimen A. 22 from Ottawa has still narrower ears and smaller nutlets and evidently leaves of Asterophyllites as seen at the point of one of the ears. A. 26 is another specimen of the same kind and like the former comes Ottawa Mines. In this one the nutlets appear elongated into short horns or bracts and the under whorl of bracts is formed as in the form of long linear bracts curved upwards. These specimens represent either a species of Sphenophyllum or of Asterophyllites and should be carefully drawn. They are in danger of Sphenophyllum marshal Sphenophyllum insaxifolium? fruiting.

8. Sphenophyllum? fruiting? One Sphenophyllum probably S. Schlotheimii. It has narrow leaves and short ears with Sp. insaxifolium Germ. but the specimen has similarities of S. Schlotheimii especially from the fruiting part. Sp. 28. The specimen, sp. 75 from Mazon creek is referable to the S. Schlotheimii and obscure. There is a good specimen of Even from the same locality which is evidently a fruiting cone of S. Schlotheimii, sp. 76. It is a compound of nutlets without bracts or if any, they are very short. From specimen 259 which I find with the fruiting cone it appears that the ears from the end of the last part of Sphenomularia Sphenophylloides see!

p. 484 ?

Genus SPHENOPHYLLUM, Brongt.

Spenophyllum cornutum, Sp. nov.

Pl. xix, fig. 1 to 5.

Main stem round, half an inch broad, articulate at equal distances (about one inch), inflated at the *nodi* or points of insertion of the whorls of leaves, smooth but obscurely ribbed in the length, divided about at right angles by long straight branches bearing whorls of five or six leaflets, joined at the base ; leaflets equal, fan-like in outline, broadly cuneiform to the base, divided from below the middle into seven to nine linear, pointed, nearly equal lobes; veins distinct, flat, four to five at the base of each leaflet, forking once, each division ascending to the top of one of the lobes (fig. 5 enlarged).

It is a well characterized and distinct species, and in studying it at Colchester, I have found among the shales a great number of broken specimens, representing different parts of it, and have seen all the leaflets, from the largest one around the broad part of the stems, to those of the branchlets, presenting the same form and kind of division. It can be compared only to a variety of *Sphenophyllum emarginatum*, Brgt., figured by Geinitz in his Verst. pl. xx, fig. 6. But it differs indeed in its essential characters: broader stems and leaflets, peculiar and equal divisions, and a different kind of nervation. The branching, as seen, fig. 1, is also peculiar for a species of this genus. It is worth remarking that the branches of this plant are mixed on most of the specimens with the remains of a somewhat obscure *Calamites*, resembling *Calamites Suckowii*, Brgt , a coincidence which may be casual. In any case I could not trace any evident connection between the two plants, and the stems of this *Sphenophyllum* do not appear as equally and deeply striate as are generally the branches of *Calamites*.

Roof shales of the Colchester coal.

SPHENOPHYLLUM FILICULMIS, Lesqx., Geol. Rep. Penn., p. 853.

Pl. i, fig 6.

Nodule from Mazon creek; F. H. Bradley.

Fruiting catkins of *Sphenophyllum*, referable to *Asterophyllites ovalis*, Lesqx. Penn. Geol. Rep., p. 851, pl. i, fig. 2, are found in the concretions of Mazon creek, and in the shales of Morris.

GENUS ANNULARIA, Brgt. Ill. Geol. Rep., vol. II, p. 444.

ANNULARIA LONGIFOLIA? Brgt.

Pl. xxi, fig. 1 to 3.

STEM thick, round, narrowly and equally striate, articulate, divided into opposite diverging branches placed crosswise in ascending, bearing at the articulations whorls of ovate-lanceolate obtusely pointed flat leaflets, marked by a broad medial nerve.

This species is represented in the concretions of Mazon creek, by two kinds of specimens, with different appearances. Those figured in our plates seem to belong to the upper, still undeveloped part of the plant. The branches and leaflets are crowded and pressed upon one another in a scarcely distinguishable mass, presenting sometimes, as in fig. 1, the appearance of a peculiar species of *Sphenophyllum*. In fig. 2, the branches and leaves are more distinct, and the form of the leaflets is distinguishable as marked fig. 3, magnified. On another specimen, which was obtained too late to be figured, and which shows the plant in its full development, the stem about one foot long, half an inch thick at the base, regularly striate in length, is articulate at the distance of one inch by whorls of leaves of the form described above, and two opposite branches diverging in open angles from under the leaves, and crosswise in ascending. The leaflets, one inch long, one-sixth of an inch broad, twelve to fourteen in each whorl, are joined at their base. The point of attachment of the leaflets upon the stem and the branches, is marked around the articulation by small, semi-lunar inflations or knots, corresponding in number with the leaflets, and placed just above the point of attachment. The plant represented by the two specimens figured, pl. 21, can be compared with what Prof. Geinitz has described and figured in his Verst., p. 10, pl. 16, fig. 1, under the name of *Asterophyllites foliosus*, Ll. and Hutt. The form of the leaflets being indistinguisha-

1. Sphenophyllum filiculme Sigu. This species appears to be the same as Sphenophyllum saxifragæfolium Germ. It is however remarkable that neither Germar nor Geinitz represents the inequality of the leaflets which in some specimens are much elongated laterally and narrowed downward. This peculiar difference of size in the leaflets is remarkable upon a specimen Sp. 66 from Newport which has narrow lateral leaflets 18 mill long, emarginate at the point with dentate lateral lobes, while the descending leaflets are only 7 mill long, twice as broad and entire or not at all emarginate only slightly denticulate as in Sphenophyllum Schlotheimii. The same difference is remarked in Sp. 1. which has its leaflets emarginate and the lobes two pointed but more acutely than in the var. of Sphenophyllum saxifragæfolium as figured in Geinitz. The same too in spec. Sp. 3 a which has short leaflets of the form of those of Sphenophyllum oblongifolium Germ with leaflets either emarginate and lobes denticulate, not bi-pointed or entire and denticulate. All these different forms are easily identified by their narrow inches and the difference of size of the leaflets. For these reasons I still consider this species as a good one and preserve it till evidence is afforded of its identity with an European species. In specimen Sp. 6. there is point of a stem with short leaves, leaflets bifid which looks as if it had a broad stem. The character therefore of narrow stem might be casual. In specimen Sp. 33, the stem is very narrow and all the leaflets are entire. However some of the lateral leaflets are narrower and longer and though entire they are not generally as broad as in S. Schlotheimii and are not rounded but truncat at the top and the veins are more undivided, the surface of the leaves covering covered with a crust. The truncat top of the leaflets when undivided seems to be a good character. In specimen Sp. 18 however which represents Sphenophyllum Schlotheimii the leaflets are unequal, the smallest being very short; therefore the unequality of leaflets is not a character. — In considering specimens again this Sp. 12 is referable to S. filiculme by the undivided nervation, narrower leaflets and shorter lower leaflets, therefore the characters of the species appear well defined. See p. 423 l. 3.

Add. 2. Annularia calamitoides Schp. appears to be the species which is here (refer to A. Schoen.) described as A. longifolia Brgt.? There is a large number of specimens all presenting the same characters. Stem broad, branching like the branches themselves in opposite open divisions from more or less inflated and more or less distant articulations, covered in whorls of 14 to 16 leaves (sometimes) linear lanceolate, winter, in a slightly more enlarged upwards, varying in length, from the base to the point of the branches, often crowded and pressed together in half globular bundles. (2 centimeters at the base, slender like a calamite.) Generally the leaves are open, placed stellate around the stem, the median nerve is broad, broader still than in the true Annularia longifolia though the leaves are shorter. As said in the description, it is much like the Asterophyllites foliosa St. Hilaire as figured by Geinitz and probably the same as Annularia Calamitoides Schp. The leaves are flat, not recurved, apparently of a softer texture or more flexible than those of Annularia longifolia. Some Calamites (or ones belonging to this species; Cs. 59. from Mazon Creek, which answers by its characters to the description and figure of C. ramosus Brgt. with Cs. 60. In branch Cs 54 both sides of the stem and the point of attachement of all the leaves are seen by compression forming an oval circle visible as if the stem had been cut in two. The same character is remarked upon most of the specimens of Annularia with leaves and stems of this species. I have separated the forms which I refer to this species from what I consider as Asterophyllites foliosa Brgt. They differ by the larger size of An. calamitoides which has broader longer more obtuse leaves which, when crowded as they are generally

(note) I have a fragment of calamite with an opening den of this species with crowded leaves.

form broader tufts than Aster: foliosa. It will be necessary however to compare all these specimens with the proper species and see what he says about it.

D 1 Annularia Sphenophylloides Ung. Varies much in size, the leaflet being in specimens from Zanesville 13 mill. long while in some nodules of Mazon creek, the longest leaflets are only 4½ " long. This variety might be comparable to A. brevifolia? Brgt. which is unknown to me or to A. minuta Stern. see. but it is all the same species. The specification of specimen A 59, sp. 132c which is placed with Sphenophyllum angustifolium belong to this species. Un 3 seems to represent the unfolding top of a branch of this species? or some kind of fruiting branch like Asterophyllites tuberculata. In 3 a is a kind of fruit of the same appearance but it has a narrow stem or axis and the elements of fruit, a metal surrounded by scales or leaves curved inward, are apparently alternate on this narrow flexuous stem like unopened buds. See pl. 10 f. 13. A brevifolia Stern. see also A. sphenophylloides

ref. 2 Annularia Spinulosa Stern. According to Geinitz this is a var. of A. longifolia. We have three small specimens in nodules from Mazon creek referable to this species. The leaves are short, varying in length from 4 to 13 mill. enlarged in the middle, lanceolate forward and upward (flat. about 20° in a whorl) marked by a deep braced medial nerve and bearing at the point a short distinct spine. There is nothing intermediate between this form and the common form of Annularia longifolia. The leaves are quite linear but more lanceolate to the point, the medial nerves broader not flat but half round and marked on both sides by two deep lines or furrows. But except these three specimens all about of the same size we have nothing which would show the further development of this species which is therefore still uncertain. He represented a Annularia Spinulosa Stern. in the drawer of the twenty ears of Annularia and Sphenophyllites. 24.5.72. — In reviewing the specimen of Asterophyllites found upon both of shale A 15 & A 97 from Salem V. Tol. carbon & a nodal from Mazon creek which belong still to the species and complete the diagnosis. These fragment represent large portions of branches. In A 15 & A 97 the leaves are 3½ cent. long and in this last specimen they are crowded together in at the point of a new internode, the articulations being quite near each other and the leaves each forming therefore a tuft. All these leaves differ much from Annularia longifolia, not only by their flat border, they are narrower lanceolate taper pointed and distinguished by the departing of the medial nerve, slightly narrowed toward the base where they are united under a narrow, slightly oblique sinus: see pl. 15 They are narrower than in Annularia longifolia but still broader than in Asterophyllites, somewhat rigid, with the whorls of the branches quite open and the zone of the stem turned inward. I consider it as a good species. The width of the leaves is about the same in all very 2 mil. in the longest or the shortest. 26.5.72. D. 58 a half nodule from Mazon Creek also belongs to this species. It is also probable that the fine specimen A 99 from Mazon Creek which represents a tuft (terminal) of leaves more than 4 cent. longer forming apparently a group of distichous leaves decurrent upon a narrow branch or axis belongs to the same species. The articulations are not distinct and therefore this branch has rather the appearance of some coniferous species, a Walchia than of an Annularia. Traces of articulations however may be seen and the form of the leaves their flat border broader nerve and apiculate point seem to refer it to this species. It is put in the same drawer.

D 3 Annularia radiata Brgt.? Two small specimens A 28. from Sacken By seems referable to this species as figured in Geinitz Pl. 12 fig. 6 & 7. The leaves however are longer, less pointed and narrow. The specimens are too small and of course for certain determination. I have seen many whorls of it in subcongelmerat coal, especially in the shale of the mines Co. Coal near Sharon, Penna.

Dr Annularia longifolia. see Dept. on Grand Rapids p. 17 (3).

Asterophyllites gracilis fructiferus. N. 39 see plate specimen from Aldrich. Woodworth mine. The specimen is covered on the back with branches of this species especially a number of them fructiferous clearly seen when the stone is humected. These branches are slightly shorter and a little thicker than the sterile ones, two centimeters long two millimeters broad or a little more, bearing, more generally in their upper part only round small nutlets in the axils of the leaves as seen in fig. 5 & 5 a enlarged of my plate. As one side of the branches is seen, and there two or three of these corpuscules distinct, there is around the branches apparently 40 or 42 perhaps more of these nutlets which are exactly globular or rather flattened and as far as can be seen either sessile or attached by a very short pedicel in the axils of the leaves which are covered up as enclosing the nutlets. Whose diameter is about 3/4th of a millim. The leaves appear to be in whorls of six and therefore the nutlets are in the same number varying however according the thickness of the branches. The disposition of these seeds is the same as in the ear in Schimper Pal. Veg. pl. XXII fig. 7 which he refers to Annularia longifolia while Geinitz refers it to Asterophyllites equiseiformis. This last author appears to be right for the fragment of ear of this kind which I have published I cannot depart on Asterophyllites ovatus were found in N.W. Wood with fragments only of Asterophyllites see p. 426 a (2)

Dr 9 Annularia longifolia fructifera. Two ears of this species of Geinitz L 1632 & 1633 in nodules from Mazo Creek. I do not know as yet if the reference to Annularia is right. The description of these ear is given 425 (3) - Bupper L 1632 the tubercles are, some of them at least separated from the axis and bore upon the stone where they are flattened, their size having a diameter of exactly two millimeters and the surface being flat and without any marking. I counted these nutlets, as described p. 425 b as being free. In the specimen the upper part of the axis, 12 millim. broad is marked by five of these tubercles and therefore there would have be at least 10 around it. The same number is marked by depressions around the articulation of L 1633 whose axis is of the same width, the articulations being by millimeter distant deeply 10 to 12 robbed between the articulations

Dr. 3 Annularia Dawsoni? Schp. a new nov. Stem slender branched bearing whorls of 12-15 linear lanceolate leaflets from 3 to 12 millim. long narrowed slightly from the middle downward and lanceolate sharply acuminate upwards or rounded to a sharp acumen like a spine. The consistence is thick apparently coriaceous the midrib thick and double or with double border. The distance between the whorl is twelve millimeters same distance between the lower with large leaves and the upper ones with small leaves. I have two specimens of this on both without N. the other Dr 140 of Meriden. This means somewhat resembles by the form of its leaves Asterophyllites latifolia Dawson of which Schimper has made Annularia Dawsoni. The branches when are not quite of slender the leaflet more abruptly and acutely acuminate, two nerved. It somewhat resembles annularia latifolia in its small form but greatly differs by the small number of its leaflets which comparatively very broad narrow and long sharp acumen. See L 1836, 3a

D 1. Annularia inflata Sp. I have compared still and now, carefully the numerous specimens of this species with those of A. longifolia and find them perfectly and always distinct. We have now in the museum leaflets or branches of the different varieties or sizes of this species, corresponding with the forms and various sizes of A. longifolia: viz: short or younger branches with shorter leaves, and other with narrow leaves. From Newport we have the species also in various forms and quite far different by compression from A. longifolia, the leaflets being broadly obtuse at the top. In A. longifolia by compression they are acute. One small specimen from Mattollon has a finely characterized small branch of this species. We have it also only from Mazon Creek, Rhode Island and Mattollon. It is remarkable that though very abundant in the no doubt Mazon, we have no Annularia of any kind from the shales of Illinois. See 1 a.

Let. 2. Annularia? [illegible] specimens from Colmet there are two very small specimens. No 61. [illegible] Sphenophyllum [illegible] whorls [illegible] leaves, the whole scarcely broader than 3/4 mill. The central nerve is very upward pointed, from which [illegible] are seen diverging to the leaf [illegible] are simple, [illegible] slightly inflated to the point, simple except on which appears branching from the vein, and [illegible] nerve. The other specimen No 61 b from the same, nerve of branch [illegible] branching in two from below the middle or [illegible] in a Sphenophyllum. This bears a considerable one and is [illegible] well. I have no specimens. Annularia? No 61 b. is evidently another species. It represents part of a branch joining near the point, 5 mill. long 4 mill. wide, with articulations 3 mill. in distance, bearing whorls of short leaves no longer than the interval between the articulations, the leaves narrowed at base, curving in such a way that the convex point of the leaves come in contact with what I call a vein appears [illegible] shaped obtuse thick capsule and may be referable to some kind of Antholithes. These specimens are in the drawer of the undetermined fruit of Annularieæ.

To this form is referable No. 3 specimen from Gottwille.

3 Sphenophyllum folium Ser. A specimen from Mattis No 62 has of this species a branch eleven cent long with filiform leaves less than one mill. in the N. irregularly bent, slightly inflated at the nodes; articulations nearly 1 cent. meter distant with dry open leaflets, the lateral ones 6 to 7 millim. long the lower ones only three and a half millim., none turned upwards, all truncate at the top some deeply lacerated with three numerous veins ten to twelve at the top, ~~[illegible]~~ three or four apparently free at the base. This has a peculiar facies, all the leaflets being turned downward and laterally. This appears to be a good species.

D 1a. Annularia inflata Sp. A small specimen from Spring Creek in Gurley with 15 leaflets, the whole only 12 to 15 millim. in diameter with all the characters of the species. [illegible] 15 [illegible] 8 cent.

D 3 a from p. 423 c. (3) Annularia [illegible] Sp. nov. I have from Em. No 36 an annularia figured which has been by Mr. Dawson, Prof. and which I considered as A minut., Prof. a species which I do not find mentioned. It is the upper part of a branch deltoid in outline 6 cent wide at the lower part between the point of the secondary branches which are in right angle and 7 cent. long, the upper branch being simple. Whorls of the primary branches 11 mill distant with leaflets from 11 to 12 averaging 5 millim long, those of the branches four millim distant with leaflets 3 to 4 millim long, those bent outside or the lateral ones longer. All obtuse or rapidly obtusely pointed with ~~[illegible]~~ really so much distinct. It differs from Dawson species in Quat. Journ. (see my Contribution) by these leaflets more abruptly and obtusely pointed and is a true Annularia. There on the reverse of No 32 another specimen of this species with short buds from the secondary lateral branches with leaves still unfolding, the buds in right angle to the branches.

See p. 419 b. 2.

ble in the above mentioned figures, a close comparison with our species cannot be established. It is nevertheless evident that it does not represent the same plant as ours, as its stem, though striate, like a *Calamites*, is not marked like ours by any knots of the articulations. From the mode of division, the form and the size of its leaflets, this species of ours is a true *Annularia*. The one described and figured by Messrs. Lindley and Hutton as *Asterophyllites foliosus*, and which does not even resemble that of Geinitz, has linear lanceolate, pointed, narrower leaflets, and is not comparable to this, which I refer with doubt to *Annularia longifolia*, Brgt., considering it rather a distinct species, under the name of *Annularia calamitoides*, Schp. Prof. Schimper has published, in his Pal. Veget., p. 349, pl. xxvi, fig. 1, a new species which, though the leaves are narrower and more acute, is nearly related to this one, if not identical with it.

Annularia inflata, Sp. nov.

Pl. xx, fig. 1 to 3.

The essential difference which separates this species from *Annularia longifolia*, Brgt, consists in the form of the leaflets, which are ob-lanceolate, obtuse, subcylindrical or inflated upwards without trace of medial nerve, or with merely an obscure line indicating a central vessel, while the leaflets of *A. longifolia*, are flat, with recurved borders and marked by a thick, flat medial nerve. The difference in the form of the leaflets is seen in fig. 3 and 4, and their comparative sections, 3*b* and 4 *b*. The stem of this species does not appear as thick as in *A. longifolia*, and the branches come out in opposite direction from the middle of the whorls, or rather from above them, than from below.

The specimens figured are from the concretions of Mazon creek, where both species are abundant, and may be distinguished always by the same characters, without any form appearing intermediate. It may be that we have here two parts of the same species, one representing branches growing out of or above water under atmospheric influences, with dry, flat leaflets *A. longifolia*, the other, representing the floating part, sustained in water by bladderly-inflated leaflets, as shown in our species. But if it is so, it is peculiar that this, so different a form of a common species, has not been found elsewhere and described before.

Genus ASTEROPHYLLITES, Brgt.

Ill. Geol. Rep., vol. ii, p. 444.

Asterophyllites rigidus, Brgt.

Pl. xxi, fig. 4 and 4 *b*.

This species has been referred to *Asterophyllites longifolius?* Brgt, p. 444, vol. ii, of this Report. The whorls of the leaflets, very close to each other, indicate the top of a branch. The leaflets are about three inches long, not quite rigid, not open as in *A. rigidus*, but they are of a hard, solid texture, exactly linear, marked in the middle by a deep medial nerve, reflexed on the borders, canaliculate on the lower surface, thus presenting the true characters of *A. rigidus* as recognized by other and better specimens from the same locality—Mazon creek. The true *Asterophyllites longifolius*, Brgt., has been found on shales from Morris, by Mr. Jos. Even. It greatly differs from *A. rigidus* by its leaves, which are soft, flat, scarcely marked by the medial nerve, ascending along the stem and undulate, and by the narrower, nearly smooth stems and branches.

Asterophyllites grandis, Ll. and Hutt.

Foss. flora, i, Pl. xvii.

Found in fine specimens on the shales of the coal at Morris. Leaves still narrower, and whorls still more numerous than indicated by the description and plate of the English authors.

Asterophyllites foliosus, Ll. and Hutt.

Foss. flora, i, Pl. xxv.

Not rare in the concretions of Mazon creek.

Asterophyllites tuberculatus, Brod., p. 159.

In the shales at Morris.

d. Asterophyllites. — The remarks on the species of this genus are made without Schimper's Palaeontology and are therefore subject to revision. They apply especially to the species as described by Newberry and Fieldner. See Rept in Grand Riv. Mem. p. 17 (3).

1. no new Asterophyllites Cistii sp. nov.? Is comparable to Annularia Calamitoides Schp. but differs by narrower shorter, linear lanceolate pointed leaves, with a narrow medial nerve; from Asterophyllites equisetiformis it differs by broader and proportionally shorter whorls of only about 9 leaves and the soft substance of the leaves. It may be some variety either of Annularia Calamitoides or of Asterophyllites; but in all the specimens the characters are well marked: sp: A 31 from Romney, A. 100 from New Jersey, A 18 from Pottsville and A 27 from Hazleton: stem broad, smooth, ~~distantly and~~ distantly and obscurely ribbed, narrowly striate, distantly articulate; stems leaves erect, along the stem; branches open flexile; articulations about ¼ the distance of the length of the leaves which vary in size, diminishing of course toward the point. branches leaves in whorls of 9 to 14 leaves, open or slightly bent upward, but not curved, apparently soft, flat, linear lanceolate pointed, proportionally broader than in other species of Asterophyllites; medium length 15 mill 1½ mill. wide, mid nerve flat, narrow, indistinct. Specimen A 18 has on its back a Calamites, C. Cistii Brgt exactly answering Brongniart's description and which indeed differs from all the species of Calamites. It has also the character of the stem described from the other side of the specimen and therefore indicates this species of Asterophyllites which should be named A. Cistii as a new one. (27.5.72).

From an ear upon the back of specimen A 14. It is seen that the species (fruiting) which in the Report of Geol. Survey of Penn: p. 852 D named Asterophyllites lanceolata is the fruiting part of this species. These fruits are narrowed to the base into a short pedicel, varying in width, including the scales from one to 2½ cent; articulations close to each other, not more than 5 to 8 cent distant, scales narrow, united to half their length; linear lanceolate pointed twice as long as the articulations, present in any specimens to 2½ cent ~~[illegible]~~ with their divisions of the same form and character as the leaves, closing together by their point at the top of the ears. Though one of the specimens has the lower part of the ear denudated from its scale, there is nothing seen under them to indicate the form and nature of the organs which they cover. They apparently are powdery matter, perhaps, pollen. For this reason I considered them as male flowers. See p. 424 c 16.

2. Asterophyllites sublaevis Lesq. The species as described and figured in Penn. Geol. Report is good but it is too briefly described or with sufficient clearness. Stems are broad, smooth, without trace of striae with articulations comparatively at a short distance, marked by whorls of linear lanceolate ~~[illegible]~~ comparatively broad erect leaves. Branches short with a thick stem, short broad, open or erect leaves lanceolate pointed, sometimes curved inward; whorls few leaved, 10 to 12 leaflets. Species well defined by its comparatively short leaves, broader at base merely lanceolate (not linear) and its thick stem and branches which appear smooth, not striate. This also different from its related species by the small number of its leaflets and the closely approached articulations of its branches. Stem about 1 inch wide has the articulations 1¼ inches distant; branches 1/3 of an inch wide have articulations at the same distance of 1/3 of an inch (27.5.72.) This species is common upon the shale of Newport Bead R.I. but there is not any large stem or calamite seen in connection with it specimens. The large stem seen in that marble above, about 1 inch thick. I have on specimen from Cannelton No 255 branches 6 cents thick articulation 15 mill distant.

3. Asterophyllites equisetiformis Schl. & A. grandis Stbg. The difference between these two species is not easily recognized and perhaps they must be united in one as has been done by some author. The specimens which I designate as representing A. equisetiformis have the leaflets somewhat shorter and broader either open or erected but not arched upward as in those which I consider as of A. grandis ~~[illegible]~~ less numerous.

424c. in the specimens of the species. A. grandis the stems are large, one inch wide, with distant articulations, marked in the under part by oval wrinkled tubercles distinctly equally strict with obtuse broad ribs separated by equally obtuse broad sulci. The coaly epidermis is particularly like a bag of paper and smooth. Under it the surface is equally so. It commences the description of Calamites Suckowi except that the intervals or furrows between the costa are as obtuse and as broad as the back of the costa. It will be necessary to see Schimper about these two species. In A. equisetiformis or in the specimens which I consider as the species the stem is really smooth or really marked by undulations running from one articulation to the other. As can be seen in sp. A 109 the back of A. equisetiformis or of that stem is twice as thick as in A. grandis. 27/5/72

16 no Asterophyllites Listeri as marked above appears to be A. foliosa L. & H. as described by Schimper Pal. 1. p. 326. It agrees about exactly and from remains it is seen that Schimper unites this species with A. equisetiformis & Calamites Listeri. Compare this with Schimper's plates which I have not got. Reviewed again. Annularia foliosa and the Asterophyllites are different. See 1°.

D/1 Asterophyllites longifolia Brgt. The species from our specimens is recognized by its very linear narrow leaves, with a mid rib or nerve by more distant articulations. The bracts are not as regular nor as much arched as in the following species. Except the regularity of the leaves, the bracteoles however are not exactly marked. Schimper says of A. equisetiformis that it has the medial nerve very narrow while in specimen shown it as broad as in the previous species. ~~Review again. Annularia foliosa and the.~~

D/5 Asterophyllites uralo Trgl. In this species I refer the Sonerian specimens with long narrow uralo leaves more or less curved upwards sometimes very long and narrow as in spec. A 46. Whose leaves are about 4 inches long, curved upwards, arched in such manner that the forms come nearly together. These leaves have a channelled back medial nerve or are nervulated but the nerve is not percurrent as in Schimper says. Nervulation broad as in the former species. From his remarks in Geinitz fig. of this species that in figure 8 is and appurtenin to Asterophyllites longifolius & lenuifolia, our specimen A 46 marked above should belong to this quoted var. which is not at all described in his text. In the remarks of him afterward upon A. tenuifolia Germ. but more confounds the question. Le Bruckmannia longifolia Hern. of fig 1 tab 58. is by its earlier title our specimen of A. longifolia but has not as regular leaves and not as curved. However this specimen by its narrow leaves and nearly flat ribs or nerves might be referred with A 115 to longifolius. Little the specimen figured in the Sep. of Mb. this vol. p. 21 fig. 4. I do not think however on first thought this is right. See p. 427 & 2.

6 D Asterophyllites grandis var delicatula. This variety is represented by a number of specimens from Newport. It is probably A. delicatula Brgt. as called by Schimper Pal. reg. p. 325 as var. of Asterophyllites grandis. In all these specimens the leaves are narrow as in A. grandis and generally shorter. There are however branches which bear leaves as long as those of the common form. I separate these specimens as a new variety.

7 D Asterophyllites gracilis Dgn as figured and described in Arts. vol. p. 310 fig 4 & 4a is a good species evidently identical with what Dawson has published in Precursor. Foss. Flora. Canad. Nat. May 1861. 2. 8 as Asterophyllites parvula. In the Arts. report it is in 1860. Hence is secure priority. I consider this species as a good one. We have it from various places, with the coal measures. See description in Arts. of the specimens is specimen A 30 shows the form of the base as narrowed downward from the middle and upward ~~to the point~~ slightly enlarged to an obtuse point in apex. A 30 and may indicate another species though the upturned leaves are of the same size and the whole stem also the bracts are scarcely perceptible with naked eyes. From Rost. Pal. vol 18. this A. delicatula Brgt. See also Asterophyllites Saunersii Hea. Pl. XVIII fig. 4. quite unlike the specimen. 17 Comparing again Asterophyllites (Annularia) foliosa and Asterophyllites Listeri I find from the former the first is an annularia with cross branches, pointed leaves and three nervulated nerves. The other is an Asterophyllites irregularly branching with linear, narrow and all leaves more bunched at the joint. The upper long divided to two to four leaves. The medial nerve is very narrow, nearly perceptible with the eye. See Asterophyllites grandis etc. 677 &

See letter post dated 423.01.

Fruits of Asterophyllites.

Calamostachys Ludw. Weissmania Stur.

1 Calamostachys major Ger. One specimen from W. Wood A. 7 b. is same as the figures and description of this species in Geinitz Ver. Sachs. pl 32, fig. 5, 6, 7, much like what I consider as fruit of Asterophyllites Castor but with shorter less numerous tracts. Specimen incomplete. is macrostachya.

2 Asterophyllites apertus Sgy. The description and figure of this species in Geinitz Rep. carbonif. p. 352, pl. 1, fig. 4 are not satisfactory. Stem form as yet undescribed resembles a Rhonophyllum. The naked axis 5 mill wide is marked by equal smooth striae like that of a Sphenophyllum, articulated at the same distance as the width of the axis or branch, slightly inflated marked between each striae at the articulations (6 striae are visible) by small brown points indicating marks of the point of attachement of leaves or scales. These leaves are short broadly lunate, apparently united together forming sheaths which are open though curved upwards and overlapping each others. I can compare this to nothing published as yet. The space between the whorls does not appear to contain any nutlets or substance looking like fructification and the species can is too broad and too long to consider it as a stem of Sphenophyllum. The part seen a mere fragment is 5 1/4 inches long, perfectly linear and equal, 3/4th of an inch wide including the leaves or scales, whose borders appear lunate-crenulate. 29.5.72. We have two specimens counterpart of a triad sp. A 6.

3 Annularia longifolia fruit? We have a number of specimens from Mazon creek. A 49, A 143 & 144 which are very good and show the details of the species. This the same species which I gave in the Geol. Rep. as small brother specimen in Asterophyllites crassicaules. The length and width of the ears are as described in Dawson's Geol. The nutlets at the ends of the ears are in 4 of whole whorls, the point toward the axis; their internal structure might perhaps be studied with microscope even on some of the specimens of Mazon creek. In the specimen A 20 from Gobles, the ovules appear either oval or rounded outside. The leaves which as sheaths surround the stem and enclose the fruit are very numerous, narrow linear bordered, curved inward, nerved, about twice as long as the articulations. Given Bonsall there is in the museum a specimen of a cone in 58 which I expect with much doubt to this species. It is 17 centim. long a little more than one cent. wide, articulations distant only 4 p mill.; sacti-ears very narrow and numerous not having convex sides ascending upward, longer than twice the distance between the articulations; ovules none or none visible. From 4 centimeters below the top, the leaves become apparently fixed together and against the stem as if the nutlets had there not been formed and fruit point both till the top of a large branch of Asterophyllites. Enough to point to representing fruit of Annularia this species appear different from long folia.

4 Asterophyllites ovalis Sgy. I do not know to what species the multifoliate are referable. I call may be still Annularia longifolia. The axis is not [illegible] the ferrule, [illegible] circular; fruit; the ovules more shorter broader with a deep median furrow and the ovules round smaller or two ones. specimens A 13 & 14c are of the same size with still narrower ears more crenulated and apiculate leaves. A 25 is towards or to be obscure. I match them all under the name of Asterophyllites ovalis. The ears are only 3 to 4 cent long and only 1/4 cent wide. May be fructifications of Annularia sphenophylloides. Compare fruit. Ears are comparable to the ear in fruit of Sphenophyllum cuneifolium, pl 17, fig 3. as Asterophyllites equisetiformis. Of this species we have a specimen; A 124 which comes from Mazon creek, whose internal structure may be studied and described.

5 Asterophyllites tuberculatus Stur. Schimper considers this as the fruit of A. longifolia. All our specimens or most of them are from W. Wood where Asterophyllites equisetiformis is found and no specimen of A. longifolia has yet been found in the Anthracite coal basin. It is perhaps a variety of Asterophyllites. What Schimper means by Calamostachys major. These specimens are also the drawer of undetermined fruits of Asterophyllites? See p. 362. & 426 Calamostachys.

Asterophyllites ovalis see p 426c (1)

425, 6. 1 Equisetites occidentalis Lesq. Compare E. ligulatus Germ. Mass. 2 p. 27 tab. X.
" Diaphragma oblique planum schistosum penetrat and minus perspicue singulas ejus
" partes oculis profert. adest autem caulis, adsunt folia basi in involucrum coalita.
" Folia lanceolata longitudinem 6 linearum attingunt, involucrum diametrum 3 linearum
" fere excedit et folia Equisetaceorum nostra et longitudine et latitudine longe superant.
" Caulem cæt. cæteris fusses credere fas est. Our species is related to that of German
but distinct by the large size of the vagina, and by the thick nerve which marks the division
and descend to the base of the vagina. It may be the same species nevertheless. It still
differs by the veinlets which descend smaller to the medial nerve. But there are only
distinct in some specimens. We have from Mayo creek a very large number of
specimens referable to E. occidentalis. most of them showing a mere part of the
sheath with three divisions. In three of them the sheaths are about entire. No speci-
men is found at Mayo creek of the ear of Equisetum infundibuliforme except one
piece described here below. But of E. occidentale we have a fruiting ear? E. 1. and
roots? St. 54. & St. 53. - What I refer as fruiting ear to Equisetites Occidentalis
is an oblongical body originally cylindrical? flattened in the stone, 7 centim. long
13 mill. wide at its base, 25 mill wide at its upper end where it bear sheaths of the
form as that of pl. 21 fig. 5 though shorter. the part denudated of scale is marked
across by strong wrinkles or rough costæ often interrupted and therefore not exactly
parallel. as in p. 129. fig. 1. The space between these horizontal costa are marked by
thin lines in Calamites which are continuous across the costa and are seen
passing above them. This may represent the young shoot of a whole specimen
E. 2. represent about the same part but the stem is smooth nor wrinkled and
attenuated at one like a branch. I refer St. 53 & St. 54 to roots of the specim
This last specimen represent the diaphragme of a cylindrical stem 3 cent. wide on the
borders of which the recurved base of broad costa are seen and from which divers
thin little cylindrical irregularly striate branches not articulate, without leaves
whose appearance and consistance is that of roots of Calamites as figured by Schimper.
These specimens may represent merely roots of Calamites. Of sheaths like that
figured loc. cit. the mass has gone still in a better state of preservation as the specimen
figured presenting exactly the same character. One of the specimen E. 7 has the division
of the sheaths broader and evidently striate or reined parallel to the medial nerve
but it appears to show the outside part of the sheath while the other shows the inside.
2. Equisetites infundibuliformis Gein. We have of this species two large part of
stems or ears less than figured by Geinitz Tab. 8, fig. 5 and one starlike
nodus like fig. 7 of the same plate. Does Geinitz cette empreint should
represent the upper part of the cross section of an ear? But apparently our specim
E 23 is something else. It is a star with 28 rays 11 mill. long united to near the
point where they divide into a short abrupt point. the middle of each ray is
marked by a strong nerve. The specimen is perfectly well preserved and shows
evidently the sheath of a Equisetites. See 426. 4.
D3 Equisetites ? Two small specimens representing part of sheaths or
leaves which appear to surround a stem being united from the middle upward
and then taper pointed. point sharp. Each of the teeth has a medial nerve descending
to the base of the sheath which is only 12 mill broad see figure p. 529 fig. 2. The
base appear marked by three small tubercules at the base of the nerves. I think that
something of this kind has been published in the Palaeontographica? 28. show
leaves of the same kind surrounding a narrow axis and apparently a Lepidostrobus?
The blade being glued on the borders. See description in Lepidostrobus p. 440 pl. 23
D4 Equisetites ? Spec. E. 28 a half nodus from Mayo. Looks like the base of an
Equisetites part of stem 7 & a m. long 23 mill wide marked equal flat ribs or furrow
3 mill. wide with a narrow furrow and having at its base and on both side what appears to
be large tubercles and in the middle a row of small wide with a long appearance of tubercles
small round tubercles

GENUS EQUISETITES, Sternb., Vers. ii, pl. 43.

Stem fistulose, cylindrical, striate lengthwise, articulate, simple or branching at the sheathing articulation, sheaths attached under the articulations, erect, dentate.

EQUISETITES OCCIDENTALIS, Sp. nov.

Pl. xx, fig. 5.

WE have only one sheath of this species, the first trace of a true *Equisetites* found in the Coal Measures of this continent. The sheath is open or unfolded, somewhat broken in the middle, about three inches across, two inches long, regularly divided to about the middle by lanceolate, obtusely pointed teeth, marked by a strong nerve, which descends from the point of the teeth to the base of the sheath. The surface in the middle and between these nerves is irregularly wrinkled, and the base, in the line of connection with the stem, is marked by regular, half round notches, corresponding evidently with the striæ of the stem.

The specimen is from Mazon creek, a concretion where this part of the plant is distinctly preserved. Another specimen from the same locality, but in a bad state of preservation, contains also fragments of an *Equisetites*, whose specific relation cannot be recognized. It has the remains of a stem about one inch in diameter, with a lacerate sheath.

SELAGINIÆ, Endl.

Genus LYCOPODITES, Brgt.

Ill. Geol. Rept., vol. ii, p. 447.

Lycopodites annulariæfolius, Sp. nov.

Pl. xxi, fig 5.

Stem round, as seen in fig. 5 dichotomous, bearing opposite leaves, apparently united by two at the base, half embracing and slightly decurrent; leaves linear-lanceolate, obtusely pointed, slightly narrowed to the base, marked with a medial nerve, disappearing above the middle, open or slightly reflexed.

The mode of branching of this species, by a peculiar kind of dichotomy observable in some *Lycopodiaceæ* of our time, the *Ruelliæ*, for example, indicates the nature of this peculiar plant. It is not quite evident that the leaves are approached by pairs, and placed in two parallel rows or distichous; the specimen shows nothing more definite than what is represented by the figure.

No species of *Lycopodites* of the Coal Measures has been as yet published having leaves of the same form and type as ours; the only one somewhat comparable to it is *Lycopodites macrophyllus*, Gold. Flor. Saar., i, p. 12, pl. 1, fig. 5.

On a concretion from Mazon creek; in the cabinet of Prof. A. H. Worthen.

Lycopodites Meekii, Sp. nov.

Pl. xxvi, fig. 6 and 6*a*.

Stem very slender, about one-sixth of an inch thick toward the base, dichotomous, with continuous, elongated branches, scarcely diminishing upwards; leaves imbricated all around, narrow, linear, lanceolate, acute, erect, or slightly open and curving upwards at the point. As seen, fig. 6*a* enlarged, these small leaves are thick, concave on the inside, sharply pointed, not enlarged, but semi-embracing at the base, and without trace of a nerve.

1 Lycopodites Meekii Lesq. Beside the specimen Sy 7 on which this species is formed, I refer to it a number of others mostly from Mon. which appear to belong to the species I have, then from Cincinnati & Waite and include leaves as in L. cariofolius. The Sy Report which I have not on hand, and especially Sy 1 & Sy 2 which I shall refer by L. cariofolius. But they are obscure and perhaps mere varieties of the common form. In a large specimen Sy 11 the leaves appear to have a thick though obscure medial nerve. Compare figure of L. cariofolius which may be referable to this.

2 Selaginites unicinnatus Lesq. Cincinnati has put this species with the Rhizomopteris as R. unicinnus Schp. but I doubt that it represents part of a rhizome. Some of the branches, the primary ones, though it represent rather a creeping than an erect form, are somewhat thicker but the division become very slender and no rhizome branches in that way preserving leaves &c. The leaves are thickly crowded, linear lanceolate pointed, apparently longer than in Selaginites Erdmanni as figured in Geinitz. It must be said however that in all our specimens it is mixed with branches of them. But the same specimen have also leaves of Lepidodendron, stigmaria branches of Palamites &c.

3 Lycopodites stachys. spined. spec. Sy 4. double specimen from Indiana. stem ribbed or striated carried 8 mill wide nearly of the same size in its whole length 18 & 20 decim. covered with closely appressed and imbricated lanceolate or linear lanceolate leaves of a thick texture about 8 mill long, pointed. In the upper part, the stem bears on one side inclined ears, 4 mill broad, three cent. long which appears to be organs of fructification and thus the plant is a true Lycopodium. The ears are covered with short more open leaves or scales than the stem. They appear to cover pulverulent glomerules; but the specimen is not distinct enough to ascertain their nature and position. This plant was the only one found in the shales of Black Creek near Indiana near New Harmony. These shales are covered with shells and remains of fishes.

4 Equisetites Infundibuliformis Sch. I have received June 23 a fine stem & part of stem of the species from Mazon Creek. It is in my Collection marks. 33 34 Presented by J. Stern

5 Calamostachys (macrostachys) Two specimens with a narrow axis 6 millim broad articulations 4 mill. distant bearing erect open narrow scales a little more than 1 millim broad long diverging imbricated, broken, forming an ear 2½ cent. broad, the scales apparently linear lanceolat pointed. This may be the same as Calamostachys foliosus fig. by Geinitz. But the ears are twice as broad and more resembling the fragment of the same author named Calamites approximatus, pl. XI fig 4. Another specimen finely preserved of this species No 25a. has the ear 2½ cent. long the axis 8 mill thick & broad the articulations 5 mill. distant. The scales closely imbricated or appressed, united in their whole length, abruptly pointed & thickened on the borders not longer than the articulations, slightly curved outside along the border. The ear is entirely preserved 10½ cent. long resembling an ear of Lepidostrobus but with the scales all around the articulations and not imbricated in spiral. This ear may be Asterophyllites tuberculat. L. & H. or Asterophyllites foliosus L. & H. as figured by Geinitz. It especially resembles the fragment figured by Schimper Val. rey. Pl XXIII, fig. 15–17. which he names macrostachys infundibuliformis and considers as ears of Equisetites infundibuliformis, But copied from Germ. Vert. fig. 12 2 = fig. 16 & 17 of Schp. named by German Huttonia carinata Fig 3 = fig. 18 of Schp. marked by Gutbrier as Equisetum infundibuliforme var. B. Now this ear may be the same as my Asterophyllites tuberculatus lanceolatus and apert. of the Germ. Report. which have all been found in a rock where

Asterophyllites equisetiformis was very common and where there was not any trace of Equisetum infundibuliforme. Specimens from Carnelton where they appear common are also found in shales with the same asterophyllites and Annularia longifolia and there is not as yet any Equisetum remains found. Their reference is therefore very uncertain. The form of the scales however does not compare exactly with any of the figures of Schimper and Germar, nor with Geinitz's asterophyllites foliosus, which is the same as Wollmannia gracilis, Hemb; nor with Asterophyllites tuberculata of Hull. Still less with W. polystachia Hemb. Peut-être Wollmannia major qui commence dit Schimper ressemblent à quelques épis de Lepidodendron mais à different par leurs articulations regulières. La forme des écailles est differente dans notre espèce qui devrait aussi constituer une espèce nouvelle, celle de Germar correspond and à mon Asterophyllites lanceolata du Penn. Report. (1) See p. 427c (3). See Geinitz sign: Thes

1) Asterophyllites ovalis Lesq. Two specimens from Mazon Creek got from Throg. No. 1634 & 1635 represent branches of this species. The broadest part of the stem is two cent broad; stems irregularly striated or nearly smooth, articulated. articulations 14 millim. distant with opposite or verticillate branches or leaves, diverging nearly in right angle, narrow, three cent long, but becoming shorter with each articulation, six in number; the axis is about 2 millim broad, closely articulated, articulations 3 mill distant, bearing a whorl of linear narrow pointed leaflets, either straight out from the articulation in right angle to them or curved up, bearing in the axils four oval nutlets, alternate at each articulation in such a way that by compression upon the stem there are seen upon the lower articulation and one only upon that above or three on one side of the axis and only one on the other. These nutlets are 1½ mill broad and 2 mill long. The leaves at the articulations of the stem are three millim long not even half a millimeter broad and of the same length and width upon the articulations of the nutlets or upon the axis. This is exactly what I have published as Asterophyllites ovalis. I consider it still as part of Asterophyllites. It has the same character as A. gracilis, differing merely by the double large size. The branch No. 1635 has the nutlet second nearly globular and the leaves somewhat broader and longer and more open. Figure this. I have figured a second specimen (2) from 110 on from specimens presented by Dr Britts from Clinton representing a form apparently new Asterophyllites as ovalis which has exactly the same characters as A. gracilis (figures) from Aldrich specimens but which is at least twice large in all its part. In some specimens it appears bushy branching fig 2. with branches irregularly distributed, the largest eight millimeters broad at the articulations which are distinctly inflated (1), obtusely striate or rather furrowed, smooth, with articulations very variable in distance from three to 10 millimeters. Fig. 3 differs by its mode of branching from that of the other specimens. There have their branches mostly dichotomous while in fig. 3 they are in a whorl below the leaves or rather opposite to the articulation of the main rachis. More distant from the branches bearing leaves all of them same as the other specimens are very short. It is not possible to doubt identity of these different specimens as both fig 2 & 3 bear some nutlets here and there attached above the leaves as they are seen in fig 4. The leaves are all of the same type, four and comparative three four millimeters long and 3/4 of a millimeter broad at the base, erected by the whole base and gradually tapering to a sharp point, joined at the corners and covered at the back by a small inflation of oval like a bubble or mamelle curved upward fig 1 a. The seeds are either upon branches as in fig 4 and fall easily as most of the seeds of these specimens fig 2 & 3 are detached; fig 2 has some of them shown

(1) By the inflation of the articulations and the size it differs from A. gracilis. see p. 427c

upon the shale, or closely placed in small whorls or verts. fig 5 which are attached apparently to the side of the branches by a short curved branch. In the first case the leaves are normal or longer and more distinct; in the second they are short and their points seemingly pressed to the fructifications and scarcely discernable. At seen figs 4a & 4b. enlarged, the seeds are oval narrowed into a point apparently the short pedicel joining them to the rachis. The mode of nervation of fig 2 is not really an anomaly. The branches are really from the articulations and by the abortion of the others they are left single and by compression of growth appear like dichotomous. This is clearly seen in the small specimen. Aster. gracilis figured upon another plat. The leaves are obscurely linear & deeply nerved upon the bark or marked by a blood scarcely visible nervation. The bark of the branches and stems is thick at least appears to be thick flakes of coal, rather smooth.

1. Asterophyllites foliosus. Geim. N. 3. of Dutts represent a whorl of leaves of this species. It has fourteen leaflets slightly and gradually enlarging from the base to the middle and then gradually tapering to a sharp acumen. Schimper refers this species to Calamites suckowii Brgt. This is certainly erroneous for that Calamite is extremely common in N. America Coal measures while this A. foliosus is very rare. Dr. Lesquereux says in this vol. p. 424 that it is common in the concretions of Mazon creek. But most of what I have referred to this species is more evidently related to what Schimper names Annularia Calamitoides.

2 Asterophyllites rigidus. ? Brgt. Specimen 334 of Lewis Brown Colliery represents an Asterophyllite with very close inflated articulations no more than two millimeters distant with whorls of very narrow deeply nerved leaves three to five centimeters long no more than 1 millim broad straight outward nearly in right angles the narrow stem scarcely half a cent broad close and heaped together looking like a branch of lepidodendron covered with narrow leaves. This is also apparently referable to A. rigidus. Another specimen with the leaves quite as crowded but erect has the leaves very rigid 8 ½ centimeters long or more and same width not more than one millim. The articulations are hidden by the leaves.

(3) Calamostachys infundibuliformis. is represented by a large number of specimens and now I believe as Schimper does that they are referable to Equisetites infundibuliformis whose stem has been found at Cannelton in three well preserved specimens of which I have one. The largest specimens of these Calamostachys are 15 cent long. I have figured part of one of the largest on an enlarged scale of the smaller I have still to figure a cross section which I take with me. See Geinitz about Equisetites rigidus which he makes same as Calamostachys. Spec. Mca. 364 is a fragment of a scaly stem scars 26 mill. wide.

4 Equisetites priscus. Geim. See a large specimen or rather a small stem or part of stem with very long branches placed star like. This specimen comes probably from the Coal but I do not know the locality. Compare Geinitz. not described. I prescind Geim in macrostachys infundibuliformis

5 Calamostachys melongena. Spec. of Lewis Tot (731) Rhizome [illegible] fibrous [illegible] long 14 cent. 7 to 8 millim broad when flattened, leaves approximate in whorls 2 mill. distant, linear obtuse [illegible] nearly narrowed at the base [illegible] in the 30 mill. length. It seems to me to doubt the reference of this species to Calamostachys. It positively differs from C. major by the linear [illegible] leaves the top of the scales distinctly obtuse and the great length of the [illegible] in flowers. See for this species in its relation to Asterophyllites foliosus p 419 & 1.

427 b.

(1) Calamostachys. Schp. There is evidently many species of this genus. I have from Decoe specimens N 212 to 215 and 221 and 222, which represent small ears of this genus intermediate for the size between C. Suckowiana Schp. Atlas pl XXIII fig. 11 & C. typica fig 1 of the same plate. They must resemble by the form the fruits of Calamodendron commune? as figured in Note et of Binney in pamphlet but are larger 37 millimeters long some a little shorter 1 centimeter broad narrowly oblong oval round pointed at the top narrowed to the pelvole with close rows of appressed lanceolat acuminat scales keeled on the back connected or joined half their length or more. It should be named. It is smaller than any seen from our Coal measures until now. I have figured N 215 under the name of Cal. minor. This can not be a var of C. typica.

2 Asterophyllites anthracinus Heer Pl. Helv. 3 p. 50 Pl. 12 f. 2-3 Specimen Mar 354.
This species agree in ~~st~~ character with Heer's description articulation very close three and an half to four millimeter distant in the whole length of the branch leaves at least twice as long as the articulation linear lanceolat to the sharp acumen, somewhat narrower at the base, the rib without trace of medial vein. Merely differs by the leaves ~~straight~~, not curved.

This extremely fine and delicate *Lycopodites* may be compared to the upper branches of *Lepidodendron selaginoides*, Sternb., as figured by Ll. and Hutt., vol. 1, tab. 12; and also to *Lycopodites Stichlerianus*, Gopp., Silurian, p 170, tab. 25. In our specios the stem is longer, more slender; the leaves narrower and proportionally longer, and the ramification different.

On the roof shales of the coal at Morris.

Genus SCHUTZIA, Goppert, Permian Flora, p. 161.

Stems either single or branching, bearing on short alternate pedicels small cones or strobiles of an ovate truncate form, a compound of imbricate, broadly linear pointed scales, united at the base.

Schutzia bracteata, Sp. nov.

Pl. xxi, fig. 6 to 9.

Stem proportionally thick, smooth, bearing alternate short pediceled cones or strobiles, about half an inch long, enlarged ovate from a narrow base, truncate at the top, slightly turned upwards, placed at the axil of a narrow linear bractlet, about one inch long and curved upwards. The cone is a compound of lanceolate pointed, concave scales, placed in spiral, closely imbricated and pressed upon one another, fig. 7 and 8; covering a transparent, yellowish membrane, formed of small, elongated, equilateral meshes: fig. 9, which enclose or support small granules of opaque, brown matter. These granules, scarcely the one-hundreth part of a millimeter in diameter, are of a roundish, irregular, polygonal form, agglomerated and separating with difficulty. Their size and irregularity of form prevent considering them as spores; they look rather like grains of pollen.

From the great difference in the form of the buds born on the stem, which cannot be accounted for, I think, by difference in maturity, it would appear as if the scape of this plant was bearing monœcious flowers, the ones in strobiles bearing pollen, the other fertile buds. These, as seen in *a*, fig. 6, have the appearance of an inflated receptacle, either naked or bordered at its top by foliaceous, narrow divisions. Two specimens of this plant have been found in the

concretions of Mazon creek, and both present the same appearance. Some plants resembling ours have been described under the generic name of *Antholithes.* But this genus is still indefinite, and the plants referred to it really unknown. I have, therefore, placed this species for description in this new genus of Goppert, as more related to it by some of its characters.

Genus Lepidodendron, Sternb.

Ill. Geol. Report, vol. ii, p. 451.

The species of this genus, as it is well known, are characterized merely by the form of the cicatrices, which have been left by the base of the leaves upon the bark of the trees or of their branches. These cicatrices or bolsters vary indeed in size and also in their relative position, according to the thickness of the different parts of a tree, where they are examined. But this variety is far from being as marked as some authors, who have attempted to reduce the species to two or three, seem to suppose it. In following the course of the development of these scars on long stems of *Lepidodendron*, from parts measuring at least one foot in diameter to the smallest branches, they may be seen to vary in size and position according to the degree of activity of the vegetation at different times, and also on account of some irregular mode of growth; but their essential characters, viz.: their outline, the position of the vascular points, as also the form of the leaf scars surrounding them, is generally preserved and recognizable in the whole length of the stem. It is argued that for the genus *Lepidodendron*, we should have too large a number of species if we would consider the scars as specific characters. But the genus *Sigillaria*, so admirably studied by Prof. Brongniart, and after him by the most careful Palæontologists, especially by Goldenberg, whose acuteness of observation is beyond question, has a number of acknowledged species, at least double of those of the genus *Lepidodendron.* Goldenberg describes sixty-seven species of *Sigillaria!* and yet the specific characters are taken from the same vegetable organs, or from the cicatrices of the bark, which are certainly as much subject to variations in *Sigillaria* as in *Lepidodendron.* Why, then, deny the value of the species of one genus, and admit the reality of those of the other. The most marked species of *Lepidodendron* of our American coal fields, *L. modulatum*, *L. giganteum*, *L. clypeatum*, *L. vestitum*, *L. distans*, published in the Geological Report of Penna., have been found over the whole extent of our Coal Measures, and are recognized everywhere by their distinct characters from the form of their cicatrices. In collecting specimens on shale, for the State Cabinet, great care has been taken in comparing the largest possible number of specimens of the same species at the same place, not only to obtain the different

See synonyms in Schimper. I follow his nomenclature

1. Lepidodendron rhombicum Gres. I have a large number of small specimens, leaves and scars referable to this species as well as to L. angulatum and perhaps L. quadratum as figured in Sternb. 2 pl. 68 fig 18, 17 & 19. Branches narrow & wiry covered with compressed & rounded flat or channeled pointed lanceolate leaves, nerved & long, about one inch long & rather rigid & shorter in the narrow often undistinct, ended a point, with L. delphinodes. Cicatrices & decorticated marks & cicatrices in the specimen of pl. 18 are of only slightly more elongated form as to the second species. All the specimens from Brier Branch of Casey Hy.

2 Lepidodendron marginatum Prest. Stems as at pl. 68 fig 16. Leaves curved inwards longer than in the former sp. linear pointed, distinctly nerved. Cicatrices wider set up and down, varying in form, large with a point at and under it also a small triangular of scar which disappears when the cicatrices become larger. See figure 4 p 520.

3 Lepidodendron Glaginodes Stern. Leaves longer than in No 1. curved inwards in the same way but not quite so much, more rigid, deciduous. In one specimen L 51 from Mt Pleasant it is always associated with Lepidophyllum brevifolium Lsqx.

4 Lepidodendron quadratum Stern. A small specimen L 37 with stigmaria loc? is exactly the species as fig. Sternb. loc cit. pl 68 Fig. 19.

5 Lepidodendron Sternbergii Bng. numerous specimens especially from Morris, stems with leaves as also stems without and with large scars = L. rugosum Sandbg.

6 Lepidodendron modulatum Lsqx. is a species intermediate between L. Sternbergii & L. aculeatum Prest. From the former it differs by its leaves, by internodes, &c and from the following to which it resembles most by its broad cicatrices and the vascular scar placed lower. These scars are also smaller and of a different form.

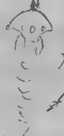
7 Lepidodendron aculeatum Stern. Good and well preserved specimens of this species both corticated and decorticated. One of one specimen L 99 shows it still with the leaves, though the scars are already large 2 centim. long and 8 millim broad. These leaves are rigid exactly straight, horizontal to the stem or nearly at right angle, narrow, two and a half millim, channeled, with a thick medial nerve, more than 16 centim long, as much as can be seen from another specimen from Newport. L 119 a remarkable species. We have also specimens decorticated Lepidodendron appendiculatum Sternb. and one L 118 which is exactly like L. caudatum in Sternb 2 pl 68 fig 7. I refer L 122 to the same species on account of the leaves rigid &c. of all the characters of this species. The species is common in the anthracite of Penna!

8 Lepidodendron Morrisianum Lsqx. Third. P. 430 pl 22 fig 1 & 2. We have only the leaves of this species but they are very remarkable and easily identified. The figure which I gave of these leaves (enlarged) loc cit. fig 2. is not good. The leaves are very long, more than one foot. (none is seen to the point) from the base 5½ millim broad, six nerved, or rather three veined on each side of the medial nerve, there being a vein here of the medial nerve first a vein and then a bend of folding with the medial vein on each side preventing the appearance and section of the leaves as flattened is extremely variable and capable of ascertaining its change. Near the point of the leaf the medial nerve is obsolete and has two broad nerves on each side. I have not seen as figured in the report. A specimen L 95 has with many leaves, some scars referable to Lepidodendron aculeatum but these leaves do not belong to it: there are other leaves of the same character as those of that species. See Rothl. Sal. Bd 18 pl XI fig 2 same species as Lepidodendron dichotomum with compressed leaves as in my L. rigidum & L. morisianum.

9 Lepidodendron politum Lsqx. The Geol Rep. of Hy see description. Distantly related to L. Sternbergii but very distinct and well named being entirely smooth. The three vascular point are very broad.

10 Lepidodendron simplex Lsqx. It may be L. rimosum Sternb. but it differs by the characters given in the Ill's Report. I consider the Decorticated or corticated specimens L 92 as the same though I can not see evidence of it. The cicatrices are merely marked in obscure outline with a nearly continuous

ridge and more elevated oval point marking the place of the vascular scar. these oval narrow protuberance are slightly emarginat in the middle see 430e. 4.

D 11 Lepidodendron obtusum Lsqx. nothing to add to fig: & description. ~~Ab~~ Geol Rep Penn. p. 875 Pl. 16 fig 6. The species might be compared only to Lepidodendron aculeatum Sternb. differing however very much. The scale of scar is nearly in the middle, pointed on both sides [illegible]. generally this scar is marked at the upper part by a deep depression a point which is not marked upon the figure which is badly made  The species which I have named L. ~~vesculatum~~ conjugum and also poorly fig: in the same Rep. Pl. XV fig 3 is referable to this species, is corticated and near [illegible] two points at a distance from each other, one depressed and one upheaved. [illegible] [illegible] than the leaf scar also nearly in the middle therefore this species is doubtfull and may be referable to it.

D 12. ~~Ulo~~ Lepi dendron distans Lsqx. Geol Rept Penn. p 874 Pl. XVI fig 8. This species may be referable to Ulodendron or U. ellipticum or U. elongatum as it bears irregular ridges like the specimen of these species. The specimen however L 4 has the cicatrices perfectly distinct, far larger than in any of the largest specimen of Ulodendron and Lepidodendron oculatum loc. cit. pl 16 fig 4 which is evidently the same species but of which the museum has no specimen has still larger cicatrices it appears however that the distance between the cicatrices is of no account as a character. In one specimen of the Museum, L 31. which has prints very small, on both sides of the same piece, through two different pieces of earth, one side has the cicatrices merely separated by the narrow ridge while on the other side they are separated by a wide wrinkled space as in Lepidodendron distans. [illegible] are so small to see [illegible] the [illegible] and details of the leaf scar [illegible] but both [illegible] belong to the same species. [illegible] both these specimens L 1 & L 4 [illegible] the same [illegible] [illegible] [illegible] [illegible] and most of our species [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] their [illegible] which induced the specific name.

D 13 Lepidodendron (?) propria? described with rimosum specimen L 45. Corticated scars marked by a mere obscure outline or depression with the surface of the cortex narrowly striate in the length. decorticated scars narrowly oval, pointed upwards and downwards, separated by broad flat [illegible] ridges, the cicatrices some 22 millim long, 6 mill. wide in the broadest part, [illegible] at the middle [illegible] the middle by a large scar  emarginate at the upper part, [illegible] at the [illegible] the narrow [illegible] base and corners no appendages or tubercles on them. [illegible] I find nothing [illegible] of L. [illegible] Lsqx. but the ~~[illegible]~~ leaf scar is different in form. [illegible] see fig 5 p 529 related to L. rimosum as figured Pl. ? fig 11. US fr. but differs

14 Lepidodendron mammilatum Lsqx. Nothing to add to description & figure see p. 432.

15 [illegible] radicans Lsqx. Geol Rep. Pl. 4, 14 fig 1. nothing to add to description only a small specimen in museum.

D 16 Lepidodendron giganteum Lsqx. Apparently a good species. See figure correctly in Penn. Geol Rep. Pl 15 fig 2. and description p. 874. To the description should ~~be~~ added after tubercules very small: with a semilunar depression under them. This depression is undistinctly marked in the figure. Remark also that the medial line or carina is smooth above the leaf scar but distinctly wrinkled downward.

D 17. Lepidodendron carinatum Lsqx Penn. Geol. Rep. p. 875, Pl. XV fig 4. The figure is good enough, but the cicatrices are broader, the borders undulate. I do not know of any species to which it can be compared. Spec. L. 7 is the only one I know and on which the species is established. See for scar fig. 6 p. 529. Add to the description that the tubercules are obsolete or none and that the medial line is wrinkled only at the base. compare aculeatum.

D 18 Lepidodendron vestitum Lsqx. Penn. Rep. p. 874 Pl XVI fig 3. The description is right. The figure from a larger specimen than ours should be made with more care or more accurately for the only specimen in the Museum L. 9. Compare L. Sternbergii in Schp. atlas of Veget Pal. Pl LX fig. 1.

D 19 Lepidodendron clypeatum Lesq. Penn. Geol. Rep. p. 875. pl. 15 fig 5 & pl. 16 fig 7. The fig. 5 is good enough but the description is very poor. The specimen represent the cicatrices under various forms which must be described from good figures. The species is good and the description is equal that one specimen show at one corner an obordate cicatrice at the point of which the leaf scar is placed. This leaf scar is nearly equilateral with point upward, the 4 angles obtusely pointed, broader than longer. The specimen is covered by two layers of superposed bark showing scarcely any outline of the cicatrices under them and marked only in the middle only by an upraised broad short line or mamill. Corresponding with the base of the leaf scars. Schimper compares this to L. obovatum with which the species has no relation whatever. However Roehl in Dal. vol 8 Tab 8 fig 8 figures a Lepidodendron which has some likeness to ours under the name of Lepidodendron Sternbergi: L. L. obovatum. S. 41 C. S.

D 20 Lepidodendron crenatum St. Good specimen of this species. L. 56 & L. 64

L 21 Lepidodendron conformum? species proprie? Spec. 20 b. A remarkable form. The general cicatrice is rhomboidal with sides nearly equilateral and the leaf scar at the top, upraised see figure p. 529 f. 7. is L. latifolium Wess from?

D.L. 22 Lepidodendron dilatatum L. & Hutt. The museum has a small specimen L. 42 referable to this species as figured by Roehl. Dal. 13 tab 8 fig 4. This is a mere form of L. Sternbergi.

23 Lepidodendron species proprie? Specimen L. 79 representing a branch with oval enlarged emarginat scar with the vascular point of a Sigillaria, appearing at some place in an horizontal position, at some other very irregular in their relative position except in a spiral very oblique direction to the right. See figure p. 529 fig. 8. 1 & 2 & 3 enlarged. It is related to the species from the old red of Pottrelle.

Rem. on species of Lepidodendron.

L. Voltzmanianum St. is much like my L. turbinatum in Ill. Geol Rep. vol 2 pl. 12 f.

L. Fijoni Lesq. in this vol is the same apparently as the one published in Dal. vol 13 by Roehl Pl 6 fig 7 which he considers as a var of Lepidodendron caudatum Ung: which Schimper refers to L. aculeatum Sterb. It is rather like L. affine Sterb. Pl. 68 fig. 9.

D 24 Lepidodendron sigillarioides Lesq. Penn. Rep. p. 415. fig 6. In specimen L. 22. on which the species was formed may represent some common species figured however exactly copied.

Det. 25 Lepidodendron? branch? "five branch S. L. marked with obscure cicatrices and apparently referable to Lepidodendron. It is one foot long, 3 inch broad, cylindrical, enlarged at one end as if from a wool or from a dichotomic and marked by spiral linear impression as by the twisting of rootlets or the gang of worms."

20 b. L. crenatum St. Specimens, cast and figures sent by Mr. Southwell are referable to this species see letter copy book. 6 Sept. 75.

26 Lepidodendron aculeatum? Lesq. At least I think it is the species which I have named thus in Penn. Report. The bolsters are longer and narrower than in L. obovatum, largest in the middle with a long acumen at both ends an exactly rhomboidal scar with large appendages on both sides and three large vascular points. The bark is thick, spill. its surface smooth the outlines of the bolsters obscurely marked under it bearing an elongated oval scar towards the base. The upper scar is scarcely visible. The lower one is very distinct as 1 inch. Appear a good species. The bolsters are contiguous.

429ª. Distribution of the Genus Lepidodendron, Brongniart remarks in mem. of Grand'Eury p. 6. that the Lepidodendron are nearly totally absent in the St Etienne basin; very rare at Rive de Gier ~~[illegible]~~ which is however lower and that they characterize the ancient and middle coal ~~[illegible]~~ formations. –

D1 Lepidodendron ~~obovatum~~ aculeatum var Stern. Brg. Under N° 23°. the Brunswick cabinet has a L. with very long, 4–5 cent. bolster comparatively narrow long acuminate at both ends protuberent in the middle (see p. 531 fig. 15) or along the middle line, undulately wrinkled on both sides in the lower part with the middle scar somewhat low or near the middle of the bolster and marked as in the figure the appendages are distinct, the points of the vessel obscure. The specimen is covered with long leaves, ½ cent broad, convex on one side, canaliculate on the other marked in the middle by three veins or ~~more~~ ||| the side veins being double or at least thick. These leaves are like those of Lepidodendron rigens but not as straight. Their point of attachment to the bolsters or scars is not visible. The central scars however have the same size as the leaves and these appear as recently separated from them. – Sous N. 39 il y a à la même collection un bon échantillon de L. modulatum avec le même genre de feuilles & qui semble provenir de la même localité. La surface est applatie. Les scars ont à peu près la même forme, appendages etc. Se différencie essentiellement dans la position des bolsters, contiguous in the first specimen N° 23°. separated in the second N° 39. They may be separated or united. If united this species is near L. obovatum variety. The modulation of the intervening borders are just as I have published them. ~~?~~ The N° 23 should rather be referable to L. aculeatum Stern than to L. obovatum. ~~Ho~~

D2 Lepidodendron? like a creeping stem (souche) of Lepidodendron Le 1640. should be described if possible

D3 Lepidodendron (Sagenaria) ~~[illegible]~~, Göpp or Sagenaria Veltheimiana as figured by Sternb. Pl LVIII fig 2 vol 2. is apparently represented upon a small specimen from Mazon creek. Le 1668. It agrees also with the short description given of ~~[illegible]~~ by Schimper Pal veget. p. 22. However the cicatricule is rhomboidal, not semilunar and the ~~cicatr~~ punctiforms are not surrounded by a round border. It is also somewhat like L. turbinatum of the Ill Rep II. I consider it as a new species

D.4 Lepidodendron Sternbergii or L. rugosum. Specimen Ma 291 a flattened branch like an internal flattened mould is marked on both side by cicatrices like those of L. Sternbergii, more elongated on one side of the branch than on the other; all covered with a thin coating of coaly matter and some of them mostly effaced. These are marked in the center or just below the vascular cicatrice, or at the point where the cauda originates (joins it) by an elongated split, like this the split is central, even lower than the middle. On some of the bolsters it is marked by a small mamilla, like this ~~or~~ smaller, upraised.

D. 5 Lepidodendron retifolium ? n. sp. a small branch 5 millim thick with scars [illegible] indistinct. Leaves distant or at least not [illegible] [illegible] in [illegible], [illegible] [illegible] [illegible] [illegible] near the base, [illegible] [illegible] [illegible] pointed or abruptly acuminate [illegible] [illegible] broad and distinct. Surface [illegible] [illegible] [illegible]

parts of a plant, but also to carefully note the variations of the same plant under different circumstances. In this way it has been possible to ascertain the reliability of some doubtful species of *Lepidodendron*, and to unite in one some parts formerly referred to different species or even to different genera.

Lepidodendron rigens, Sp. nov.

Pl. xxvii, fig. 1 to 3.

The concretions of Mazon creek, which have generally preserved plants or their parts in their integrity, without deforming them by compression, have furnished, among other very interesting specimens, the branch of *Lepidodendron* which is copied in our figure. It shows distinctly the bolster, the point, and mode of attachment of the leaves, around the leaf scars, and the vascular vessels, or bundles, in their disposition in passing from the stem to the leaves, as in fig. 2. At the same time it proves that, in some species at least, the leaves of *Lepidodendron* were inflated, or somewhat cylindrical in their whole length, as marked in fig. 3, and not flat, as they are generally seen on the shales. These leaves were not hollow or tubulose; they are too stiff for that in this species at least, but were probably filled by cellular tissue traversed by three bundles of vessels. The form of these leaves does not appear to be exactly like the outline of the leaf scar, as they seem to extend and become flat on the sides in joining the scar, fig. 2, and in the cross section, fig. 3, enlarged, the leaf does not indicate any angular compression on the sides. The bolsters of this branch have not yet their definite form, and therefore the specific affinity, considered from these characters, can not be satisfactorily recognized. The narrower leaves and cicatrices distinguish it evidently from the following species, which it resembles by the length and straightness of the leaves.

Lepidodendron Morrisianum, Sp. nov.

Pl. xxii, fig. 1 and 2.

The cicatrices of this species are of three kinds. Under the surface or true cortex, they appear slightly upraised, like those of a *Knorria*, upon a short pedicel which is enlarged downwards, rough on the sides, with a flat rhomboidal top or leaf scar, marked like that of the surface by three vascular points, fig. 1 *a*. The surface cicatrices are broadly rhomboidal, with the opposite sides nearly parallel, curved outside and the leaf scar placed near the top, rhomboidal obtuse above and below, acute on the sides and marked by three horizontal large vascular points. The medial line of the bolsters is merely indicated by two or three horizontal wrinkles, enlarged in the middle. These cicatrices of the surface, when covered with the base of the leaves and their coat of coaly matter, appear hexangular, fig. 1 *b*. The leaves one foot long or more, one and a half line broad when flattened, are sharply marked by three vascular lines and narrowly, regularly striate on their surface, formed of a pellicle of coaly matter as thick as a leaf of paper, fig. 2 enlarged.

The tubular form of the leaves of some *Lepidodendra* is visibly marked in this species, for it is only by considering them in that way, that we can account for the difference remarked in the relative position of the vascular bundles when the leaves are flattened, for they appear on our specimen either central or lateral or single, double, triple, according to the plan in which leaves have been compressed. This fine specimen from the roof shale of the coal of Morris was communicated by Mr. J. Even. It now belongs to the State cabinet.

Lepidodendron modulatum, Lesqx. Geol. Rep. Penn., p. 874.

Pl. xv, fig. 1.

In the shales at Morris, by Mr. S. S. Strong. It distinctly preserves its characters, though the cicatrices are small. Found, also, in concretions at Mazon creek.

1 Lepidodendron modulatum Lyq. On the same specimen from Carbondale and belonging to cover this Lepidodendron there is a large part of the shale bearing the rootlets of Caulopteris obtecta Lyq. They can not be referable to the same. But the relation is remarkable especially so if it is casual.

2. Lepidodendron morsianum is a Sonatophlois like the new species of Penn: Ma. 21.

3. Lepidodendron modulatum Lyq. is as said p. 428c (6) intermediate between L. aculeatum, St. & L. Sternbergii Brgt. which = L. obovatum St. — L. rugosum Presl in St. LXVIII f. 4 & fig. 6. by its longer more prolonged cicatrices attenuated up and down in a long curved caudal tail. In this it is much like L. aculeatum from which it differs by the pulvinuli placed lower or nearer to the middle, the constant border which surrounds the scar. The different form of the pulvinuli. In this species the wall covering is thin, distinctly & deeply and regularly striate in the length, the lines being parallel, half a millimeter distant. The cicatrices however vary sometimes broader sometimes narrower; but the curved base and top and the pulvinuli are constant characters. see p. 430-1.

4 Lepidodendron simplex? Lyq. A few small specimen, No 1589. from from Nauch Gap. Penn: represent cicatrices 17 mill long. 4 millim broad in the middle. where they are broadest, with a pulvinulus exactly rhomboidal ◇ obtuse at the four corners, comparatively large placed in the middle of the cicatrices with have the lower part flat, not carinate and a mere trace of depressed line or furrow for the canda. The vascular point are in the middle of the pulvinulus, three very clear, the middle one a little lower or somewhat obsolete appendage none. The pulvinulus (the middle) is two and one half millim. each way between the corners. The wall surface or bark covering the ~~scar~~ cicatrice is comparatively thick, thicker than in the former species and totally smooth and polished. The cicatrices are separated by a double border with a groove in the middle) one to one and one half mill meter broad. This species much resembles L. simplex of the 2d vol of the Pa Rep and appears positively different from L. rimosum, as fig. 6 Geinitz though the ~~difference~~ relation is great. The pulvini are flat not carinate; the central pulvinulus is obtuse at the 4 angles of an equilateral rhomb. Another specimen No 1593 which is apparently referable to the same species has the cicatrice either contiguous only limited by an upraised narrow border or has them separated by a depression as broad as the ridges in the spec. No 1589. In this also (1593) the central pulvinulus is enlarged on both sides which are acute while the upper and lower ones are rounded ◇ the vascular points are however in the middle and there is no trace of appendage and no canda. The ~~scars~~ cicatrices as in the other specimen are shorter and broader than in L. simplex. However I think it the same species. The leaves are narrow though not as narrow as in L. simplex, carinate (deeply with two lateral nerves ~~one~~ on each side of the carina. I have seen also specimens of the same species in nodules of Mazon creek at Dr Strong (1876). One of

them has the bolsters separated by flat borders with ridges also flat. The pulvinuli are of the same form as in my figure of the species. with vascular points effaced. The cicatrices are three and a half centimeters long eleven millim. broad. The other specimen has the bolsters only three cent. long and 12 millim broad with the pulvinuli much larger and more deeply marked. and the bolsters separated by four a five narrow sharp and deep ribs which mark the whole surface as undulately ribbed in the length.

1. Lepidodendron modulatum Lesq. Spec. No 365 is a fine branch 37 cent long, 3½ cent broad with scars only 1½ cent long showing the characters indicated by the species. The borders of the scars are either round or flat, ~~more~~ broader when flat but distinctly characterized both ways. When the borders are flattened and enlarged the cicatrices or bolsters represent well enough Lep. conicum of the 1st Pa report. Both with flat and round borders cicatrices are upon the same specimen.

[illegible] Lepidodendron [illegible] Spec. No 558 [illegible] shows [illegible] a branch with [illegible] leaves [illegible] the impressed large [illegible] The leaves are oblique straight and apparently rigid [illegible] cent long [illegible] to a sharp point [illegible] under the leaves are deformed and do not [illegible] with the leaves [illegible] the same impressions [illegible] as in the [illegible]

Q 559 Lepidodendron longifolium [illegible] Lesq. Spec. Leaves in tuft at the top of [illegible] the only part of the specimen preserved, long 11 cent or more very narrow [illegible] perfectly similar to those [illegible] pl. 161. The leaves are very crowded and [illegible] upon another. One of the specimens bears a half round or oval [illegible] Lepidostrobus [illegible] is borne upon a long narrow ribbed pedicel 2 small. [illegible] 2½ cent long 1½ cent broad [illegible] with a [illegible] which does not allow a distinct [illegible] small long lanceolate acute [illegible]

A [illegible] distinctly seen. The coaly coating is of the [illegible] that of L. longifolium and seems to belong to the same species [illegible] are very small [illegible] the fig in the margin. (Referred to Dr. Aldrich.)-

[illegible] Lepidodendron [illegible] Spec. 565 [illegible] by the deep grooves [illegible] the middle of the [illegible] fig [illegible] about [illegible] the middle [illegible] the vertical [illegible] equally [illegible] about 1 millim [illegible] and [illegible] continuous [illegible]

[illegible] with [illegible] bone [illegible]
[illegible]
[illegible] the middle [illegible] the [illegible]
[illegible]
[illegible] my sketches [illegible] do not think that [illegible]
of the L. Veltheimianum. Fig. 1 [illegible] See p 431 b.1.

1. Lepidodendron. A specimen [illegible] 30 cent broad, 50 cent long, flattened [illegible] 6 cent [illegible] surface covered [illegible] [illegible] 1/4th of a mill. [illegible] the middle of these leaves are not distinct [illegible] very small and narrow [illegible] fig. 548 (X) [illegible] ~~the~~ ridge or other absent. The lower [illegible] [illegible] that could be [illegible] [illegible] very distant. much more [illegible] Lepidodendron [illegible] much smaller than I have seen them. [illegible] doubtful if ~~the~~ specimen [illegible] Lepidodendron [illegible] kind of tree. The reverse of the specimen has the [illegible] under surface lined by thin [illegible] the leaves are merely like those of the other surface however more distinct and sharp as in 6.

2. Lepidodendron Veltheimianum? A specimen of [illegible] with stem forking near the middle. It is 190 cent long 15 cent broad. flattened to 9 cent [illegible] 100 cent [illegible] 2 cent [illegible] the decort. surface [illegible] whole length. I have figured p. 546 fig. 3 three forms [illegible] of L. Veltheimianum, one of them [illegible] upon the same specimen. — Another specimen has [illegible] attached to the scars. They differ in size according to [illegible] 6 to 2½ cent [illegible]

3. Lepidodendron crenatum var.? [illegible] specimen 684 has [illegible] 546 (13) with very [illegible] [illegible] L. Veltheimianum. [illegible] are large with a clear [illegible] they are 7 mill broad [illegible] together apparent, [illegible]

431 ?

Comparing my figure with Hernberg's species, I find it somewhat like that of Lepidodendron crenatum as figured in Hernl. 1, pl VIII fig. A 1. Differs however by the bolsters somewhat larger, wrinkled above and below the vascular cicatricule and separated by a flat broad margin 4 mill. broad wrinkled in the length. Comparable to L. Weltheimianum as figured Pl XX figs 1–4 & 6. but where the bolsters are separated by flat margins. But in all these forms there is no trace of wrinkles or wrinkled canals either below or above the vascular cicatricule. The reference of this specimen is therefore uncertain between L. crenatum & L. Weltheimianum.

1 Lepidodendron Weltheimianum St. I have figured sketches of two very fine specimens of this species, Lacoe 24 & 26. p. 546 f. 15. a. b. The bolsters are very clear, predominant or deeply moulded; the rep. from the top of the bolster to the top of the central pulvinet is sharp and elevated gradually; the tail distinctly wrinkled across. The three vascular scars close and at the base of the pulvinet. See figure. They evidently represent the species like those mentioned 430 c 4. Another specimen is fig. 8 same fig. copied from Lacoe 717. it is the same form exactly as that figured by Hern. Acad pl. 1 Baeren Island pl VIII f. 2 the scars being only a little larger in Lacoe specimen. It is also comparable to the scars of U. commutatum Lesq. and as Dur refer Ulodendron commutatum to Lepidodendron Weltheimianum these might also be referred to the same.

Lepidodendron forulatum, Sp. nov.

Pl. xxiv, fig. 5 to 8.

Cicatrices distant, oval, narrower and pointed at both ends, wrinkled across; leaf scar large, central, marked with three distinct large vascular points, without medial line or appendages; corticated surface deeply undulate-wrinkled lengthwise, marked by deep, narrow, equally distant furrows, separating the cicatrices in vertical rows as in the genus *Sigillaria*. The decorticated surface, fig. 7 and 8, is regularly striate lengthwise by narrow, nearly straight wrinkles, and has its cicatrices upraised or convex-rhomboidal, split from the central point downwards, by a deep narrow line.

The peculiar furrowing of the surface of this species does not appear merely casual. A disposition of this kind has already been observed, though not quite as distinctly marked, in *Lepidodendron costatum*, Lesqx., described and figured in the second volume of this Report.

Found at St. Johns, in the roof shales of the main coal.

Lepidodendron Tijoui, Sp. nov.

Pl. xxiv, fig. 1 to 3.

Cicatrices of the cortex proportionally small, ovate, long pointed at both ends, separated by a flat irregularly wrinkled border, about one line broad; leaf scar large, placed above the middle, smooth, marked by its three vascular points, without medial line or appendages; cicatrices of the decorticated surface of the same form, smooth, merely marked in the middle by a vertical line, fig. 3, (3*b* enlarged). A small piece, fig. 2, of the same, though taken from the largest part of the tree, preserves the form and distance of the cicatrices as in the specimen of fig. 1. The coat of coaly matter covering the surface is thin, smooth, and the place of the leaf scars is hardly indicated on it.

The specimens of this species were found in connection with the *Lepdiophloyos auriculatum* and its *Lepidophyllum*, as seen in fig. 1, in the roof shales of the main coal of St. Johns. Dedicated to Mr. Thos. Tijou, superintendent of the coal mining company, Duquoin.

Lepidodendron mammillatum, Sp. nov.

Pl. xxv, fig 1.

General cicatrices marked obscurely by an irregular narrow furrow, obtuse at the upper end, narrowed downwards into a caudate curved point, central scar round, mammillate or convex, notched at the top, or with irregularly undulate borders. The specimen represents the decorticated part of the species, and does not indicate any trace of leaf scar or of vascular points. The surface is deeply and irregularly grooved, the grooves passing in undulations between the cicatrices.

Found in large specimens on the roof shales of the coal at Morris.

From specimens obtained two late for the plate, the species shows the character of a true *Lepidodendron*. The cicatrices are broadly oval, pointed at both ends, the leaf scar is of an oval form, enlarged on the sides or horizontally marked with a large medial vascular point and two lateral ones, placed at the corner of the leaf scar under which is an oval convex bolster. This bolster is the only part left of the specimens where the surface is old or eroded, as seen in our figure.

Lepidodendron cruciatum, Sp. nov.

Pl. xxv, fig. 2.

Surface furrowed by deep, irregular grooves, diverging from the scars in quincunxial direction ; cicatrices distant, deeply cut in the shale, but irregular and variable, generally oval and narrowed downwards. The supercortical layer of coaly matter is very thick, one line at least, deeply, narrowly and regularly striate, filling the depressions or hollow scars, and obliterating their forms.

The specimen from which the figure is copied, is large, and apparently represents the base of a tree whose bark has become roughened by age. The species is uncertain and not satisfactorily known.

Roof shales of the coal at Morris.

1 Lepidodendron crucianum Sp. Mazon is a far better specimen. It should be drawn. The bolters are oval elongated marked near the top with a round scar and a central vascular scar. Some of the bolters seem to have three semi-lunar scars like those of Sigillaria. The specimen should be studied and found in a better state of preservation, if possible. See if this was not published in Wood's pamphlet.

the specimen [illegible] which the figure is copied, [illegible] and apparently repre-
[illegible]

[illegible] a. ovat m. [illegible]
[illegible] marked under [illegible]
[illegible] bordered by [illegible]
[illegible] vascular point.

[illegible] in a policarpicid
and [illegible] in the [illegible] of [illegible] leaf scars, it is probable that this species
may belong to another genus, or that it is the type of a new one.

[illegible] Mr. U. A. Green, in Mercer Co., Ills.

LEPIDODENDRON RUGOSUM, Engt. Bind., p. 88.

[illegible] Engt.

[illegible]

[illegible] Engt.

[illegible] of Mr. [illegible] of Lithostrot, there is an [illegible]
[illegible] of a [illegible] covered with short [illegible],
[illegible] are considered by more recent authors as

Lepidodendron? Greenii, Sp. nov.

Pl. xxvii, fig. 7 and 8.

Cicatrices distant and deeply marked, oval in outline, pointed at the top, rounded at the base, marked under the point by a round, deeply sunk leaf scar, bordered by an upraised ring, and marked by a single central vascular point, thus resembling the scar of *Syrigodendron.*

From the great distance of the cicatrices, which are placed in a quincunxial order, and from the form of the leaf scars, it is presumable that this species may belong to another genus, or that it is the type of a new one.

Found by Mr. H. A. Green, in Mercer Co., Ills.

Lepidodendron rugosum, Brgt. Brod., p. 85. = L. Sternbergii,

Little Vermilion; Dr. J. C. Winslow.

Lepidodendron gracile, Brgt.

Veg. foss., 2, t. 15?

Lepidodendron elegans, Brgt.

Veg. foss., 2, t. 14?

In the roof shales of the coal of Morris and of Colchester, there is an abundance of small stems or branches of a *Lepidodendron* covered with short, linear, lanceolate-pointed, flat leaves, referable, from the figures given by the author, to the above-named species. These are considered by more recent authors as identical with *Lepidodendron abovatum*, Sternb., the form of the cicatrices being alike, and differing merely in size. *Lepidodendron abovatum* is also found at Morris and Colchester with large cicatrices.

GENUS ULODENDRON, Rhode.

Beitr., Pl. 3, fig. 1, Endl. Gen., p. 70.

STEM arborescent, simple, ? covered with rhomboidal cicatrices, remains of deciduous, strobile-like branches, densely covered with imbricate leaves.

This description, translated from Unger's Genera, p. 262, does not give a clear idea of the form and nature of the trees referable to this genus, for the good reason that now, after years of research among the remains of fossil plants, these species are known to us by mere detached fragments, whose relation is uncertain. Prof. Brongniart has considered this genus as merely representing species of *Lepidodendron*, and this opinion has been more or less generally admitted by others. And truly, the bark of the trees or of the species referred to this genus, bear cicatrices or bolsters generally of the same type as those of the true *Lepidodendron*, with also the leaf scars and vascular points of the same kind and placed in the same position.

They differ essentially in this: that they have two or more parallel rows of large round or oval scars, which appear as if they had been made by the base of large strobiles or cones, thickly covered with scales or short leaves. These organs have not yet been found in connection with trunks or branches, and therefore their origin is hypothetical. They have been considered either as the cicatrices of a peculiar kind of leaves, a supposition which is not admissible, or as the scars of lateral abortive or adventive branches, a supposition also unsustainable for vegetables regularly dichotomous, like those of the genus *Lepidodendron*, or as the scars of large strobiles like those of our *Lepidostrobus princeps*, (this Report, vol. ii, pl. 45, fig. 1) whose size corresponds with that of the cicatrices, and prevents the idea that they may be borne at the top of the slender branches of *Lepidodendron*.

I consider this last supposition as the right one. These scars, one or two inches in diameter, are placed in parallel rows, alternate or opposite to each other, at a distance varying vertically from two to eight inches. It is possible that these organs were borne on peculiar fruit-bearing branches of species of *Lepidodendron*. The horizontal distance between them is not great: 2 to 3 inches. What seems also to indicate *branches* is the small size of the cicatrices of the bark, which in all our specimens is about the same. There is, nevertheless, a peculiar character remarked on the specimens of all our American species, which is not observable on the bark of species of *Lepidodendron*. Their surface is ribbed lengthwise by irregular ridges, from one-fourth to one-half of an inch broad, one to two lines thick, generally angular at the top, bearing be-

Ulodendron. Schimper [illegible] mixed Ulodendron in a bad way. I have arranged the specimens of the museum according to my descriptions in this vol. It is possible that Ulodendron elongatum would be the same specie as U. Ellipticum as the large spec. U. 23 is equally referable by its scars by both. [illegible] leaf scars being contiguous and some of them distant. But I doubt that U. ellipticum & U. pseudatum could be considered as the same. We have good specimens

D1. Ulodendron minus. St & Ettl. I refer to this species a fine small specimen U 37 which has leaf scars exactly well definite resembling those of Lepidodendron monadis. Brandt. 16 millim. with a matrix covered by obovate scales. Have star like. A fine but small specimen. It is apparently the same as specimen U. 32.

A specimen of U. minus is described from Mont Valle coal mines Ala. CB p. 9 N° 10. I have another from St Aldrich, which is perhaps a fragment of the same but of a larger part of the stem. It is 40 cent long 15 cent broad, flattened to a thickness of 5 cent. The scars are nearly contiguous, some quite contiguous some half a centimeter distant exactly round, 43 millimeter both way. The character of the ~~scar~~ leaf scars are as ~~described and figured~~. It bears 5 ear scars on one side and six on the other. No part of it is shed.

Another and very remarkable specimen of the same species Al. 88 a flattened branch four and an half centimeter broad and ~~twelve~~ five and an half centimeter broad where it branches off, being dichotomous. The leaf scars are evidently quadrangular or rather ◇ exactly rhomboidal with the vascular scar at the top. The size is the same as in the specimen which I have figured or three millimeter each way while in the larger specimen from Aldrich these scars are 5 millimeter. The leaf scars are contiguous, 9 in a length of 12 centimeters, one centimeter broad. Their surface covered with a shining coating of coaly matter and the structure of the scale ~~[illegible]~~ only distinguishable. The specimen where it branches has been compressed and the ear preserved, in part only, its lower part on its base nearly two centimeter broad, composed of long imbricated linear scales, two millimeters broad max. thin, closely appressed and imbricated. lanceolate acuminate, about one cent. long as far as they can be seen. The rhomboidal base however is distinctly marked across the superposed blades which are here and there destroyed or abraded. This specimen is very interesting. The specimen should be figured. In some specimens are the scars distant as in those figured by Schimper in his pl. 64 fig. 1 – 3. I have never seen them also variable in size as in Lind & H. fig. vol. 1. ~~pl~~ pl. 6 copied by Schimper

[illegible] wanes is not observable on the back of specimen [illegible] *Lonsdaleia*. Their surface is ribbed lengthwise by irregular ridges from one-eighth to one-half an inch broad, one in [illegible] feet generally [illegible] the top bearing ne-

less developed and a close examination of the disks reveal the fact that they are lobes of the borders more undeveloped & abortive branches and not the impression of disks of ears as seen in some Ulodendron. The leaf scars are however exactly those of U. majus Al. & Hut. by all their characters, being transverse rhomboidal with an oval & nearly round ring around a single central vascular scar just as marked in this vol. Pl XXII fig. 4. I consider this as possibly identical with Ulodendron majus, at least in its young state. It is however not well possible to compare the scales left upon the disc of Ulodendron to the impression of abortive branches and still more difficult to admit the regular position of these branches either alternate or opposite in vertical lines upon the trunks. This however is not more difficult or hard to understand than is the same position for ears of fructification and I must say that most of the disks which I have had opportunity to observe in large number have the surface covered by irregularly disposed scars which may quite as well represent ~~disfigured~~ leaf scars disfigured by age and compression as basal scars of ~~f~~ cones. The question is thus still unsettled. One specimen however gives evidence of the presence of buds of branches exactly represented as they are seen upon its borders and at the top of the division ~~b~~ where they it enlarges somewhat and is apparently stopped in a new subdivision by a number of these adventive lobes which terminate it lithologer. The specimen is an impression into Cannel Coal. It is very distinct in all its parts. – I should be disposed to consider this fragment as of a young creeping stem. Its flexuous form seem to indicate it. ~~There~~ may have been in the swamps of the carboniferous other kind of floating stems besides those of Sigmaria and it may be that many of the Lycopodiaceous species which are represented in the booths as erect are on the contrary horizontal or floating by stems. This might explain the peculiar disposition for ferns per example of the branches of Megaphytum Pachypteris Gifordi, Howere offers an analogous kind of disposition of the fronds branching all around a stem and therefore can not be floating or creeping stems. Unless I have seen (Ulodendron ~~of~~ farcinum with scars on both sides of the stem.?)

D 1. Ulodendron majus. Ll. Ll. N. 7. Aldrich has from Monteralls a fine specimen referable to this species. The strobil-or branch scars are large, nearly round not quite three cent. distant, 4½ cent long and 4 cent broad irregularly marked by convertical rays or rather ridges of the surface, slightly convex and also slightly umbonate in the middle. The leaf scars where the surface coating of coal is rather out are little than of Pl. XXII fig 4b of the vol.; the surface coal being marked obscurely with their outline and a point in the middle differing therefrom of fig. 6 of the same plate. The pellicle of coal is about ½ mill. thick. The specimen 26 cent long has three and an half branch scars and is indeed very fine. His however narrow and it is not well possible to see if the costa are marked upon the trunk.

D 2 Ulodendron commutatum Schp. Pal. regét. II p 40 Schimper describes quite exactly under this name a species of which we have two large fine but somewhat broken specimens from Monteralls Coal mines N. 889. The trunk is not large; perhaps the specimens represent branches or young stems 19 cent wide, flattened to about 5 cent, irregularly costate, the whole surface covered with a shining thick coating of coal, twice as thick as in the former species. Leaf scars ◊ rhomboidal elliptic, acuminate at both ends, somewhat more enlarged on one side than on the other in the middle, ◊ longer than broad, convex carinate with a slight oval cicatrice at the top and a regular point in the middle. Seal scars large, round oval, a little longer than broad. Top centimeters long, four and an half to five cent. broad and marked either by the impression of the leaves (cicatrices) scars of leaves somewhat more observed than upon the surface of the trunk and disposed in spiral. See Schimper about this which is a good species intermediate between U. minus & U. majus. The distance between the scars is greater than in the first and less than in the second. In a smaller specimen where the leaf scars are 4 cent long the distance between them is the same.

D 3. Ulodendron Mansfieldi sp. nov. See fig. from spec. N. 790 Mansfield. Stem slender and flexuous, 22 millim. diameter dichotomous. discs round, small, 1 cent. diam. deeply cut into the stone by impression or half globular convex. four to five millim. high upon the stem of which the impression is preserved into the coal (cannel) comparatively distant three to four and an half cent distant from centre to centre, meridional or without regular position as seen in the figure, mostly in the middle of the stem or at its borders: with obscure traces of impression of scales toward the lower circumference. The stem is marked on its borders by small abortive dichotomous branches in a, more or

to 435 c. (1)

tween them flattened furrows, or strips of true bark with its cicatrices. The irregularity of these ridges, which vary in size as well as in their respective distances, being sometimes close to each other, sometimes a few inches apart, contradict the supposition that they are a kind of organism resulting from the normal growth of the trees. They are mere excrescences, similar to those which are seen on old trees; for in some places, by the expansion of their borders they cover part of the scars, in some others they push them aside, as from the enlarging border of a split. When supercorticated, the surface of the species of this genus between the top of the ribs, is filled by a coat of carbonaceous matter, half a line to one line or more in thickness, in such a way that the surface of the coat of coal is on a plane with the ridges, and that consequently, the coal is thicker in proportion to the depth of the grooves, as seen, pl. xxiii, fig. 1.

The surface of this coaly matter is smooth, striate lengthwise by narrow parallel lines, and the position of the cicatrices of the bark and of the leaf scars is merely indicated by a slight depression, with a point in the middle. The peculiar nature, or rather the mode of formation of this supercortical coat of coal, which covers the surface of the plants now examined, as also of most of the species of trees found in the shales and in the sandstone of the Coal Measures, is not explained. It is evident from what is seen on our specimens, that it does not represent a true cortex, but that it is rather produced by some exudation of matter (ulmic acid ?) forced, by compression, during the process of maceration and carbonization of the plants. This supposition, however, does not account for the peculiar marks left and defined upon the surface of this matter, and different in each species.

435 1/1

Ulodendron majus, Ll. and Hutt.

Foss. flora., i, p. 22, t. s.

Sigillaria Menardi, Lesqx.

Ill. Geol. Rep, vol. ii, p. 450, Pl. 43.

Large and numerous specimens of this species, obtained from the shales at Morris, have afforded opportunity of studying it under various appearances, and of recognizing its identity with the species described and figured by Lindley and by Sternberg. Though the cicatrices are most of the time obliterated, and their outline modified, some specimens present them in their primitive forms, with the essential characters, the three-pointed leaf scar of the genus *Lepidodendron.*

They are rhomboidal in outline, pointed or truncate at the top, rounded at the base, enlarged on the obtusely pointed sides, marked in the middle by a

slightly inflated bolster, and topped by a small rhomboidal leaf scar, marked with three vascular points. The details characterizing this species, and which have not been given by the authors, are represented in our plate 22, fig. 4. The outline of the cicatrices differs indeed from that of the known species of *Lepidodendron*, and when the surface is somewhat erased, as in the part represented fig. 4*b*, and as is generally the case on specimens of this species, it is undistinguishable from that of *Sigillaria Menardi*, Brgt.

In its decorticated state the species equally preserves the appearance of a *Sigillaria*, its wrinkled surface being marked by mere semilunar, inflated dots, as seen in fig. 4. The strobile scars are proportionally large, approximated to each other, alternating in two vertical rows, nearly exactly round, or rather enlarged horizontally.

Mr. Jos. Even, of Morris, has kindly sent photographic plates of large specimens of his, which bear these strobile scars, one and a-half inches in diameter, at a horizontal distance of three inches, and only one and a-half inches from each other in vertical direction. The vertical distance of these scars is apparently variable; it is, however, generally shorter in this species than in the following ones.

On shales at Morris and Colchester.

Ulodendron ellipticum, Sternb.

Pl. xxii, fig. 3, and Pl. xxiii, fig. 1 to 3.

Under the name of *Lepidodendron ornatissimum*, Prof. Brongniart has represented in his Foss. Flor., vol. 2, pl. 18, a large specimen of this species. As there is not as yet a detailed description of it, and as the cicatrices of the surface are not as clearly defined on the European specimens as on ours, I have figured the essential parts of this species as exemplifications of its general appearance.

The surface cicatrices are almost exactly rhomboidal, angular on the sides, slightly elongated, more or less distant, with the leaf scar nearly central, marked in the middle by a depression or small hollow, as indicating the place of a single vascular scar. These scars are not indicated by any of the European authors. It is probable that the two lateral ones are obliterated, but, although a great number of specimens were carefully examined, they could not be detected on any one of them. Pl. 23, fig. 3 enlarged, shows the details of the forms of these cicatrices.

The strobile scars on this species are opposite to each other, vertically more distant than in the former, or four to six inches, and horizontally six inches.

1. Ulodendron ellipticum. I have seen at S.S. Strong one specimen of this species with bolsters distant across or horizontally twenty centimeters. The same distance is measured upon another from Pittston vertically; this last specimen is narrow and has only one row of Bolsters.

2. Ulodendron? [illegible] N: 580 of Lacoe. It is in [illegible] the [illegible] and [illegible] bolsters [illegible] attached. [illegible] marked [illegible] like those of st. [illegible] decorticated & [illegible] without [illegible] of cuticular scars opposite in two rows. Longitudinal, vertically incurved lines, the space [illegible] situated in the middle of the stem continuous across the scars which are not deep covered with a coating of coaly matter [illegible] in passing into a cavity diverging accordingly on both sides are straight in the middle. Scars 7 cent. long. 4 cent. broad. No trace of leaf or of vascular scars the whole inwardly the stem which when the coating of coal is taken out is now [illegible] any foundation [illegible] smooth surface. See Sigillaria Serlei Brgt. p. 483 (2)

3. Ulodendron? N: 580 A specimen of Lacoe shows a compact large plat with nodes broadly and irregularly striated and at one side three oval obtuse scars also deeply striate more or less marginal at the upper end 3½ cent. long 2 cent broad without the bridges of the species. This may be different but I consider it as the same. See Sigillaria Serlei Brgt. Ther Rep. p. 483 b (2)

4. Ulodendron minus L. & H. No 581 Lacoe Mount Cobey. It is evidently a good species as marked by this typical specimen. The scars are opposite distant 10 cent. from the base, [illegible] and the same distance vertically, exactly circular. 3 cent in diameter with a wide margin 3 cent in the centre and surrounded by smooth and narrow stria. The scars are like those figured by L. & H. pl. 101. somewhat modified however for they appear with raised rims as obtuse or half round at the base. They are truly in bosses and the whole point in the middle surrounded by a [illegible] groove. The groove becomes also covered and obliterated by a coating of coal, matter and then some of them appear as open obtuse or half round at one side. But this is not the general one. The surface between the scars is marked by [illegible] like those of U. ellipticum. Bolsters [illegible] 1 cent. and high [illegible] also broad. Needed of a proportional height [illegible] in these transverse sections.

5. Ulodendron flexuosum minus L. & H. a specimen N: 582. of Lacoe shows the scars and stem decorticated the scars vertically somewhat more distant than generally but not much 3 or 4 millim. and the decorticated surface marked in [illegible] Sagenaria sp. 451 examined before. That may be U. flexuosum Gold. but I consider it as U. minus. In N: 45. the decorticated surface marked by [illegible] which are obscure and with only by O.D. compare Goldenberg. and to if this is indeed U. flexuosum. I have received July 7 another splendid specimen of Aldrich from Monteralli mines. A branch 44 cent long 10 to 12 cent broad. with 12 scars of branches round united or bordering at the base 3½ cent diameter; the two rows of branches are opposite or upon each side of the specimen

slightly inflated bolster
with three vascular points
have not been given by
The outline of the vertebrae left
Megalichthys, and also
the case of the specimen is somewhat
the case of the specimen

The strobile scars are proportional
each alternative in two vertical rows, nearly as
Mr. Judge, Keeper of Morris, has kindly sent photographic pl
cimens of his, which bear these strobile scars, one and a h
over, at a horizontal distance of three inches, and only one
from each other in vertical direction, as in the
the following ones.
On stalks at Morris and Connecticut

Plassiliquid

The surface circular
Slightly elongated, ho
marked in the strobile b
single fascular
peno authors. It is probable

the strobile scars on Mnioderics

[illegible] of its cicatrices, this [illegible] with our *Lepidodendron simplex*, and the sessile scars [illegible]

[illegible] resemble to *Lepidodendron rimosum*, Sternb. [illegible] and Hutt., which Prof. Geinitz, in his [illegible] only remarkable that this celebrated [illegible] cones as sustained at the end of [illegible] description are only one-third of [illegible]

437a.

1 Ulodendron elongatum. Fig 4 I have seen at St. Henry, Morris a very large specimen, 30 cent. broad and 1 meter long, ~~with a~~ flattened, bearing opposite round or nearly circular bolsters, eleven on each side, comparatively small at least considering the size of the specimen. The leaf scars in this and all the specimens which I have seen and have obtained are exactly alike and always separated by a double border as figured and described here. Another specimen of the same species has the bolsters 6½ cent long and 5 cent broad. The two specimens which I took with me have them seven to eight centimeters long and four to five cent. broad. The form of the bolsters is therefore very variable. While the character of the leaf scars is permanent. In both these specimens which apparently belong to an old and large tree these bolsters are less than one cent long and scarcely half as broad in the middle. The coaly covering of the species is thick, at least one millimeter. The distance (vertical) between the bolsters in old trees is twenty one cent. with bolsters 5 to 5½ cent long and 4 cent wide

2. Ulodendron elongatum. The distance between the bolsters in this species is sometimes very great as I have seen at Henry specimen one foot square without any bolsters. It is always deeply irregularly ribbed, as seen at LXIII fig. 1.

3. Ulodendron. No. 2,5 fragment of a stem surface about 10 centimeters broad covered by small ◇ scars like those of Ulodendron minus but covered with a coating of coaly matter which renders their character obsolete. The middle of this stem has an oval convex scar three and one half cent. long, a little more than two cent. broad covered with the same kind of scars though it is exactly like the half of an Ulodendron. It is very coarse conglomerate and the coating of coal has been flattened by stripping surface the whole is not distinctly determinable.

On the largest of my specimens, the scars are two and a-half inches long and one and three-fourth inches broad. Some of these scars are distinctly marked by the cicatrices of the surface nearly to the middle, or just to the point of attachment of the strobile, which has only one-third of an inch diameter. This clearly indicates that the growth of the leaves was stopped around the pedicel of the cones by the compression of their open scales, and that the cone itself was attached to the tree by a pedicel as small as is generally the central axis of a *Lepidostrobus*.

Collected in splendid specimens from Morris, by Mr. S. S. Strong.

Ulodendron elongatum, Sp. nov.

Pl. xxiii, fig. 4.

The cicatrices of the surface are in this species about of the same form as those of *Lepidodendron rimosum*, Stern., or of *Lepidodendron simplex*, Lesqx., as represented vol. 2, pl. 45, fig. 5, ofthis Report. They differ only by a narrow, elevated round border, which, as they are slightly apart from each other, leaves between them a narrow smooth furrow. The leaf scar is nearly central, as marked on the figure, and shows the three vascular points of a *Lepidodendron*. The strobile-scars are proportionally longer and narrower, than in the former species, nearly twice as long as broad, vertically distant eight inches or more.

As I have not seen any specimens with double rows of these scars, I do not know at what distance they are placed horizontally, and whether they are alternate or opposite. From the form of its cicatrices, this species might be identical with our *Lepidodendron simplex*, and the strobile scars represent the base of a cone like *Lepidostrobus princeps*, Lesqx., loc. cit. Both species also may be referable to *Lepidodendron rimosum*, Sternb., and *Lepidostrobus variabilis*, Ll. and Hutt., which Prof. Geinitz, in his Verst., p. 35, describes as the same. It is only remarkable that this celebrated author persists in considering these enormous cones as sustained at the end of small branches which, according to his description, are only one-third of an inch in thickness, and that he admits the round scars of cones as mere branch scars. He has only figured one of them, however, in his tab. 3, fig. 16. It appears to represent the three different forms of *Ulodendron majus*, under the name of *Halonia punctata*, Ll.

Ulodendron punctatum, Sternb. Vers. 2, p. 186.

Tab. 45, fig. 1, a-e.

I refer to this species, though with some doubt, a beautiful and well preserved specimen, lately communicated by Mr. John Collet, from the Mahoning sandstone? of Clinton, Vermilion county, Ind., near the limits of the State of Illinois. The specimen represents a branch compressed into an oval shape and slightly arched, three and three-fourths inches broad across in its broadest diameter, two and a-half inches in the narrowest compressed part, its upper cortex marked by small, oval, convex-pointed intumescences, with a small oval, deeply concave scar at the point, placed in spiral at about one line distance from each other. The upper cortex is formed by a pellicle of ferruginous, semi-carbonaceous hard matter, no thicker than a quarter of a line. Under it the surface is marked with the same kind of cicatrices, but the top oval scars are obliterated. On both sides of the branches there are two longitudinal rows of strobile scars, one and a-half inches distant from each other, a little less than one inch broad, oval in outline, the center marked by a round cavity, from the bottom of which a small mammilla protrudes. This is surmounted by an elevated margin surrounded with round cicatrices like those of the bark. These branch or strobile scars are alternate, five on one side, three on the other, horizontally three inches distant in measuring across the upper broadest part of the branch, and six inches in measuring on the other side across the more flattened part, therefore appearing as placed in two rows on both sides and towards the superior part of the branches. The same configuration is remarked in Sternberg's figure; but here the scars are placed along the concave border of the curved branch, while in ours it is along its convex portion. The name of *punctatum* is given to the species from the points upon the branch scars, in the author's figure, the cortex being marked by broadly triangular cicatrices. A few only of the same form are perceptible at a single, small, decorticated spot near the most erased part of our specimen, under a double layer of upper cortex. It appears, therefore, that this specimen represents the same species in a better state of preservation. *Bothlodendron punctatum*, Ll. and Hutt., 2, p. 86, has the same cortical cicatrices as ours, but differs by its long and more distant strobile scars.

Morris, on shales.

1 Bothrodendron (Ulodendron) punctatum. The description there is good.
I have a copy of a specimen in my [redacted] album just drawn, both in the scar
14 cent long 10 cent broad. I think it comes from the Collection of
Marietta College. Schimper considers this species same as U. Lindleyanum.
There is another sketch of the same species in the same book for the
Duke of Newcastle U.

238b 1. Lepidophloios species. Butts No. 142 is a species of this genus very much like my L. obcordatus of the Ill. Report vol II p. 457. The specimen is however somewhat crushed and the scales rendered undistinct.

[illegible]

and a distinct scar under the leaf [illegible] Another specimen 73. has the scar somewhat narrower [illegible] below the cinder 1a. the same. Lace has another fine specimen of the same as No. 609.

1 Lepidophloios laricinus, Hent. spec. from Pennilton upper Pennil Coal No 79 very fine - a flexuous or tortuous branch or stem, 12 cent. long twent, three millim broad, dichotomous marked with round deep scars of branches lent n diameter, two to three cent. distant covered with very deeply marked bolsters of leaves transversely rhomboidal inflated on the back with a bipunctate bolster at the base. At least this is so, in considering the direction of this branch as it is done in Goldenberg, the bolsters being turned backwards. From the dichotomous branch at the base of our specimen, this can be understood only on admitting this as a root of Lepidodendron or perhaps Halonia? to which this is like by the scars of branches or still more of a Ulodendron, the leaf scars resembling those of Ulodendron minus (Sp. Pal. veget. Pl LXIV, fig. 1. In contrast, it lent, the short dichotomous branch appears flattened and dichotomously subdivided in four branches, small somewhat more flat, with obscure scar leaves. And below the branches, the mamellon and the secretion point are evidently central without the elevated bolsters mentioned above them in Goldenberg figure which is copied by Schimper Pl. 64 fig 4. There is in the specimens of Mansfield one representing evidently Lepidophyllum majus as figured by Schimper and by Goldenberg pl. 16 fig. 11. There a good figure of this and of the different forms of the bolsters. Of course if these stems are roots the Lepidophyllum is not referable to them. The wound scars resemble those of roots and not of branches, the bolsters are marked to near the bottom which has a small round cavity 3½ millim broad showing point of attachement of the rachis.

2. Lomatophloios Crassicaule? Corda. No 1618. a specimen from Morris shale is represented by an external cylinder flattened representing a branch 2 to 2½ cent. thick, marked with obscure scars placed in spiral, more principles undistinctly split in the length at the top, nine centimeter distant in the spiral direction the cylinder covered by a shaly crust 4 millim thick whose surface bears impressions of erect obovat, truncate scales barely imbricated at their base, twelve millim. long & mill broad, grooved in the middle, truncate-cut at the top. These impressions are just like those figured in Corda Beytrage Pl 1 figs 7, 8, 9. except that the upper rhomboidal scar is cut out or the lower part merely preserved. The depression in the middle of the scale is narrow and descends to near the base. I refer this specimen to the species with some doubt but it represents Lomatophloios very much like that of Corda. The same shale have Lepidophyllum cuneifolium under the eruption which may be referable to this as L. latifolium fig 11 Pl XVI of Goldenberg is referable to Lomatophloios crassicaule? or Lepidodendron

3. Lepidodendron or Lomatophloios apparently new. No 2. Scars small obovat, acute at the top acuminated at base. Cicatricule at the top enlarged obtuse at the lower part pointed above appendage large conic none. With these there is a fragment of some Lepidophloios. It is like L. obovatum but has not any conic and the cicatricule is placed higher and broader. It is Lepidodendron depressum? Upper Devon. p. 179 Pl XLIII fig 5. Differing however by the cicatricule tripunctate not subbipunctate by the total absence of conica which in Goppert's species marked by three or four cross wrinkles. See it figured p. 532, 5 Another specimen No 2 has a conic

1. Lepidophloios. Of this genus the museum has specimens of the three species mentioned in the rol. Nothing to remark.

D 2. Lepidophloios protuberans Lqx. Remark on this species that the protuberance upon the cuticular specimens is rarely marked. It was so in the first specimen which we got. But in others there is scarcely any trace of it. From specimen L. 130 which represents Lepidodendron manillatum Lqx it would seem that this species is a decorticated form of L. protuberans. The specimen however is varnished and the evidence is not at all positive.

J 3 Lomatophloios crassicaule Corda. Cat. 71. is the internal path of this species as figured by Goldenberg in Fl. Saraponiana, Pl 14 fig. 9 & 10. I 15 appears to represent the same species though larger. He cites fig 9 loc. cit.

Lepidophloios [illegible] is [illegible] relation by the form of the cicatrices which are narrower, less extended on the sides to L. laticeps Lqx. and also to Lomatophloios macrolepidotum as figured by Gold. tab 14. fig. 25. But from this it differs by the much smaller size of its cicatrices and from both by the larger size proportionally at least of the leaf scars. Fig. 10 a p. 529 represents the natural size, 10 b the enlarged cicatrice, 10 c the cuticular scars of the same species. He is from Kentucky. Lou. Oxford. Tunnel Ro. His much like Tab. 14, fig. 14 in Gold. Fl. Ver. of Lomatophloios crassicaule and should be referred to this species. See p. 439 c (2)

J 5. Lomatophloios? Mary spec. In Hans Fuchs specimen I find N. 18 - 20 large Lepidophyllum with linear lanceolat acuminat blade much like those of Lepidophyllum major but longer rather more like Lomatophloios intermedium in Gold. Pl. 15 fig 5 differing however by more linear longer blades and by peculiar sporange. The blade being undulat crosswise near the lower part. One is 10 cent. long with the blade apparently narrow linear with three inward veins in the middle. The other of the same length is oblong, lanceolat acuminat, slightly narrowed at the sporange same size and form as Lepidophyllum major Ost. as fig. by Geinitz Pl. III. 5 except that in our specimen the sporange is more pointed evidently representing a sporange. — With this there is a specimen Ma 21. which should be figured whole. It is a piece of bark, representing bolster with the middle scar broadly rhomboidal distant, surrounded by smooth depression, elongated downward like the tail of a Lepidodendron bolster. also resembling those of Lomatophloios in Gold. Pl. XV f. 9. but much more distant. The same specimen has a leaf linear with broad inflated midrib which is distinctly lineate and borders nearly smooth. The whole leaf about 8 millim. broad. Which much resembles fig. 8. of Pl XV of Gold. and three other specimens represent large leaves of a thick stem flattened but covered with a thick coat of wet. about 1 mill thick which appears like fig 15 of the same plat. All these specimens have to be figured and compared for description referring them to a Lomatophloios but evidently a new species. — Lepidodendron Mordianum is a Lomatophloios.

GENUS LEPIDOPHLOIOS, Sternb.

Ill. Geol. Rep., vol. ii, p. 457.

LEPIDOPHLOIOS? AURICULATUM, Sp. nov.

Pl. xxx, fig 1.

STEM or cone covered with large thick rhomboidal imbricated scales, broader than long, rounded at the sides, marked at the top by enlarged rhomboidal cicatrices and three obscure vascular points.

The specimen copied in our figure looks like a part of a large flattened cone, whose broad thick rhomboidal scales are imbricated like those of a strobile of pine, and in the same order. According to Prof. Goldenberg, specimens of this kind should merely represont the surface part of stems (*Lepidophloios*), whose leaves are attached at the base of the scales which cover them. If this is the case, it is doubtful, indeed, whether our plant is referable to this genus, notwithstanding the similarity of the scales to those of some species of European *Lepidophloios*, or whether it should be considered as a cone or *Lepidostrobus*. It is evident that the scales, which are often found isolated and variously grouped on the shales, were free to their base; that in their union, as in the specimen which is figured here, they rather represent the form of a strobile than that of a stem, and that also some of these scales appear connected with *Lepidophyllum auriculatum*, Lesqx., though the mode of connection is not distinct. On the other side these scales are marked at the top by three vascular points like the scales of *Lepidophloios*, and also have in the middle the small scar scarcely perceptible with the naked eye, which Mr. Goldenberg considers as the scar of a spine, and which also is a character of the genus. They are, moreover, remarkably similar in form to those of *Lepidophloios laricinus*, Sternb., as figured by Goldenberg in his Flor. Sarr., pl. 16, fig. 1. Though this may be its true generic relation, this species differs from the European one by the scales, which in ours are proportionally broader and shorter, and by the small medial scar which is triangular and not round.

Found in the shales of the coal of St. Johns.

Lepidophloios laricinus, Sternb.

Vers. 1, p. 23, Pl. 11, fig. 2, 3, 4.

It is not rare in the shales of the coal at Morris, in good, well characterized specimens.

Lepidophloios protuberans, Sp. nov.

Pl. xxvi, fig. 1 and 2.

Stem arborescent with cicatrices somewhat distant, separated by thin, undulating, continuous wrinkles bordering the cauda; cicatrices double; the upper part or leaf scar is rounded upwards and downwards, obtusely acute on both enlarged sides, marked by three vascular points, the middle of which is capped by a small, half round dot; the lower part like a broadly oval-rhomboidal wing, has both sides curving downwards as a prolongation of the borders of the leaf scar, and abruptly bent into a long pointed cauda, fig. 2. The wing is marked above the middle and under the leaf scar by a semi-lunar upraised scar. The cicatrices are generally deeply immersed in the stone, and their outlines rarely discernible. They are often covered with a coat of thick carbonaceous matter, and their center marked by a prominent nose-like gibbosity.

In the shales at Morris; collected by Mr. S. S. Strong.

Genus LEPIDOSTROBUS, Brgt.

Ills. Geol. Rep., vol. ii, p. 455.

Lepidostrobus (species).

Pl. xxx, fig. 4 to 7.

The figures represent in detail a specimen of a cone of *Lepidodendron* in concretions, which has its sporanges and spores still preserved in their primitive position. The form of the

Lepidostrobus & Lepidophyllum.

D. 1 Lepidostrobus variabilis L & Hutt. as figured and described in the supen. Vegt. flora. Vol. 2 p. 61. We have a large number of specimens referable to this species. In stature we closely approach the cylindrical &c: all the characters indicated by the author, a small broken specimen only, Ls 25 show the horizontal direction of the sporanges; all the other specimens inflattened showing only the form of the imbricat blades.

H 2. Lepidostrobus Mencs propria? Specimen Ls 8 from Dinstown and in the same rock with the former species is abundant appears to have the blades more linear and not lanceolat in form of the cone and its size too is the same. This may be due to the compression of upper stem leaves covering the ear. The specimen is therefore undetermined.

T 3 Lepidostrobus princeps Lgy. This species of which we have a few good specimens in the museum, especially the cross section, fig 3 of Pl. 13 the ref. vol 2. is scarcely different from L. Geinitzii Schp. (L. variabilis Geinitz). appearing however to differ by shorter ear and proportionally shorter and broader blades. On the back of specimen Ls 24 there are however leaves, Lepidophyllum, appearing nearly as large as L. major or L. auriculatum. On the back of the same specimen has also a branch of Lepidodendron Sternbergii. Brgt.

T 4 Lepidostrobus Goldenbergii Schp.: The museum has from Mayo creek Ls 36 & Ls 37 referable to this species. From these specimens and by cutting them the form, form &c. of the sporangia and nature of the leaves may be easily ascertained. These specimens by form of cone seem exactly answer the description and figures of Schimper Vegt. vol. 2 p. 61 Pl. 61 Fig 3 & 4.

T 5 Lepidostrobus ornatus L & H. Only a small broken specimen from Mayo creek, referable to this species as in Brongniart figure n. 2.

H 6 Lepidostrobus linearifolius? pe. pro. Ear cylindrical, 2 centim. wide about 6 centim. wide long, with blades erect, appressed, long, 3 to 4 cent. narrow, 2 millim. wide, linear, marked in the middle by a broad double nerve as in Lepidophyllum. The specimen is broken and nothing more can be seen. It may be the same species as the one figured in this vol. pl 30 fig 4. The name anyhow is not good as I have already dedicated Lepidophyllum linearifolium which is far different. (see p. 442 Pl 31 fig 1 & 2.)

T 7 Lepidostrobus ovatifolius Lgy. This vol p. 441 Pl 30 fig 2 & 2b. At sight from numerous specimen the separate basis the same. In a good specimen Ls 28. the width of the ear is 13 mill. length of the sporangia 4½ mill. the axis is 3 mill. wid. This species has the blades of the same form as the following, only shorter and lance pointed ^ slightly obtuse so. It may be a mere variety. The figure shows it more rounded at the corners than it is generally. It may be a variety of the following. — From reexamination it appears that these species are indeed different, the basilar corner of the first, L. ovatifolius being less extended outside and obtuse though not quite as much as in the figure. The blades are shorter more lanceolately pointed. See figures corrected Pl 30 2b & 3b. See p. 442 (1)

T 8. Lepidophyllum lanceolatum Brgt. not much difference from L. oblongifolium. The blade is narrower proportionally longer, linear lanceolat with a broader shorter sporange. All the specimens representing this species are from Pottsville or rather Eagle vein near Pottsville, a low coal. Mammoth or 5 foot vein. The specimen Ls 16 from Newport which at first I considered as a new species on account of its broad sporange appears to be either this species or rather L. oblongifolium with sporange deformed by compression like the other specimen of Newport. It is in same drawer with this L. lanceolatum.

T 9 Lepidophyllum lanceolatum? Lgy. Vegt. Rep. p. 442 Pl 31 fig 7 & 7b. One specimen only Ls 38 from Morris. The blades are more long pointed or more tapering, but for this there is no difference.

(see Lepidostrobus lanceolatus p. 442 a/b)

440c

10 Lepidophyllum sp.: propriis? ined. Represented by a large number of specimens all from Mons. Its form is that of L. lanceolatum, but with the blade proportionally broader, being shorter while its sporange is twice as long and abruptly narrowed at the base of the blade and linear lanceolate. I supposed at first that the sporange of the former species L. oblongifolium, lanceolatum &c might have been broken but it is not so. In this species the sporange is often broken always at the point of attachement with the blades; whereas in the present it is always the same twice as long and half as broad as in the related species. Specimens Ll 26 to Ll 29. Ll from the length of the sporange & its reins intervals to this same species. It is the only nodule representing a cross section of Lepidostrobus with broken or poorly preserved blades.

11 & 12. Lepidophyllum brevifolium & L. hastatum Lesq. Penn. report, pl 17 figs 6 & 7 are good distinct species, the first from Wilkesbarre, the second from Johnstown. Some of the blades in these last specimens have a few shorter coriaceous blades, but they preserve their form, enlarging hastate from near the base while the other enlarges by an arched border from near the point. The figure of both species is right, only that of L. brevifolium is generally sharp pointed. See corrected figure 6. The strobile of both these species appear to have been composed of both sporangia bearing scales and of leaves mixed with them. The leaves in neighbouring being longer & inches about, twice as narrow as those of brevifolium shorter and not one inche falcate, ovate. It is so difficult to see the relation of the leaves upon our specimens. These leaves may be a kind of bracts at the base of the strobile. Ls 1b upon same specimen as Ll 1b. Lepidostrobus brevifolius; has a Lepidostrobus apparently L. lanceolatum. Bot. see 440c 20. L 443c-1.

13 Lepidostrobus species propriis? Specimen 25. 43. A fine large strobile 11 centim. long, 4½ cent. wide without the blades, oval cylindrical or somewhat narrowed from the base upward, axis about 9 millim. wide; sporange somewhat oblique or nearly at a right angle to the axis, long 16 millim. blades slightly open curving upwards not apparently accolate, tapering from an enlarged base into a long narrow point. The leaves are mostly imbedded in the stone and their form is not distinct. They are a little more than 2 cent. long. The form of the blades as described is seen merely from the top of the strobile. They are much like those of Lepidostrobus principis in Ill. Rep. 2 Pl. 9. fig 2. & fig 4. but the form of the strobile which is much shorter and rather ovate is different.

14 & 15 Lepidophyllum majus & L. auriculatum. Two distinct species differing not only by the auriculate base of the blade, but still more so by the more linear (not enlarged at the middle) longer tapering blade generally with a longer sharper point sometimes falcate or turned to one side. Both have apparently the same form of the sporang which however is shorter in Ll. auriculatum. and both have blades somewhat longer or shorter indicating that Ll. & Ll. species Lepidophyllum intermedium is a mere variety of L. majus as my L. acuminatum Penn. Rep. is a var of L. auriculatum Lesq. by L. see. Ll. a sum of this vol. p 443 Pl. 31 Fig 8, I have a splendid specimen Ll 8. which seems to prove that the narrowing at the base of the blade is due merely to a flexure of the borders and not to a peculiar kind of organization and that therefore this species is a form of L. majus. see p. 443 b.

16. Lepidophyllum linearifolium sp. nov. ined. Spec. Ll 13. Blades long narrow, from base 2 millim. wide, linear, acute-pointed, slightly enlarged above the collum where it rounds to a narrow lanceolate pointed sporange 12½ millim. long. The blade from the collum to the point is 7½ cent. long. This species must resemble what Schimper has figured and described in Pflz. Tal. 2 p. 71. Pl 61 figs 4 & 9 as Lepidostrobus Bailanicus except that the sporange of ours is narrower and naked or without seeds. Specimen 85d of Lowe has the blade with the sporange. The sporange is nearly equilateral 1½ cent long, 8 millim. broad. The base of the blade or support enlarging above the axis of the seeds. see fig. 10 p. 533. Stamens are not covered. Another specimen 85b is represented by the same. The leaves [illegible] the blade of the same width as that because the bracts seen [illegible]

Ld 1. Lepidophyllum species? two specimens may be referable to this genus. Ll 41 representing a long linear narrow channeled leaf enlarged at base without sporange. Ll may be a leaf of Lepidodendron. and Ll 11 a linear very thin lanceolate regthe shaped leaf about 3 cent long abruptly enlarging into a "homologital sporange?" is venation is not discernable. At the point where it is the broadest and just below the sporange the leaf is 4 mill wide, near the point it is scarcely one millim.

D 18 Lepidostrobus truncatus Lsqx. This vol. p. 442 & pl 31. Fig 5. From the form of the small ear with the same form and same form of appressed scales, I consider this specimen as representing the species. The appressed blades are lanceolate pointed.

V. 1. Lepidophyllum?? Ll 11. A narrowly oval body about 4 centim. long, oval at its base with broadest part, obtuse, narrowed downward to a kind of petiole, smooth or without trace of nerve. It may be a kind of fructification like in other particulars to figures 4 p. 62 Lq. see Lq incertus p. 443 & 27 I had at first considered a few

D 20 Lepidostrobus brevifolius? or L. proprius. blade of this species L. 26 & 27 as part of a theca of Lycopodites. But specimen Ll 60 show these to be imbricated around a common axis and to be mere blades of long oblique sporanges immersed in the stone. The form of the blade is intermediate between that of Lepidophyllum brevifolium & Lepidophyllum hastatum. Broader and shorter than this last species but exactly lanceolate pointed. It may be a new species; but the specimens are not good enough for satisfactory determination.

D 21 Lepidophyllum foliaceum Lsqx this vol. p. 444. pl. 31 fig 10. I can see nothing more than I have published on this species though the museum has now a specimen with 3 leaves which are flattened around a common point or an axis. It is impossible to see if these leaves have a sporange immersed in the stem at their base. See Ll 36. See p. 444 a. (1)

Ld 1? Lepidostrobus? L. 5. Le peculiar branch of imbricated round irregular scales which has no analogy to anything known to me may be annelida??

D 18. Lepidostrobus truncatus Lsqx. I refer to this species with doubt a small Lepidostrobus L. 44 whose blades are consistent and which has merely relative to this species by its form and its size. It may be something different, perhaps not even a Lepidostrobus. But the specimen is too obscure to positively say what it may represent. It is the same with the specimen L. 45 which represents the same kind of organism, an obscure somewhat triangular and inflated nucleus same form and size as fig. 5 of pl. 31. and it is covered with longer blades linear or lanceolate.

D 23. Lepidostrobus convivens Lsqx. The specimen Ll 46 is exactly like fig. 6. pl 31 of this vol. only three times large. It represents an oblong somewhat conical ear born upon a narrow peduncle 1½ to 2 millim wide, 4 centim long from the base of the sporanges, to 18 millim wide near its use, 12 millim wide near the top which is round truncate, marked in the length by five to 7 parallel narrow ridges which come together at the summit. The sporanges right near the base are nearly perpendicular or at a right angle to the axis, the blades appressed and appressed against the cone appear long and linear. The cones do not represent the blades as I supposed it in describing the small specimen figured by it. though well marked, the blades do not appear as marked over them. His circumstance is the same that as with the blade described Ll 40 c. 10. But they do not appear to belong to it. It is therefore known merely from its peculiar form and as distinctly described as I can be from its appearance.

Dl. 24 Lepidostrobus ?? Specimen L.S.9 represent a branch 6 millim wid obscurely marked by cicatrices rather pointed at both end placed in spiral as in Lepidodendron. bearing thick, short, lanceolate pointed leaves arched upward and joining in a point at the top. It may be referred to Lepidodendron dichotomum Hemb. or rather to L. selaginoides as figured by Hemb. 1 Pl. 16 fig 3. I put it with this species in drawer. Specimen L.S.7. is also a branch which may belong to Lepidodendron it is a ~~top of~~ tuft of appressed linear leaves at the top of a curved branch. The form of the leaves or blades as also the scars of the branch are totally obsolete. In drawer of Lepidostrobus ?

25 Dl. Lepidostrobus ? spe. nov. Ma. 23. cone long 18 centimeters, base and top destroyed, linear, comparatively narrow, nearly three centimeters broad without the blades, which are open but half erect and seventeen to eighteen millimeters long distantly narrowly lanceolate-acuminate from an enlarged base. The cone is flattened its surface covered with decaying of coat half a millim. thick marked in the decorticated part with very small triangular scars in spiral. Compare to this Macrostachya infundibuliformis in Schp. Atlas. pl. XXIII, fig. 12. and also Lepidostrobus variabilis Geinitz Pl. II fig. 1. But in our species the axis is broad, there is no place for the horizontal position of the sporanges. It can not be a Lepidostrobus but more probably a Macrostachys. but this has nothing to do with fructification of Calamites or of Calamostachys infundibuliformis, the scars being in spiral, while in all the Calamostachys the scars are in rows. This might be a large stem of Lepidodendron like those figured in Brongniart. differing however by the very small scars. (This is a true Lepidostrobus. The axis is covered, this not large.). – I find the same cone in the museum of New-Brunswick under N. 38 and named by one upon the label L. insignis. see p. 442 b. 1.

26 Dl. Lepidostrobus ornatus Dl & H. Transversal section Ma. 85 This section is two cent. broad, the axis 4 millim; the flattened sporanges alternate with the blades short and obtuse like those of the cone figured in Hoother Geol. survey. pl. X fig. 1. & 7. Small seeds microspores appear through the tissue or ~~parietes~~ of the sporange

27 Dl. Lepidostrobus ? cross section Ma. 89. The cross section of a lepidostrobus ? It is very obscure and similar to a whorl of Annularia sphenophylloides of large size. The relation to Lepidostrobus is indicated by a number of macrospores of Lepidostrobus scattered upon the shale, nearly half a millim. in diameter by one when seen from their point, rounded upon the other side. This cross section is about of the same size and the sacs or sporanges of the same form as in the former species which however has apparently microspores, as far as can be seen through the walls of the sporanges. May be the same species.

28 Lepidostrobus ~~fraxinus~~ don't know the species now. Sp. nov. N. 524 Large specimens Cone 25 cent long narrow, two cent broad. scale closely imbricate, linear acute or lanceolate of indefinite form. axis nearly 1 cent broad. The cone is inflated balloon like at the top.

blades and of the sporange-pedicels, as they appear when isolated from the cone, is not recognizable, therefore its specific relation is uncertain.

The cone is figured as an illustration of the position of the sporange-cells on their axis, to which they are perpendicular, and also of the form of the seeds. These seeds, fig. 6 and 7, highly magnified, resembling those of a *Lycopodium*, are exactly three one-hundredths of a millimeter in size, nearly round or slightly tetrahedral, with valves discernible but without borders, and often agglomerated by triplication, but separating easily. The absence of borders or wings on these seeds indicates their maturity. They are easily detached from the sporanges, like a brownish powder. The part seen at the top of the cone, and represented enlarged in fig. 5, seems to be the support or the pedicel of a blade or the scale of the sporange.

In a concretion from Mazon creek.

Lepidostrobus ovatifolius, Sp. nov.

Pl. xxx, fig 2 and 2*b*.

Cone about three inches long, one inch broad, with short, erect blades; blade obtuse at its base, lanceolate obtusely pointed, comparatively broad; pedicel of the sporanges short, lanceolate. The axis of the cone appears to be narrow, a peculiarity which does not agree with the shortness of the pedicel of the sporange. As the detached blade, fig. 2 *b*, is copied from another specimen which is crushed, and whose form is unrecognizable, it may belong to a different species.

In concretions from Mazon creek.

Lepidostrobus oblongifolius, Sp. nov.

Pl. xxx, fig. 3 and 3*b*.

A very fine specimen, also from the concretions of Mazon creek, representing an exact cross section of a cone. The central axis is one line broad, the blade one inch long, its breadth one-third of the length, oblong, obtusely pointed,

squarely cut at the base, and without auricles; pedicel of the sporange narrow, lanceolate pointed, one-fourth of an inch long. In its length it corresponds exactly to the distance between the border of the axis and that of the line of circumference of the cone. The sporanges are obscurely marked on the stone, mixed with pyrites, but I could not detect any spores.

Lepidostrobus lancifolius, Sp. nov.

Pl. xxxi, fig. 7.

A small, apparently narrow cone. The pedicel of the sporanges, fig. 7 *b*, is very short, broadly wedge-shaped, obtusely truncate at its base; blade one inch long, slightly enlarged in the middle, tapering into an acute point, with slightly diverging acute auricle at the base; medial nerve sharply marked.

On a concretion from Mazon creek.

Lepidostrobus truncatus, Sp. nov.

Pl. xxxi, fig. 5.

Cone less than one inch long, round ovate, obtuse, truncate at the base, with densely imbricated, short, lanceolate *sphorophyllæ* (blades). None of these can be distinctly seen, being compressed against the cone.

In a concretion from Mazon creek.

Lepidostrobus connivens, Sp. nov.

Pl. xxxi, fig. 6.

Cone small, ovate obtuse, of the same size as the former, with long, narrow, linear lanceolate *sporophyllæ;* blade as long as the cone, curved at its top and covering it.

Lepidostrobus oxylepidus Lx. I have seen at Morris from Mazon creek some cones preserved entire in nodules and which seem to represent this species, though this may be a new one (see specimen L 4612). The cone is 13 cent long, 22 mill broad without the blades which are imbricated but open, averaging one centimeter long and 7 to 8 millim broad at the base. The form is that of Pl. XXX fig 26 of this vol. the blades being only apparently a little more acuminate. The axis appears very narrow and there the sporanges measure also one centimeter in length. The whole cone being cut vertically through the middle the trace of spores or small rounded cavities are seen, irregularly placed and few. Their reference to spores is uncertain. Compare Lepidostrobus insignis (L 4402, 25.) — I have compared it. This cone of Mazon Creek is shorter by at least one half, narrower with shorter broader triangular obtuse pointed blades, very different indeed. See p. 4426 (7).

Lepidostrobus hastifolius? Lxo. Specimen of Lacoe 216 & 221, represents a small cone four centimeters long, seventeen millim broad above it, tapering linear-oblong very gradually narrowed upward to near the top where it is still one centimeter broad. Sporanges apparently that of blades turned upwards closely imbricated apparently enlarged at the base and lanceolate broadly nerved in the middle. The form of the blades is not distinct. If answer to that given in pg 7 Pl. 17 Penn: Bepat but the enlarged base of the wings can not be seen distinctly, may be referable to L. variabilis. Al & H. which refers to different species.

Lepidostrobus variabilis, Al & Hutt. A very fine and entire specimen of Lacoe No. 3015 may perhaps represent this species. The cone is linear oblong gradually tapering upwards to a point or exactly lanceolate 13 cent. long 2½ cent broad from above the middle to the rounded base. Sporanges narrow exactly horizontal or in right angle to the axis, blades narrow lanceolate acuminate erect, closely appressed to the cone and imbricated, about eight millim. long and one millim broad toward the base, undistinct. This answer to the description of Schimper and his figures copied from those of Lindley except for the point which in those authors is obtuse while in this specimen it is exactly lanceolate or long-taper pointed. See p. 4426

Lepidostrobus lanceolatus Bryt. Lacoe specimen 334 b has a fragment of a cone of this species. Cone exactly linear and narrow, apparently very long; the fragment preserved measures 4½ centimeters long; its width without the blades 1½ centimeters. The axis four millimeters and the sporanges on both sides only 5 millimeters or a little more. The blades are half open, diverging 40 to 45° from the axis. As seen from a separate Lepidophyllum upon the same specimen and which is one of the largest which I have seen of this species (see figure) and also the best preserved, the sporange is 8 millim long uniform obtusely pointed at the base, truncate undulate under the base of the blade, inflated with a deep line in the middle and two more obscure on the sides. (see figure). The blade is 33 millim long linear or oblong lanceolate acute 7 millimeters broad in the middle and at the base which is enlarged hastate on both sides in joining the sporange. This last character is not seen upon all the specimens for most of the time the base of the blade seem to cover just the top of the sporange. As seen upon the cone, the blades appear shorter but equally large; they vary in length only from 5 to 8 millimeters. The fragment of cone should be figured

4442ᵈ. X.

D. (1) Lepidostrobus ~~insignis~~ Goldenbergii? see 4441ᵈ. 25. There is at Mr Mansfield an entire cone of this, of which I have one specimen partly broken. The entire cone measures 33 cent long and is obtusely pointed at top. The base is seen on my specimen.

Dl 2 Lepidostrobus cylindricus Lx. nov. cones nearly exactly cylindrical, 7 millim broad at the base, five at the top, 7½ cent long; central axis narrow, two millimeters; sporangia at right angle, blades very short subuliform, linear lanceolate appressed to the cone and imbricated. Dr Britts. Lacoe spec. Cabinet Coll. 556

D. Lepidostrobus productus [illegible] Lx. nov. [illegible] nearly 15 cent long [illegible] Mr Lacoe's cabinet [illegible] [illegible] the cone [illegible] [illegible] 12 cent long, the blades [illegible] [illegible] linear 3 or 4 millimeter broad [illegible] [illegible] the base [illegible] narrowed [illegible] [illegible] Lepidophyllum [illegible] 53

D. Lepidostrobus Goldenbergii? [illegible] to the [illegible] part of [illegible] [illegible] 17 cent long [illegible] cylindrical [illegible] 8 millim [illegible] sporangia inclined and blades [illegible] lanceolate or linear lanceolate [illegible] narrowed to a point, curved inwards and imbricated [illegible] deeply carinate with a broad nerve [illegible] [illegible] narrow [illegible] separate the first species from this one.

D. [illegible] not curved inward [illegible] Lepidostrobus [illegible] same [illegible] 575 [illegible] this species [illegible] cylindrical cone [illegible] than [illegible] pl. 10 fig. 1a & pl. 11. The scars are [illegible] not quite two cent. in diameter (flattened) with the blades short [illegible] narrowed to a sharp acumen, curved inward and imbricated.

Lc [illegible] affinis Lx. nov. [illegible] of Lacoe [illegible]

[illegible] nearly curved in the middle [illegible] of the form figured in the [illegible]. Another specimen 577 from Butler mines, 4 cent [illegible] long with [illegible] sporangia 1½ cent long [illegible] the cone, imbricated [illegible] also obliquely [illegible] are narrower [illegible] [illegible] to the same species.

~~variabilis~~ Spec. nov. Lacoe Spec. 578. Butler mines. [illegible] cylindrical [illegible] about 12 cent [illegible] [illegible] imbricated [illegible] lanceolate [illegible] [illegible] 17 millim broad at the base. The name of truncatus may be changed.

D. 7. compare ~~Lepidostrobus (2)~~ above

Lepidostrobus ovalifolius Lx. [illegible] Spec. 682 & 683. Two specimens [illegible] one of which [illegible] cone, 11 cent long, 3 cent broad [illegible] imbricated and open [illegible] [illegible] sporangia [illegible] a cross section of the cone is discovered upon the same specimen. The other represents only a fragment of a cone of this species.

1. Lepidostrobus ~~brevifolius~~ Aldrichii 26 a specimen from Aldrich upon yellow clay, and without locality has some cones of the species. Cone cylindrical, 35 millim. long, 10 millim. broad, blades closely imbricated, 4 millim. long, acuminate, enlarged at the base where they measure 2½ millim. broad, marked upon the back by a strong broad nerve. The very base of the blade can not be seen on account of the imbrication. This may be comparable to the small cones I have from Alabama. These are not distinct at least not the form of the blades. The size and form of the cones is the same, the bracts are longer at the base and long acuminate or terminate with a long narrow acumen generally curved inward.

2 Lepidostrobus incertus Lesq. MS 4 X 1 X f. 25 a long cone Ma. 516 is 9 cent long but base has lost longer ones. The scales or blades are sequent, irregularly imbricated, open or turned upward and generally displaced by compression. The axis is large marked by narrow oval impressions of points of attachment in spiral. Same as the species named Lepidostrobus brevifolius p. 440d 20. The axis varies from 2 to 6 millim. broad.

1. Lepidophyllum auriculatum, Lqx. Lq. 1610 & 1609 from Morris show the difference of this species with L. majus, not only by the smaller size and auriculate base of the blade, but by the ~~broad~~ surface, very thinly lineat indeed; but the line distinctly seen with the glass when the epidermis is destroyed. The sporanges are also comparatively to size somewhat longer. The auricles are scarcely marked. This may be a new species. Compare it. I think it however the same.

D2. Lepidophyllum Morrisianum (nov sp.) Lq. 1610 a fine species. Blade exactly lanceolate gradually tapering to a long acumen, rounded and narrowed to the point of attachement of the sporange which is comparatively long and narrow. Blade 4½ cent. long, 11 millim broad a little above the base where it is rounded and contracted to an sporange 12 millim long.

D3 Lepidophyllum majus, as represented in specimens seen at Mr Thomas Moores, many of them, has blades 9 cent. long and 18 millim broad with sharply acuminate point.

D4. Lepidophyllum Lacei, species nova. Lacee spec. N. 4014 The blade is linear slightly enlarged above the middle where it is 12 mill broad and ten only near the base, nine narrowed upward to a long sharp acumen with borders perfectly entire, not undulate with a broad midrib, ~~nearly three~~ two and a half or a little more than two millim. wide. Surface minutely rugulose when seen with the glass. The sporange is covered. It is far different from the following and also from L. majus. see 4a

D5 Lepidophyllum ~~undulatum~~ vagulatum, specimen Ma. 120. Blade eight cent long oblong, enlarged in the middle where it is 19 mill broad while it is only 11 just above the slightly auricled base rounded and repeatedly acuminate with a three costate midrib only 2 millim broad and the surface smooth. All the specimens which I have seen and they are many have the blade deeply undulately folded across above the sporange which is seventeen millimeters long triangular narrowed downward to a point or longer than broad.

Del 4d. No 199 of Lacee has three specimens referable to the same species, that is three blades exactly of the same form long-sharply acuminate of the same width, only a little shorter. 7 centimeters long. All have the sporange broken off or immersed into the stone so that the blades only are known. They may be a var. minor of L. majus. and may be figured.

D6. Lepidophyllum striatum Lx. See the Report. I refer to this specimens Lacee N. 199 at least it seems to be the same. It is described above as L. Lacei and figured. N XXVII bb. fig. 14.

D7 Lepidophyllum acuminatum. In the specimens of Gibson N 3 I find a fine specimen referable to this species. This narrower than the one figured in the Report. The blade 6 cent long with a long slightly scythe shaped acuminate point 7 cent. broad in the middle and at the base with the sporange gradually pointed 1½ cent. long. Narrow as same as in the one figured in plate. Just like my fig. 13.

D: Lepidophyllum ~~[illegible]~~ umbrosum sp nov. Lacee Lace 663 has three lepidophylla [illegible] with blade and sporange 2 cent. long [illegible] the blade 1½ cent long oblong narrowed to the [illegible] sporange triangular [illegible] borders slightly rounded to the pointed base.

Lepidophyllum [illegible] ulmaeifolium [illegible] Lacee Fig. 7 n. 5-46 has the blade [illegible] also the sporange not seen upon this specimen I don't think it is another where it has been seen with blade about as long as L. inflatum and round top as in the fig. 7 [illegible]

In this species, also, the pedicel of the sporanges is unknown. Both these small cones resemble in size and somewhat in form *Lepidostrobus gemmiformis*, Gopp., Permian flora, p. 142, pl. xix, fig. 14, 15, 16; but are evidently distinct species.

From Mazon creek, in concretions.

Lepidostrobus ornatus, Brgt.

Ll. and Hutt, Foss. Fl. 3, Pl. 26.

A broken specimen of a cone of this species has been discovered by Mr. Jos. Even, in a nodule from Mazon creek. It is cut across near its base, and the form and position of the sporanges and of the pedicels are distinctly observable.

Genus LEPIDOPHYLLUM, Brgt.

Ill. Geol. Rept., vol. ii, p. 456.

Lepidophyllum rostellatum, Sp. nov.

Pl. xxxi, fig 8.

A large blade, broken in the middle, four-fifths of an inch broad, with a triple medial nerve, round, attenuated at the base or strangled at its point of union to the pedicel; pedicel of the sporanges half an inch long, rounded at its enlarged sides, and narrowed to an acute, slightly curved point. The collum between the blade and the pedicel is long and narrow, giving to this species a peculiar appearance.

Mazon creek; in concretions.

Lepidophyllum striatum, Sp. nov.

Pl. xxxi, fig. 9.

The specimen shows two blades and curved pedicels of sporanges. The blades, broken at the point and along the borders, are about half an inch broad, two inches and a half long, lanceolate, slightly enlarged above the middle, marked with

one narrow medial nerve, and striated in the length with well marked parallel regular lines, nearly as strong as the medial nerve. The pedicels of the sporanges are still curved as in their normal position on the strobile, and appear linear.

This species is distinct from every other kind published, by its striated blade.

Also from Mazon creek; in concretions of clay iron ore.

Lepidophyllum foliaceum, Sp. nov.

Pl. xxxi, fig. 10.

This leaf or blade has a form totally at variance with any other seen in the Coal Measures, and it is doubtful whether it represents a kind of vegetable organ, like those described under this generic name. It is marked in the middle by an inflated body (medial nerve?) one-tenth of an inch broad, which, at its base, is abruptly curved on one side like a sporange pedicel of *Lepidophyllum* at its point of union with the blade. This medial nerve,? slightly enlarging upwards, abruptly terminates at some distance under the obtuse point of the blade. The whole leaf is a little more than one inch long, half an inch broad, oblong-ovate in outline, cut or truncate at the base, with a small round lobe on one side of it, and split at the top in two or three deep, narrow, obtuse lobes Its surface is smooth, covered all over by a pellicle of coaly matter; the medial broad nerve only is naked and obscurely striate in its length.

On a piece of shale from the main coal of Murphysborough.

I have lately received from Mr. S. S. Strong, and from the shales of Morris, another specimen of this species, representing an agglomeration of three leaves of the same kind and form as the one above described. The point and mode of connection of these leaves is not distinguishable, though they appear to be imbricated around a common axis.

1. Lepidophyllum foliaceum Lyg. I have obtained of this species a specimen No. 1613 given me by Mr. J. Strong. It is a pebble, cut through the middle, exposing the internal part of a sporange bearing exactly the form of this species and is figured pl. 31 fig. 10. On both sides of the broad mid rib which appears to be a central axis there is a cavity filled with large spores nearly one millimeter in diameter, apparently agglomerated originally but detached ~~up~~ and irregularly strewn upon the specimen. Triangular on the lower side rounded on the upper lik seeds or large ~~Lepidostrobus~~ Macrospores, larger than any of those published in Schimper's Atlas. This organism is therefore a sporange surrounded by a narrow border or fringe. Math drawing?

This is L. acuminatum. Ben. & Zpat. p. 275 Pl. XVIII f. 2

2. Lepidophyllum lanceolatum p. 100 h. 119; of Lance 4 [illegible] from mineral spring (see p. 546. fig. 8. & 9. The blade is long [illegible] very [illegible] in the bar of the blade nearly flat [illegible] Dreg. 10 [illegible] from Chiphant. Lepidophyllum lanceolatum. Shorter broad shorter acumen [illegible] the length and abruptly ~~narrowed~~ contracted top of the sporange [illegible] Mr. Binney this rd. pl. 31 fig 8. I refer the specimen fig. 11 [illegible] Col. Co. L.E. to L. majus? Dregl. The plant is inerme, racemose ovate [illegible] acuminate the acumen shorter and the sporange broader & shorter compa[illegible] & substance in both the cones seems [illegible] [illegible] 12 No. 659 seems to represent [illegible] [illegible] specimen [illegible]

3. Lepidostrobus Walkeri [illegible] 681. A fine specimen. Cone oblong ovate rapidly pointed. 4 cent. long 3/4th cent. broad in the middle leaves closely imbricate 3 cent. long 2 mill. broad, unicuspidate. midrib narrow but strongly marked. resembles [illegible] with leaves decidedly at least in comparison with those figured of this species by Schimper. Another specimen 681 leaves more distinct, more loosely imbricated, only 2 cent. long [illegible] 681 the length was not very exactly measured the point [illegible] 2 cent. this to the term spoiled.

4. Lepidostrobus or Lepidophloios. ? spec. nov. Ma 484, 484a & 486. Crushed fragment of what appears to have been a large cone like that of Lepidophloios with macrospores Pl. 62 f. 7a. The denudated surface of the cone is smooth and marked as in the above figure by obscure rhomboidal pulvini. The leaves or blades attached to what appears an exactly linear lanceolate gradually narrowed to a sharp point, apparently thick, broad nerved, the bases being at the base 2½ millimeters broad and the medial nerve one millimeter. It is generally flat but sometimes keeled or the middle. The difference from this species with L. lanceolatum is in the longer blades not contracted upwards to an acumen but gradually and equally lanceolate or tapering from the base to a sharp point. Fig 486 represents a fragment of bark of Lepidophloios or of a cone with the scars being covered with the lacerated base of the leaves or blade. This compares well with the cone figured by Grand Eury as Sigillariostrobus rugosus & ~~[illegible]~~. Pl XIV f. 4.

5. Lepidophyllum? ~~[illegible]~~ Ma 493. Leaves exactly linear 1 cent. diameter, wrinkled across especially along both borders and without middle nerve. They resemble leaves of Stigmaria but the wrinkles are very distinct nearly regular and nothing like this has been observed by authors until now. At least to my knowledge

Knorria imbricata Sternb. Specimen in Stromg collection has leaves more than two and an half cent. long linear, broken truncat at the top and enlarged to the point of attachement. They are more enlarge at the base and more distant than in Schimpers fig. Pl LXV.

2. Knorria acicularis, Gopp. Ta. 27. An instructive specimen in regard to the relation of Knorria. This branch or stem compared to 5 centimeters in diameter and two centimeters thick. On one side in the middle of the upper surface scars appeared in form cylindrical acuminate projections about 1 cent. long not quite two millim. thick at the base placed in spiral. Spcent distant in the direction of the spiral exactly similar to those of Pl XXX fig 30 Gopp Trans. Pl. from the transition formation of Silesia. On both sides of the flattened branch however these elevated linear stars disappear, being first replaced by shorter more enlarged convex scars like those of Knorria Schrammania Gopp. fig 4 of the same plat and farther to the borders by deep scars of Stigmaria minuta or a species much like it which is represented in the same lot of specimens from Sidebing Hill by Fig. 28, 29 31 L83. When the upper cortical surface covering the scars is taken out the sub-surface appears finely granulat with stigmarian. This specimen is very interesting and should be figured.

[illegible] Spec. 606 of Lace a large number of flattened stems one of them 180 cent long, base at the 1st order 5 cent wide, at the second 1 cent, at the second 17 cent wide at the next [illegible] 10 cent in [illegible] reduced in the middle to 3-5 cent [illegible] flattened and is located only by an oval scar generally [illegible] see figure p. 5 [illegible] 7. always in spiral position. The scars [illegible] of the very numerous specimens. [illegible] flattened in the same degree as the Knorria [illegible] measure 1 to 1 5 cent to the point [illegible] thin they are reduced to 5 cent width. Point flattened [illegible] degree and measuring cent acron at the stem. The scars [illegible] regular spacing spcent distant, round or oval, very small [illegible] indented [illegible]

D1 Knorria. We have two fine specimens L 78 L 81. which in the corticated state show the cicatrices of a Lepidodendron exactly like some of the varieties referred to L. Sternbergii from Morris and which under the bark are true Knorria. In this species which is interesting as proving against Schimper opinion the identity of Knorria and of Lepidodendron, the pulvini are not more elevated upon the bark than in any other species of Lepidodendron. They are inflated only under the bark and seem to raise up in growing. see Schp. Tal. veg. pl 65 fig 8.

D2 Knorria Hygmarioides specimen. Three large specimens in nearly cylindrical or somewhat flattened 1 foot long, four to 5 inch wide, marked in spiral by large scars of broken branches nearly 3 centim. wide, 6 mill. over in the widest part. The half round broken part [illegible] which is the base of the branches. These are at a most distance from one another; some of the scars which have not been broken show a large round cicatrice about like that of Lepidodendron with a central point resembling a that of a Hygmarion surrounded by irregular wrinkles in the direction from the center to the circumference. When corticated in covered by the coal which is less than one millim. thick, the cortex is marked by a point apparently corresponding with the center of the scar? or generally merely uneven. This specimen Di 91. Another specimen shows in one part the scars (perhaps smaller) broken branches as in the former, placed in the same direction while at another part the branches are seen preserved in some length in the form of round leaves of Hygmarion, some of which are flattened against the stem while other scars detached of it. In another part is an 1½ to 2 cent. long contrary to these scars and as going out of them in a contrary direction the same specimens is covered with leaves of Hygmarion. Another specimen L 71 L 72 shows the same appearance of broken scars or rather of scars of broken branches conical active, all turned in the same direction and all exactly in spiral line 1½ cent. distant with the upper scars still bearing flattened parts of what appear to have been broad leaves like that of Hygmarion. The first specimen Di 91 may represent a distinct species remarkable for very large scars. But some of the size of the scars Di 74 are intermediate in size to those of Di 72 and therefore all appear to represent only one species.

D3 Knorria imbricata Sternb. I refer to this species a portion of plan L 12 which has the pulvini small, linear lanceolate, close to each other, all inclinate they are 2 millim. long and 1½ millim. wide. This species is near Knorria circulata Gopp. Übergangsb. p. 210 tab. 30 fig 3 only with the pulvini more closely approached to one another. To this species is also referable L. 32. which I have figured and described in Rep. of the Arts Lancy p. 311. pl 4 fig 1 as Diploteca truncatum n. nov. and which much resembles Knorria (Sigillaria) rimaria in Stern 2 pl. 49 fig 1. The pulvini slightly inflated near the base are abruptly truncate. see p. 445 c. b.

4 Knorria sellonii Sternb. From the greater distance of the pulvini which are more pointed or truncate nearer to the point, Specimen Di 3 B & Di 53 c are referable to this species.

D5 Didymophyllum Schottini Gopp. One specimen of Sandstone L 13 has the pulvini broad short, contiguous, broadly oblique and cut or slightly emarginate at the point. They somewhat resemble those of D. Schottini as figured by Gopp. Sanero, a species which Schimper places with Knorria imbricata. But the pulvini are short contiguous round at top. Perhaps a var. of Knorria imbricata.

Genus KNORRIA, Sternb. and Gopp.

Cicatrices half cylindrical, obtuse at the point, more or less enlarged downwards, like those which are indicated as the essential character of this genus, have been recognized as subcortical scars of some species of *Lepidodendron* by Prof. Goppert and other recent authors. We have seen the same also in our *Lepidodendron Morrisianum*, and in this Report still a specimen referable to *Sigillaria monostigma*, Lesqx., is figured, and bears the caudal intumescence of a *Knorria*. We have, therefore, abstained from describing any new species as referable to this genus, though we have in our Coal Measures the two species admitted to it by Goldenberg: *Knorria imbricata*, Sternb., mentioned in vol. ii, of this Report, and *Knorria Selloni*, Sternb., Vers., i, iv., p. 37, pl. 57, from the shales at Morris.

Genus SIGILLARIA, Brgt.

Ill. Geol. Rep., ii, p. 448.

Sigillaria corrugata, Sp. nov.

Pl. xxiv, fig. 4, and Pl. xxv, fig. 5.

Cortex very rugose or deeply wrinkled in the length, marked by linear-oval, elongated cicatrices, gibbous in the middle and cut by a round angular scar, as seen pl. xxv, fig. 5. Lower surface also wrinkled lengthwise with smooth, shallow striæ, marked by cicatrices, oval in outline or somewhat pointed at the top, rounded in its lower part, marked in the middle by three irregular, vascular scars, placed in the shape of a horse-shoe, or by a semi-lunar scar which points downwards, and a mere vascular point underneath. These cicatrices are one inch long, half an inch broad, distant, and placed in quaternate order.

This species resembles a *Lepidodendron*, appearing related to *L. punctatum*, Sternb., which Prof. Brongniart considers a *Sigillaria*. Its leaf scars have more analogy to those of the last genus.

Found at Marseilles, LaSalle Co., at the base of the thick bank of sandstone which there appears to take the place of the lower coal strata, and which generally contains remains of large species of plants, rarely in a good state of preservation.

Sigillaria Massiliensis, Sp. nov.

Pl. xxv, fig. 3 and 4.

Stem ribbed, ribs flat, half an inch broad, with intermediate, deep, sharply cut furrows; surface striated lengthwise by distinct, nearly continuous lines, scarcely flexuous on the borders of the cicatrices; cicatrices larger, one-third of an inch long, not quite as broad or half as broad as the ribs, rhomboidal, rounded at the top, enlarged downwards to the angular sides, obtusely pointed at the base, minutely, obscurely striate on the surface; vascular scars three, the lateral ones semi-lunar, caudate, vertical; the medial one horizontal, large, oval. The cicatrices are separated from each other by a space equal to their length. The form of the decorticated cicatrices is not known.

This fine species is allied to *Sigillaria intermedia*, Brgt., differing in its proportionally larger cicatrices, and by the regular striation of the ribs, without cross wrinkles at the base of the cicatrices, and by their angular base.

In the sandstone at Marseilles.

Sigillaria monostigma, Lesqx.

Pl. xxvi, fig 5.

This species is referred, with some doubt, to the one published in vol. ii of this Report, p. 449, pl. 42. It represents a part of a trunk or branch, four inches broad, flattened to one-half an inch in thickness, marked all around in the general quincunxial order by broadly rhomboidal scars, with a round point in the middle, exactly of the same form as those of the cortex of *Sigillaria monostigma*, and at the same comparative distance. These scars are placed at the top of an inflated lanceolate cauda, three-fourths of an inch long. This kind of half cylindrical appendage attached to the specimen evidently under the cortex, gives to this species the character of a *Knorria*. If, as Prof. W. P. Shimper will have it, in his *Vegetaux fossiles du terrain de Transition des Vosges*, p. 33, *Knorria*, as a genus, differs essentially from *Lepidodendron* by the cicatrices having a single central vascular scar, our species should be considered as a true *Knorria*. But the same author denies the existence of any

Sigillaria. In the distribution of the species of the genus I follow Schimper. Identification with some remarks on species.

Sigillaria Brongniarti. Schimper says has in appearance of the genus the following species of authors, of which we have specimens. - 1. Sig. Brongniarti Sch. Sil. 6 x 11 to include leaves and bases of leaves, Sil. 6 x 6 b. Sil. 1. fig 16 b. Gold. and Quadar Stars. 2. Sigillaria elegans Brgt. with rows of cicatrices enlarged on the sides, much like 1. but without costæ. The specimen has articulations of branches and one of them is cylindrical slightly flattened. Stem Sil 7 has these articulations inflated or deflated as around where the large cicatrices are marked, the stem is tuberculed. These large cicatrices appear only with the coal deposit regularly placed in relation to others. 3. Sigillaria minima Brgt. in good small specimen exactly corresponding with Gold. fig. 17 b. 4. Sigillaria hexagona Brgt. also with more angular sides as in the figure of the author. In many specimens. 5. Sigillaria ornata Brgt. a small specimen Sil 86 marked obscure and tuberculed resembling the figure of the species in Schimper's Pal. Vegt. II 67 fig 5.

D2 Sigillaria Dournasii Brgt. though the cicatrices are smaller as in the figure of Brgt. and of Goldenberg, the specimens Sil 9 appear to belong to this species. In one 6 the bases is fine lume.

D3 Sigillaria mamillaris? Brgt. To this species I refer with doubt two fine specimens Sil 6 3 & 63.6 & Sil 92 & 92.6 Sub milsone gut coal (see catal.) They are much like Gold. fig 8 of pl. 8 however showing the cicatrices always enlarged into an angle behind at middle and then rounded at base. There is scarcely any difference. In 92 & 92.6 specimens of Lesley the scars of the leaves are elevated from the point to the base, the intervals descending in the form of an inverted scar. (see fig. 11 p. 529 this vol. See p. 480 a (1.))

D4 Sigillaria elliptica Brgt. All the specimens given number Sil 6 are from the roof of a mine at Cuyahoga falls. It represents without difference the three forms figured by Brgt. Pl 152 fig 1 & 3 see

D5 Sigillaria Lesquereuxii Schp. Pal. vegt. Pa vol. p. 85: Sig. attenuata Lesq. in part Cat. pl. 2 fig 7. See Schimper loc. cit. for description my figure of this species is exact.

D6 Sigillaria Gardeyi Lesq. Cat. Nothing is said in description. I can not see any distinct cicatrices and think it must be a form of Sig. obovata Lesq. no see

It is also overall. I consider this a good species on account first of the narrowness of the scars comparatively to the width of the ribs. The furrows are deep but not narrow. On the contrary there is in Sil 5 deep and broad furrows 6 millim in diameter, at nodes where the ribs from the base of the furrows are 16 millim. wide and the scars only 3 millim: in their width but not in the base. I refer without doubt to this species Sil 32 two decorticated specimens Sil 35: is remarkable representing a layer of the wood or bark the medium which marked on the upper surface by small oval points as in the decorticated state of the species and on the lower surface by thick arcuate or lunulate scars with the same. Specimen Sil 77.6 upon coal species doubtful. See p. 474 a 4

D8 Sigillaria attenuata Lesq. Cat. pl 2, fig 3. The specimens which I refer to this species have scars of the same form of scars as the former species; but widely superior, the narrow is and the narrow furrow a mere line which separates them. Specimen Sil 38 is wrinkled or undulated throughout excepting the scars. It may be referable to S. silliniana Brongt. But the scars in our species are more regular, as may fig 3 middle are marked transversely. Many of them

of European authors and of mine too should be erased or united with others. Nos 47 & 48 are decorticated and doubtful, very similar to this. The scars are arranged by most single points.

+9 Sigillaria intermedia Brgt. Only decorticated specimens.

D.10 Sigillaria tessellata Brgt. Also merely decorticated specimen. I put all doubtful under this name. The specimen is of a broad form, longitudinally double ribbed, tessellated scars, and sulcus more or less distinctly marked. Some of the scars are referable to Sigillaria antiquus & 44 from L. S. calamitat

D.11 Sigillaria ampliata Brgt. Represented like the former only by decorticated specimen. I refer to this species all the forms marked by two large nearly round scars either contiguous or separated. Specimen No. 1 is remarkable for its very deeply sculptured large scars oval in outline & carina emarginated marked near the borders by a very emarginate upward and in the middle by an upward or convex furrow. The specimen is very similar to figure 12 p. 52 Q. The surface of the stem is deeply wrinkled longitudinally & transversely, the scars alternate vertically & decim. distance varies from 3½ cent. from one side to the other, or 4½ cent. from center to center.

+12 Sigillaria Lindleyana Schp. Sigillaria undulata Brgt. & Hutt. A fine specimen or candidate No. 11 which is figured in my plates for H. & Ft. Pl. 9 fig. 2 as Sigillaria cyclostigma Brgt. Compare Al. & Hutt. Organism No. 1 is not S. cyclostigma any time.

+13 Sigillaria mamillaris Brgt. Sigillaria Brongniartii Hutt.? A fine specimen No. 25 which is figured in H. & Ft. Pl. 9 fig. 3 as Sig. pachyderma.

+14 Sig. dendrosporea Caracciolo. Given as figured in Sitz. Ber. 1. fig. 5.

+15 Sig. [illegible] Brgt. Not the vol. 27 fig. 14 nothing said.

+16 Sigillaria notata Brgt. One specimen No. 15 a very fine one showing apparently a dichotomous branches or branches diverging from each other nearly at right angle is referable to this species. Agrees with Brongniart's figure 1 of pl. 153 and with Schimper's description Tab. Bot. Vol. 4 p. 87. However there is neither in Brongniart's figure nor in Schimper's description any remark about the decorticated state of the species which is especially seen from our specimens, the scars being represented by two oval small mamillas like the 00. The decorticated scars are seen only upon a part of the specimen agreeing with the form of Brongniart's figure but small. Specimen No. 50 which is decorticated is referable to this species with doubt.

D.17 Sigillaria reticulata Lgh. Ill. Geol. Rept. p. 310, pl. 3 fig. 2. The figure is good. The description given in this work says often lateral angle where they are generally acute. We have three specimens of this species which though comparable to the following is yet different by the form of scars & reticulation see p. 438 & 1.

+18 Sigillaria mamillaris Brgt. A good specimen agreeing well with Brongniart's fig. and Schimper's description. Leaves inclined equal to S. obliqua.

D.19 Sigillaria rhytidolepis Brgt.? The specimen No. 25 is intermediate between this species and S. lepidodendrifolia or even S. reticulata. It is evidently corticat but the furrows are not distinct as Schimper says; they are mostly obsolete, sometimes totally wanting or running out of the view at time. The surface in the decorticated state is strongly wrinkled longitudinally; the scars somewhat smaller with more acute side borders as in Brongniart's figure, exactly

as in Goldenberg's fig 1 of Pl. 9. This however and also that of Brongniart do not show the strongly wrinkled surface. May be a new species, marked Sigillaria minima Rept.

D 21 Sigillaria leiodermis Rept. Scars very narrow oval, 1 cent long 4 millim wide, marked in the center by an obscure point, which lengthwise and also but more obscurely for space between the scars. Differs from Brongniart species by narrower more scars at less distance and somewhat irregular in position. Specimen not quite good though the scars are distinct, detached from the surface or slightly exposed in a fissure.

D 21 Sigillaria monostigma Lesq. Nothing to add to figures and description. Specimen No. 53 & No. 102 are added to this species with doubt. Decorticated & obscure.

D 22. Sigillaria Sulpt. Sigillaria fissa Lesq. may be the same species but the characters are marked in figures & description. Penn. Rept. may be true description or authors separation. They are exactly marked. The museum has good specimens of it. I unit to Sulpt. from a number of decorticated specimens. No. 19, 146 where scars are marked by a single large round point & with surface nearly smooth or very narrowly striate. A few cicatrices are seen just flat upon the part of one specimen appearing like that of Pl. 157 fig 4a in Brong. for sp. which is a scar of L. rhombidea. Other specimen from this peculiar round point which I have not seen in any specimen of the section may represent a new species.

D 23 Sigillaria stelata Lesq. Good species. The museum has three good specimens. Description in Geol. Rept. of Penn. p. 871 is correct in Rept. Fig. 5 pl. 13 is incorrect.

D 24 Sigillaria Schimperi Lesq. This a remarkable species. The specimen did not show anything more than is figured and described in Penn. Geol. Rept. I have corrected the description. Showing the lower part of the scales & scars on the corners too, and perhaps it might be represented thus. But though it may be nothing else yet published I compare it.

D 25 ~~Sigillaria depilo decorticata Rept.~~ The museum has one specimen No. 105 from Moores the only Sigillaria I found in the place, which by the regularity of position of the scars is referable to this species. The scars however are smaller and then form variable, generally nearly round oval, generally narrow & very compressed. Show the same form of scars as in Brongniart only smaller.

D 26 Sigillaria stellata Lesq. Nothing to add to description in Geol. Rept. of Penn. a very fine species. Specimen right. The cicatrices diminish at the ends. The rotulae scars is not a scar. The middle scar is nearer to the middle of the lateral ones.

D 27 Sigillaria [illegible] Fig 2 p. 531. an S. oborata? compare. a large stem. The flattened fragment 15 cent broad with 15 ribs, wavy striated along the borders, granulous or wrinkled under the scars. Scars broadly rhomboidal small round, enlarged at base 3 cent distant, marked in the upper part with a round point and two descending semilunar appendages. Mauch Chunk in Lesq. collection. S. ? Decorticated a. [see p. 47 fig 3.]

28. Sigillaria. From Mauch Chunk Lesq. coll. Rubber. Specimen 20 cent wide. 1 cent or a little more flat concave. Scars closely 1 cent distant, decorticated oval enlarged at top, round at base with a large central point. It has a very large number of specimens. See No. 446. 28a

446e and two thick oval or semilunar appendages on both sides. Corticate the surface is regularly and clearly striate without any trace of scars or with an obcordate scar marking the central point and the appendages see figure. In the decorticate state, the ribs are smooth.

1 Sigillaria semiformis Brongn. Rec. collection a large specimen in Seeley coll. has the scars as marked in p 531 fig 4. the scars at an horizontal distance of 2 cent. and at a vertical distance of only 2 cent. The specimen is large, quite flat. The lower part has the place of the scars marked by a mere irregularly oval convex protuberance and the surface of the whole specimen regularly and equally striate see p. 481 c 3

2 Sigillaria alternans Sl & Hutt. A very large specimen in Seeley collection has double scars 2 cent long, at the same vertical distance of 2 cent, the ribs 5 cent wide. The whole covered by a carbonaceous layer 3 to 4 mill. thick whose surface is obscurely but regularly striate See page 481 c 3

3 Sigillaria elegans ?? Compare and determine. May be S. stellata. The specimen represents upon a large surface the three kinds of scars marked upon the figure p 531. f. 4.

4 Sigillaria sp. nov. Hardeni a large trunk 45 cent wide flattened to a thickness of 5½ cent. Surface double, the upper one ribbed, ribs flat, 2½ cent wide undulately striate or wrinkled indistinctly marked by scars like figure p 531. f. 5 a nearly round covered by horizontal lines with a slightly protuberant point in the middle. Decorticated surface ribbed equally but with thin striae; the scar marked only by a point (~~only by a vertical form a side~~ (range 50 ~~This is remarkable proving that the sub corticate form of the point is no good character~~) ~ The bark is thin, the upper one ¾ on mill the lower on half a mill.

5 Sigillaria S. g. of Seeley no. 6. marked ribs narrow convex somewhat high. Scars decorticate close to each other 1 cent long 1 cent distance see fig 6 of p. 531. The surface is not striate. Bark thick surface of the bark thinly striate but without scars. ~~lower part~~ an elongate point as marked in figure p 531 fig 3. in S ovata

6 Sigillaria N. 27. has a large number of large specimen some of them have the ribs nearly twice as large 1 3/4 cent. the scars broader but of the same form and not quite as distant 3½ cent from central scar to central scar, ~~regularly~~ and thinly striate in the length. See Sigillaria attenuata Cat Polex. p. 17. #1.

6 Sigillaria Mardleyi N. 27. Taxton College. Has large specimen with ribs smooth as large as those of this species but the decorticate surface on some ribs O simple oval and on other double OO from more careful observation this is referable to S. alternans the scars broader longer and irregular in position O

#1. In S. attenuata the upper scar upon the striated surface is elongated

specimen showing, at the same time, the character of *Lepidodendron*, or the three vascular scars of the leaves and the semi-cylindrical and subcortical appendages of a *Knorria*. These we have evidently in our *Lepidodendron Morisianum*. The value, therefore, of the genus *Knorria*, and its true characters, are still questionable and open to discussion.

Colchester and Morris.

Sigillaria alternans, Ll. and Hutt.

Foss. Fl. 1, pl. 56.

A remarkable specimen of this species has been found upon a piece of coal at Morris, by Mr. S. S. Strong. In its lower part it shows the row of double scars separated by a space of half an inch, elongated and irregularly oval. In ascending, the scars approach insensibly till they pass to a row of single ovate pointed cicatrices, joined together by their ends with an oval depression in the middle. This last representation of *Sigillaria alternans*, Ll. and Hutt., is exactly *Sigillaria catenulata* of the same authors, Foss. Flor. 1, pl. 58, and therefore both species ought to be united in one, as is done by Goldenberg.

Sigillaria spinulosa, Germ. in Gold. 2

2 P. 20, Pl. 10, fig. 4.

Our species merely differs by the lateral angles of the cicatrices being slightly obtuse and not acute, as figured and described in the European species. There is no trace of scars of spines. It may be a different and a new species, but it is on a piece of coal, decorticated, and all the details of structure cannot be recognized.

Carmi, White county; collected by E. T. Cox.

Sigillaria Cistii, Brgt.

Veg. Foss. 1, p. 418, Pl. 140, fig. 2.

This species is placed in the genus *Stemmatopteris* by Corda, and appears to be a true *Caulopteris*. Mr. Bradley has found at Morris a specimen referable to this species; but it has only one scar, and from it to the base of the specimen there is a surface half a foot long, without trace of any other scar. The whole surface is ribbed or striated as in Brongniart's figure, the striæ curving and uniting under the scars.

Genus SYRINGODENDRON, Sternb. and Brgt.

Ill. Geol. Report, vol. ii, p. 451.

Syringodendron pes-capreoli, Sternb.

Vers. 1, 4 ; p. 24.

In shales at Grayville ; collected by E. T. Cox.

Syringodendron Porteri, Sp. nov.

Pl. xxvii, fig. 4 to 6.

Stem round and thick. (The State cabinet at Springfield has a branch four inches in diameter, and another double this thickness.) Surface covered with scars placed close to each other in vertical rows, no more than one-sixth of an inch distant, the horizontal space between the rows double as large, filled with vertical parallel and continuous lines or narrow wrinkles close to each other. Scars small, scarcely one-twelfth of an inch across, round, marked in the middle by a vascular depression, overtopped by a convex or semi-lunar deep cavity, which gives to the scars the appearance of an open eye, fig. 6. This line either divides the round scar at its top, or passes a little above it. These scars have the form of those on *Syringodendron cyclostigma*, Brgt., and the striæ of the surface are also of the same kind in both species.

But this species greatly differs by its closely approached scars, and especially by the absence of the intermediate furrows. This character might even prevent the admission of the species into this genus. If, as I am informed, there is a specimen (which I have not seen), found in connection with those examined for this description, and which is abruptly strangulated and reduced to half its diameter, a form indicating a root rather than a branch, this species should be admitted into the following genus.

Found at Eugene, Ind., and presented to the State cabinet by Mr. Isaac Porter.

Lepidodendron ? might this be a Lepidodendron? Lilli d. Weltheimianum.

1. Sigillaria sp. nova, (Blackrock in Fort Carbon) in Cabinet of Lafayette college. Stem apparently large. Scars oval slightly acute on one side, rounded at the other 1½ cent long 1 cent. wide and 1 cent distant. The surface appears granulose and the bolsters are marked in the middle or above it by a scar ∪ Fig. p. 531 f. 9.

2. S. sp. nov.? a large specimen in the Warder museum of Paxton. I copy a few scars p. 11. p. 531. as S. fissa? compare S. fissa is represented also in Lorenz, collection at Chestnut Hill under No. 28.

3. Sigillaria Schimperi? See p. 531 fig 12. Two finely preserved, corticated large specimens of Sigillaria might perhaps be referable to S. Schimperi. The bolsters are deeply impressed into the stone, large 1 cent, as seen in the figure rhomboidal, obtuse up and down, acute at both sides with two oval vascular scars and a semilunar one under them. The surface is regularly and clearly striated the scars by their depression seem surrounded by a frame whose sides are oblique in passing down from the surface to the borders. Compare Sigillaria Schimperi — See p. 449 fig. 1

4. Sigillaria (genus.) see remarks of Brongniart in Mem. to Grand Lury p. 16 (1)

5. Sigillaria Brandei Dournasii? Prest? Aldrich 1. Numerous specimen corticated and decorticated. This N. 1 which should be frequent resemble minus hat to the species as frequent and described by German N. XI fig 1, especially the part on the left of the figure. But it differs from the cast well as from Brongniart and Goldenberg figure by the scars deeper into the stone narrower though of the same form (5) placed at the top of a much longer frame and accordingly at a greater distance this resting in area between two large scars in German being three millimeters and in our 5. Goldenberg & Brongt's figures have the same distance; but the scars and bolsters are twice as large as in our; they are moreover placed in the middle of the frame while we have ours at the top or nearly so. There is a character found in this species of Alabama common with S. Brandei as figured by German, it is the equal striæ which cover as an epidermis the corticated part. In this specimen the striæ are extremely thin and are equally the intervals, the frame and the bolsters. May be and is probably a new species. The specimens are marked No. 1 to 4. N. 4 is part of a small half cylindrical stem, flat and corticated on one side, decorticated on the other and there marked with small punctiform elevated scars closely placed in spiral, four millim distance in following the spiral generally marked with a circular small scar at the top. This specimen resembles somewhat a Halonia; But is evidently a form of this Sigillaria for the flat side of the same branch has the scars of S. Brandei? as described above.

6. Sigillaria Brandei a new species as N. 5. I refer to this two large flattened stems of Sigillaria, 30 centim. broad marked like N. 4 with upreared half round bolsters split at the top, 13 millim distant in following the spiral line and nearly as broad, the whole surface being narrowly lined or striated in the same way but less distinctly as in the specimen 1-3. The cortical part is covered with a thick coating of coal 2 mill thick when surface is covered with round slightly elevated bolsters flattened at top without scars but of the same size and distribution than on the other side. I consider these two specimens as the same.

See Sigillaria reticulata p. 481. 1.

4486.

(1) Syrigodendron Brgt. (Genus) Le Brgt. in Grand Eury mem. p. 17 (2)

2. Sigillaria tenellata. Brgt. A fine specimen No 9 sent from Illinois by Tyler McWhorter from low coal measure represents the species very probably. The bolsters are however somewhat larger than figured by Brgt. 8 millim. long, just 10 mill. broad at the middle angle, 3 mill. vertical distance and a rudy of the same width between them. Form of the bolster exactly like the fig. of Brgt. especially enlarged fig. 1a of Pl 156. The vascular scars enlarged or inflated up and turned inside or outside as mother: Brgt with a transversal line or a point in the middle, rather a point all the lines around the bolsters are straight, the lower in some time a little curved outside the vascular scars nearly in the middles. The agree exactly with the description of S. Tenellata in Schimper Val. vegt III p. 81. to which he adds as synon. S. tenella S. microtigma Syrigodendron pachyderma S. hexagona! S. elegans Pl 146 1. S. alveolaris Pl 147. 5. S. Ichthyolepis Corda Beitr. S. minima & S. ornata Brgt. etc. and probably S. Dournaisii Brgt. see 4746 (3)

3. Sigillaria spec. nova? like S. Dawsonii No. 10 of the same contributor as 2. is deeply narrowly grooved, the grooves two millim. broad and as deep; costa narrow about 5 mill or a little less pulvini oval oblong truncat at the top, rounded at the bar, contiguous, filling entirely the costa vascular scar above the middle in the form of a horseshoe. The bolsters are seven millim. long 4 millim. broad toward the bar which is much inflated. The epidermis is destroyed but where it is left they appear thinly striate Samtypes Dawsonii, Dournaisii tenellata. The specimen is a branch nearly cylindrical, 4½ cent. thick very regularly costat around.

4. Sigillaria spec. nova or Dorsalis? Sgo. reniformis in alg. S. laevigata. Stem very large. Ribs flat 7 cent? separated by a deep groove or double groove. The distance from the pores 2a across the ribs is marked on the paper herewith 7 squares or about 4½ cent. The scars are a distance of three of these squares, or 2 cent. nearly circular more enlarged on the sides, slightly emarginat upward at the top and round at the base. see fig. 1 p. 532. marked in the centre by two semilunar scars in the barred in the middle. The surface is irregularly distantly and obscurely striate in the length. Specimen No 49. in the Hale cabinet of New Brunswick, New Jersey evidently S. reniformis Brgt.

5. Sigillaria Lorenzii spec. nov. A species closely allied to Sigillaria obliqua merely differing by the form of the bolsters, narrowly oval elongated acuminate at both sides, rounded above and below. The middle scar (–) and also the relative distance of the bolsters are of the same nature or character, but the bolsters are much larger. The specimen in the collection of M. Lorenzi at Chestnut Hill near Philadelphia is very large and the bolsters very distinct as figured in the paper herewith. The fragment of the species given to me L. 5 is not quite so distinctly characterized. The surface is regularly striat in undulations on both sides of the Bolsters.

1 Sigillaria monostigma Lqx. In the Mansfield collection, there are four specimens No. 67, a. b. c. representing this species in better specimens than the ones figured in the 2d. vol. of the Geol. Rep. of Illinois. The best preserved ones 67 a & 67 b with the epidermis upon them show the scars little fig. 1 pl. 42 of the Rep. the striæ or straight wrinkle passing from the bolsters obliquely being still more defined. The distance of the bolster in following the oblique lines varies from 1 to 2 centimeters. These bolsters are in general somewhat smaller than in fig. 1. more acute at the top sometimes at least but generally as in fig. 3; marked when the epidermis is upon them with a large round vascular scar at the top extended downward by a large circle which bears at the base trace of a second vascular scar. When the epidermis is gone as in No. 67 b. the upper scar is a small round mamilla and the middle one a point deeply marked two vascular scars sometimes covered by a small mamilla. This fine specimen is very valuable and should be figured again. Another specimen fig 76 has the scars nearer to each others and shows them by decortication as in fig. 4 of my plate loc. cit. — Specimen No 96 represents the species fully preserved with a simple vascular point in the middle of the bolsters and sometimes another with an upraised gland just above it. The middle one is depressed, the upper one elevated.

2 Sigillaria elliptica, Brgt. No 83 from Carrollton as in the collection of Mansfield though the stone is different and coarser than the other specimen. The scars are very deep somewhat oblique close to each other. The ribs distinct undulating and narrow only 7 millim. distance, the scars being 5 mill broad. The vascular scars are little in Brongniart's figure of the species.

3 Sigillaria Yardleyi Lqx. I have found at Brant gap, a very fine specimen L. 1599 of this species. It is in entire concordance with the species published in my Catalogue of Pottsville under the name, the scars very distinct of the same form, covered in places with a thin striate coating of coal. Another specimen L. 1600 has this coating more general upon one side of the specimen and there the oval single scar is remarked as in my figure as also the striate surface. The reverse of the specimen has apparently the same species; but the distance between the ribs is not as broad, only 13 to 14 millim; in the other specimen it is 18. The ribs are less regularly parallel, the scars not quite as large but slightly more elongated. I consider it as the same species, the form of the scars being the same. In my specimen figured for the Catalogue, the lateral vascular scars are turned outside; in these specimens they are parallel.

4 Sigillaria Catenulata L. & Hutt. is not described in Schimper's Leg. Gal. It is very common in the low coal of the anthracite. A number of specimens got at Brant creek L. 1601 to 1604 represent this species with strong half round ribs distant 3 cent. The bolsters mamillate convex in the middle

of the space, sometimes separated, sometimes united end to end forming in the middle a thick ridge where the separation of the scars is marked by a more slight depression or even not at all, the bolsters being more elevated and broader than the ~~[illegible]~~ costa.

1. Sigillaria Schimperi Sig. The specimen fig. p. 531 fig. 12 and ~~and~~ considered p. 448 (3) as perhaps referable to this species is certainly not. I have apparently found this species in specimen 4 1611 from Morris (given by Henry) a fragment of shale bearing remarkable forms of bolsters which decorticated appear to ~~[illegible]~~ represent the fig. 1 pl. XIV of the Penn. Report. The bolsters are placed in spiral order, at a short distance from each other, 2 cent, broadly rhomboidal, enlarged on both sides, 2 cent broad, rounder upward, cuneate or pointed at the base, convex, mamillate in the middle ~~[illegible]~~ when decorticated, marked by ~~[illegible]~~ a large ~~[illegible]~~ central regular point with a very minute ~~[illegible]~~ except the bolster ~~[illegible]~~ can above ~~[illegible]~~ figure. ~~[illegible]~~ The whole surface is covered with short appressed lanceolate scales like the leaves, half a cent long, 4 millim. broad at the base, thick coriaceous, generally marked with a thick nerve in the middle, mucronulate, pressed all around the bolsters, mostly upwards. The epidermis or scales covering the bolsters is of the same thick texture, the upper part being covered by the appressed scales, while the lower is denuded or without scales. These scales fill also the space between the bolsters. It is difficult to form an idea of the appearance of the specimen which should be figured. It rather resembles a Lepidophloios or to some new genus of plants than to a Sigillaria. It has some likeness to Lepidophloios Laricinum as figured in Schimper's Atlas, Pl. 59 fig. 4 & 6 & 8 & 11. ~~[illegible]~~ My Sigillaria Schimperi seems to be nothing else but large decorticated scars of Lepidodendron Chorus Bog. Syst. pl. XI. 11 f. 2, 3, 4.

2. Sigillaria rhombo-ovata Brgt. J. 226 of the Museum is perhaps a representative of this species. The surface is closely distinctly even deeply narrow lyrate under the coal epidermis. The scars distant 1 centimeter from center to center large rounded up ~~[illegible]~~ (1) or large as this. The surface lines are nearly straight not undulate around the scars. See specimen.

3. Sigillaria Sarlii Brgt. Lacoe specimen N 332, 333 represent a small branch of this species. It is only one and an half centim. broad and dichotomously branched. Therefore it is not a Lepidodendron. But the leaf scars are exactly like those of S. Sarlii figured in Brgt. still more enlarged on the borders as this ~~[illegible]~~ but not as large ~~[illegible]~~. It may be figured. See p. 480

4. Syrigodendron pachyderma Brgt. As represented by specimen 498 of Lacoe. The species is as O'Hara figured it in Pl. 24 fig. 3 & 3a. It differs much from that of Brongniart which has the ribs only half as broad, a distinct fascicle of striae running up and down from the decorticated central point and more marked or deeply striated in the middle than at the border of the ribs and the surface of the cortex marked by a tubercle deeply longer than in this American form. It is well to remark however that in the specimen from Lacoe there is upwards either from both side of the decorticated scar two thicker lines ascending to two or three millimeter or arising on from the middle. This character is marked upon my figure. Brongniart's figure has the ribs 1 cent broad. The figured specimen has them 12 millimeter and in Lacoe specimen they are 1½ cent. This can not constitute a specific difference. The Bark in Lacoe specimen is 5 millimeter thick.

See for Sigillaria p. 480 & 474 a.

Syringodendron cyclostigma, Brgt.

Hist. Veg. Foss, p. 480, Pl. 166, fig. 2 and 3.

Found at Alton, by Mr. H. A. Green.

Genus SIGILLARIOIDES, Lesqx.

Cylindrical roots or stems ? variable in size, marked on the surface either by round scars, without trace of a central vascular point, placed in a regular quincunxial or spiral order, or by defined *Sigillarioid* cicatrices with a central vascular point, without any regular order of position in relation to each other. To this genus are referable the remains of what I consider as roots of *Sigillaria*.

Sigillarioides radicans, Sp. nov.

Pl. xxxi, fig. 4.

Primary axis cylindrical, about one inch broad, irregularly inflated and strangulated towards the narrower base, bearing long tubular rootlets or leaves attached to rhomboidal cicatrices, which are narrowed on both acute sides, and marked in the middle by a broad vascular point; leaves or rootlets more than one line broad, marked in the middle by a vascular line or medial nerve. The scars are tolerably distant, and without any regularity of position relatively to each other. Though slightly variable in their form, they are so remarkably similar to those of *Sigillaria monostigma*, that the intimate relation of these remains cannot well be doubted. This specimen is interesting, especially as seemingly indicating a similarity of scars between some species of trees of the Coal Measures and their roots.

Mazon creek; in clay iron-stone nodules.

SIGILLARIOIDES STELLARIS, Sp. nov.

Pl. xxix, fig. 3.

STEM cylindrical, half a foot in diameter, irregularly inflated and contracted, obliquely crossing the shale, marked on its surface by small, round, slightly angular, sometimes nearly square or triangular cicatrices, in exact quincunxial order. These are slightly upraised above the surface, truncate, without trace of vascular point. Surface obscurely wrinkled between the scars, with lines diverging starlike toward the nearest cicatrices.

This beautiful specimen, figured half its size, evidently represents part of a root of a large *Sigillaria*. Its oblique position in the shale is marked by the upper and lower flattened surface, to which the direction of the stem is at an angle of thirty degrees. The inflation and contraction of the cylinder, which is irregularly strangulated, indicates also a tree's root. The scars placed in regular order, though double the size marked in the figure, are much smaller than cicatrices of *Stigmaria*. In the strangulated part of the cylinder, some of these cicatrices are deeply immersed in the stone, and do not show, any more than those which are slightly upraised above the surface, any trace of a mammilla or central point. The wrinkles of the surface and their direction resemble those of *Stigmaria anabathra* var. *stellaris*, Gopp.

Found in the roof shale of the coal at Morris; by Mr. Jos. Even.

GENUS HALONIA, Ll. and Hutt.

Foss. Flor. 2, p. 12.

THIS genus represents aborescent stems bearing two kinds of cicatrices; small ones, like round or rhomboidal points closely approached, disposed in regular spiral order around the stem; large ones more distant, upraised like half round, obtuse tubercles, disposed about in quincunxial order.

1 Halonia. Of this genus, the museum has only the species which I have known as H. pulchella Ad Ll Rep! p. 311 Pl. 3 fig. 3 and the specimen is broken. However a hole in L. 30 from Lacue shows exactly what is seen in my figure on which a more detailed description can be made. What is marked as showing showing point of attach of a branch may be merely a small iron pyrite or its place.

Cyclocladia. ? species. Specimen from Lacue 451 represents a branch like that of an Halonia or Ulodendron. It is quite flattened. 7½ cent broad marked in the middle and on both sides by round circular scars, the outside obscure circ 22 millim broad, elevated in the middle as there marked by a distinct circular umbonal scars 6 millim diameter with a deep depression or hole in the middle and no trace of a central point. The distance from center to center of the depression or scar is 4 millim cent. and from border to border of the outside undistinct rings. 17-18 millimeter. The half scars are undistinct but apparently of the same form as in Ulodendron minus covered by a pellicle of coaly matter irregularly minutely punctate or transversally rugulose. By the form of the bolsters and of the scars this species is somewhat like Cyclocladia ornata of Gold. Pl III fig. 11. c. But the bolsters are only outer rows and by this it is more like Ulodendron flexuosum of the same author Pl 2 fig 10. a species which is not mentioned by Schimper. Put this to H. Mansfeldi?

3. Halonia tortuosa? Ad Ll. Specimen No. 367. represents a small branch, positively referable to Pl 2 fig 2 of my plat, having exactly the same characters but with the bark still preserved and therefore the original form of the scars. The specimen is ten cent long, one and a half cent broad. with alternate knots on each side just as marked upon my figure, these knots bearing upon their surface trace of scars of the same character as those of the main branch but not as well defined. It appears therefore that they are not lateral remains of branches or of fructification but merely adventive buds. The bolsters are rhomboidal square with inflated borders and an inflated central mamelle. The specimen should be figured.

4. Halonia gracilis, Ad Ll. I have a specimen. No. 581 of Lacue which seems to explain this species of Lindley, a branch 2 cent broad 6 cent long with close rhomboidal scars just like those of Sigillaria Brardei and small circular scars of branches about 3 cent. distant 4 millim. broad with a central point and slightly oblong scars around the point. This is most evidently Ulodendron majus. Ad Ll. The scars are exactly like those of my fig. in Ll Rep IV pl. 22 fig. 4 a.

1. Halonia tuberculata Brgt. The figure of Gopp. in Flore des Ulbeyanys d. pl XXVIII fig. 3 is more comparable to ours than that of Brgt. The tubercles appear hollow in the center. Compare Halonia regularis in Binney, Part III, 1872.

2. Dechenia Euphorbioides, Gopp. Gall. Hft. 3, 4. pl. 3 fig. 1. appear to be the same as those representation of agglomeration of rounded oval tubercles found so commonly in the Anthracit of Penn. I have seen them often and considered them generally as inorganic. Goppert considers them as bolsters upon the bark of some trees like Pinnaria. see Gall. loc. cit. p. 43. I have in black band iron ore a fine specimen from Wm Gifford. Also which presents the character of Dechenia as figured by Gopp. Gall. l. 3 d 4. Pl III fig. 1. The bolsters are however much longer from 4 to 6 cent long very irregularly oval. often on one side, narrowed on the other about 2½ cent. broad. strictly ~~fro~~ regularly or about regularly in undulated strice like those of Calamites the strice about 1 millim broad convex. with deep intermediate lines. The surface is smooth, leathery. This is like the bark of some trees or the skin of great saurians; ~~too~~ irregular for that of animal. The relation to Dechenia of Goppert is advisable. Name H. D. Striata. The strice are more or less broken across or in right angle by small wrinkles or rugulose; the bolsters seem as superposed irregularly compressed and pushed aside by contact. The representation fig. 3 is exactly like Sigillaria displicatrix Brgt. in Dict. Sarcap. Pl 10 fig. 8. I may be this figured.

3. Halonia secreta - Spec. nov. Specimen from Wm Gifford, ~~returned~~. The specimen is long. 30 cent. and from information more fragment still are in the possession of the owner, exactly linear, 5 cent. broad reduced by compression and flattened to about 1 cent. in thickness. Bolsters narrowly oval, ~~enlarged transversally~~ 1 cent. broad, even to 8 millimeters in vertical diameter, forming a convex smooth surface slightly elevated above the surface of the stem which is equally smooth and without distinct joints or with merely slight irregular rugosities. Bolsters placed in spiral close one centimeter distant from center to center in the direction of the spire, formed of a hard stony pellicle or bark which when broken show a deep cavity mostly filled with carbonaceous dusty matter which easily comes out of the cavities and when taken out leaves in view an elongated linear depression fig. 1 a. marked with three points in horizontal line similar to the three vascular points or scars of Lepidodendron. The elevation of the closed bolsters above the surface is about one to two millim not more and the tubercles are flat or convex, not half globular as in other species of Halonia. These bolsters are 11 in a turn of spire around the stem having between the corresponding upper and lower points or bolsters 5 ranges which makes a distribution of 5/11 – See on the subject of Halonia what Schimper says. He compares the closed bolsters to abortive (mamelons) etc. This opinion seems contradicted by what we have here a part of stem or a symposium which represents unopened or abortive buds? which seems to correspond to the ~~bud~~ of organs like those of leaves of Lepidodendron. It would indeed be easy to see in this part of stem a Lepidodendron whose leaves unopened and covered perhaps under ground or in water has grown like the ordinary branched Lepidodendrons enlarging the bolster with age and not at all what Schimper thinks of the scars or bolsters of branches and leaves. See Halonia tuberculata Pl XXIX of this vol. and Halonia Tokiensis in C.B. 841.21 H.D.3 p. 38. Compare H. tuberculata in Hen Pl. of Boa Island, and pl. which appears to have covered stem.

D1 Stigmaria ficoides Brong. Specimen St 6. shows in its upper part, flattened surface tubercles or scars, somewhat larger than they are generally and on the under side a flattened narrowly striated stem irregularly marked by rows of rootlets, bearing somewhat like Stigmaria irregularis sigg. tending to show that this species may represent a cast of the internal mould of the species. It may be however a stem & fern attached to the butt of a Stigmaria. I refer to Stigmaria ficoides what is described in Goldenberg with varieties in Stigmaria anabathra. and varieties at least in parts being unable to see specific difference from the scars at least for most of them. In separating them from the size of the scars for example, I would take St 29 the stem preserved in iron with wound distinct rhombic at first as S. anabathra in which the pith is very small compared to the stem and of the same size and form as figured in Gold. Foss. Heft 3 tab 19. fig 1. Also the same with St 65 which has small wound convex scars in regular order and fifteen cortex but whose pith at the base of the trunk (which is round) is proportionally very small and marked upon its discovered ~~surface~~ surface by elongated rameolate or narrowly oval tubercles resembling the scars upon fig. 11 c. pl. 3 of Gold. which the author considers as ~~branches~~ processes of roots going to the leaves. Evidently the character of the thickness of the internal cylinder can not be taken as a character of same as yet. It is possible that what I call Stigmaria unionate in Geni. geol. Rep. p 870 is referable to this species. The specimen is not in my possession. Some of the specimens, St 61 from Laurens Co. Geni. are covered with irregularly agglomerated rootlets which render their surface very rough and the scars invisible. To Stigmaria anabathra I refer specimens which have evident relation by scars ~~of~~ and undulation of surfaces &c. to Corda's species & description.

D2 Stigmaria anabathra Corda. Specimen with parallel lines diverging from the scars ~~and forming~~ lamina.

D3 Stigmaria anabathra var. minor Gold. apparently have stem of Stigmaria of a Sigillaria like S. minor or S. monotyloma.

D4 Stigmaria anabathra or sp. nova. Has more or less distant and somewhat irregular in position small round with a convex border surface covered with an epidermis of coal, irregularly marked lengthwise by elevated disconnected ridges varying in thickness. Much like the irregularities of surface of Bloodendron of which this may be under stem or floating stem.

D5 Stigmaria irregularis & S. radiciens Lesq. A number of specimens in the Museum represent these two species both sometimes upon the same specimen as in St 72. which has upon one side a smooth narrowly striate surface with irregular scars or rootlets with S. radiciens and on the other an irregularly deeply striate surface like that of a calamite but more irregular and also irregular scars as in Stigmaria irregularis. As I do not see exactly what these specimens may represent, I put them all together with the number marked as above. See No 12 p 452 b.

D6 Stigmaria species propria. Stem more or less regularly and distinctly striate lengthwise. Scars at a short distance from each other, in about regular spiral order, 7 to 8 mill. distance from each other in the size of the spire; round cavities not quite 2 mill. broad, with a mere point at the bottom, lines narrow. The scalar scar is distinctly distinct. Many specimens representing perhaps two species as one specimen St 16 has undulations oval and distinctly rhomboidal. ~~St 16 has~~

D7 Stigmaria minima Lesq. Geni. Rept. Specimen St 15 from Marietta O. has some likeness to it differing by scars more distant and apparently triangular. The specimen is somewhat obscure. St 15.

1. p. 451 c.

HALONIA TUBERCULATA? Brgt.

Pl. xxix, fig 1.

STEM about three inches broad, flattened by compression to one inch, bearing large, round, elevated tubercles, hollow in the middle, or funnel-shaped, with a round convex point or small mammilla in the center. The specimen is not only decorticated, but corroded by sulphuric acid, and nothing is seen of the cicatrices between the tubercles but irregular, undulate wrinkles, crossing each other without any definite direction. The hollow tubercles look like large cicatrices of *Stigmaria*.

As the tubercles of the species of *Halonia* have never been described *hollow* in the center, our plant is doubtfully referred to it. The deterioration of the surface has evidently not produced the cavities of the tubercles, for the internal surface is smooth, regularly inclined downwards, bearing at the bottom a discernible vascular scar, similar to that of a *Stigmaria*. This species may be a *Stigmaria*, though the cicatrices are at least double of those of *S. umbonata*, Lesqx.

From the Chester group, Pope county.

Sechonia Gopp. 2p. 451 c.

GENUS STIGMARIA, Brgt.

Ill. Geol. Rep., vol. ii, p. 447.

STIGMARIA ELLIPTICA, Sp. nov.

Pl. xxix, fig. 2.

STEM thick, half a foot broad, flattened to one inch; cicatrices placed in regular spiral quaternate order, elliptical, more or less elongated and proportionally narrow, with a central nearly round, small mammilla, marked in the middle by a vascular point. The specimen is covered with a thin coat of coaly matter, which has filled the scars, where it has an increased thickness, obliterating generally the mammillæ. These

are, however, distinguishable at the bottom of some cicatrices. Their size is proportionally small. The species is perhaps referable to some of the numerous varieties ascribed by authors to *Stigmaria ficoides*.

Prof. Goppert (*Flora des Ubergangsgebirges*, p. 246, pl. xxxii, fig. 3,) has published as *S. ficoides* var. *elliptica*, a specimen apparently decorticated, with oblong, elliptical and unequal cicatrices. These, by their irregularity of form, size and position, evidently belong to a species different from ours. The same author, in his *Gattungen Liv* .1, 2, pl. xv, fig. 49, shows part of the stem of a *Stigmaria ficoides*, whose cicatrices, taken from within the cylinder, are elliptical, while those of the surface are round. But in the specimen here figured we have the true cicatrices of the cortex. I do not think it advisable to enumerate and describe the different forms of *Stigmaria* as mere varieties of the same species. The vegetable remains described in the next genus, demonstrate that even the roots of plants of the Carboniferous age are distinguishable by peculiar forms and peculiar cicatrices. It is my belief, the genus *Stigmaria* does not represent tree roots, but floating stems, of which species of the genus *Sigillaria* constitute the flowers or fruit-bearing stems; the difference in the form, the size, and the relative position of the scars ought to be admitted as specific characters in the same manner as for the species of the genus *Sigillaria*.

True

Duquoin; shales over the main coal.

Stigmaria umbonata, Lesqx.

Geol. Rept. of Penn., p. 870.

I refer to this species remains of a *Stigmaria* found in abundance in the shales of the coal at Colchester, where the leaves are seen in connection with the stems. The cicatrices of the stems are of much larger size than those of *Stigmaria ficoides*, and the flattened leaves are twice as broad, measuring half an inch or more in diameter.

Genus STIGMARIOIDES, Lesqx.

The species referable to this genus, very variable in form, tuberculose, or globular, or cylindrical, are apparently ~~tree~~ roots or *rhizomas*. They have, as common characters, round,

8 Stigmaria latifolia sp. nova ined. Of this remarkable species there are three specimens. St 62 which show part of a stem of Stigmaria with round scars and leaves apparently thick 1½ to 2 centim. wide, regularly and narrowly striate with equal line and a thick midrib. I have seen at Dr Guion's school that filled only with this species but could obtain only broken specimens. St 63 & St 66. St 63 is a large leaf 6 cent. wide with irregularly undulating border narrowed to one side; thinly striate with perforations here and there by what appears to be scars of Stigmaria and in which I do not know what to do of. It may be a cordaite for it is hardly possible to admit there a leaf of Stigmaria.

9. Stigmaria triangularis sp. nova. A nodule with part of a stem, smooth with scars in regular order 3 millim. wide, at the base which is fixed to the bottom remain of a leaf round pointed upward, nearly triangular in outline base flat, about 6 millim. wide. The stem is 3 cent. wide. Nothing more can be seen from the specimen St 79. May be some form of Stigmaria Anabathra inde or rather Sigillaria radicans Lyell (this report p. 31 & 94 note).

10 Stigmaria species. A piece of petrified (but phosphated of iron) stem showing in the middle a large median flattened canal, the central part undistinct the borders marked by rays diverging starlike to the borders. The surface on one side appears as covered with leaves of Stigmaria.

11. Stigmaria with leaves. St 31 a fine specimen showing that of pattern of Stigmaria fixed, at least from the form of the stem, long straight apparently rigid leaves 4 millim. wide with strong medial nerve and borders somewhat waved.

12. Stigmaria leaves or rootlets of Calamites. A large number of rootlets or leaves regularly placed around a stem? broken, contiguous to each other narrowly striate, sometimes slightly undulat first in the length, without medial nerve and appearing like rootlets of calamites coming out around a stem like the leaves of Calamites. These leaves vary in breadth from 7 millim. to two centim. and are here and there marked as by perforation of rootlet with irregular scars. These leaves are much like those of Sigillaria irregularis and this species I think is also referable to leaves of Calamites.

~~13 Stigmaria de villosus Lyo. Thir. ref.~~

(13) Stigmaria (genus 1. ex Brongniart in Mem. Grand Eury p. 17 (1).

14 Stigmaria species. A large trunk, standing in the museum of Brunswick New Jersey represent a Stigmaria — Sigillaria, with scars of Stigmaria and leaves coming out of them and descending down and along the trunk forming in appearance the ribs of a Sigillaria. This Stigmaria trunk show that Stigmaria are not roots as the trunk is large, standing and covered with rootlets or rather leaves appressed against the trunk and nerly parallel between them.

15 Stigmaria species (~~nondicata~~ nuda). Specimen St 1605 from Raritan gap. Surface ~~rarcinata~~ rugose polished covered with wrinkles lengthwise. Scars nearly in regular quinuncs small scarcely 2 mill. in diameter with a small central vascular point, distant, one an one half centimeter in ~~spiral~~ lateral directions and 3 for cent in the vertical. There is nothing figured like this species what by its smooth rugose polished surface and its distant small scars present an appearance totally different from that of all other forms. I have seen the same in nodules at S. & Strong without any difference whatever. (1876.)

1. Stigmaria minuta, Lesq. The sp. Pa. 29. & Pa 31, represent this species which appears to be the same as S. exigua Dawson. Foss. pl. Acad. Dev. fig. 30. The specimens are obscure or badly covered with a coating of coal, but the outlines are readily distinguishable. Pa 29 represents very small branches not thicker than half a centimeter, with scars regularly placed two mill distant from center to center in all the directions and then quincuncially disposed. They appear round but are rather somewhat oval or ⬭, being filled with coal the real shape is not exactly seen. The branches fig. 31 are larger two cent. or more, their scars proportionally larger and distant, the disposition the same. In this the scars are distinctly like those of my fig. 2 of Pl. XVI, and therefore I consider them fragments identical. The specimens come from the Serpentine below Pottsville.

2 Stigmaria ficoides. One specimen S.m. 45 a is a part of a cylinder 7 ½ cent broad slightly flattened with oval scars in exact quincunx ⊙ with the pith on the lower side and out of the woody axis or of the stem like this, the whole transformed into sandstone.

3 Stigmaria radicans. Ly. I can not consider this species as a good one. I find however in all the collections, especially in that of Lacoe, specimen N. 549 leaves apparently of Cordaites, smooth surface closely striated or rather lined like Cordaites borassifolius crossed or perforated by small openings generally oval but irregular in outline, about 5 mill. long 2 to 3 mill. wide often bearing scars or point of or of a leaf of Stigmaria emerging from it. This appearance is remarkable upon shales, of a coarse surface and those points may be mere lacerations of the leaves caused by the irregularities of the surface or some other thing of organisms underneath.

P. 453.

Higmarioides Lgy.

1. Higmarioides lineatus Lgy. From Arkansas we have a fine specimen St 28 which is exactly like the specimen figured in the rep. Pl 31, fig 2. being only larger. The primary axis is 15 millim wide marked by round scars and a central point just like small scars of Higmaria. The branches 4 to 5 millim either go out of the stem in right angles or descend obliquely to it. These, like the primary axis are marked by the same kind of scars more or less irregular in position. One of these branches has 6 of these scars about upon the same line, varying in distance from 5 to 10 millim, no more than one millim wide with a distinct central regular scar or point. The branches however have no trace of medial nerve. They are smooth or like the central axis irregularly, narrowly and obscurely striate. Specimen St 41 appears to represent the same species, one branch only whose divisions are narrower, subdividing in linear that narrower horizontal branches scarcely one millim wide like Tinnularia. Its principal axis has the same kind of scars. St 81 is still a better specimen with branchlets nyphereous, flat, ribbon-form. see 1a below

2 Higmarioides trenis Lgy. Same as described and figured Ill's Geol Rep 4 vol 2. p. 448 Pl. 39, fig. 9. is rec. St 32 St-38 has the scars smaller and the surface flat, not undulate. May be a different species. But form of the scars is the same.

3. Higmarioides rillosus Lgy. This rep. p. 454 Pl 31 fig 1. One of our specimens is that figured as above. Another of the same has also a branch of Decopteris rillosa with it.

4 Higmarioides tuberosus Lgy. This rep. p 453 Pl. 29 fig 5. The specimen shows the tubercle and a still longer part of stem joined to it. The tubercle is punctulate with round convex papillae. The axis appears to be a round rugose stem coarsely striate lengthwise.

5 Higmarioides affinis Lgy. The specimen figured St 41 is in the Museum We do not have any other and it is exactly copied and described p 455 pl. 27 fig 9.

1a. St 41. a specimen from Morris shale represent a bun stigmaria? anabathra? with surface irregularly costate lengthwise. costa or wrinkles narrow parallel undulating slightly 1 centimet distant like the small round elevated tubercles scarcely more than one millim. in diameter and with a deep central point in the middle. This is the same as described p. 451 St 4 as Higmaria anabathra? See the specimen in my drawer. Large specimens of a species like this which I have named to Strong as S. microtigma sp. nov. are apparently also referable to this. The scars are in regular spiral order small, about 2 millim. broad, 1.3 centimeters distant with a ring and central ~~deep pocket~~ manilla upon smooth surface of the stem.

6 [illegible] Higmarioides [illegible] "Higmaria lineatus" mixed with other [illegible] with thick borders like those of Sigillarioides radiatus indicating that both these organism Higmarioides and Sigillarioides are of the same [illegible]

small scars of rootlets, generally placed without symmetrical order, and without a central vascular point.

The affinity of this genus with the former appears at first very close; but we have here species, evidently roots, some of them rhizomas of ferns, marked by irregularly placed scars, which cannot be united to a genus which, even if it should represent a kind of roots, is far different in its essential characters, viz: the regularity of position and the form of the scars. The name of *Rhizolites*, P. Braun., a genus enumerated but not described by Unger, might be, therefore, appropriate if, per contra, the species had not a near relation to those of the former genus, by the form of the cicatrices and of the leaves.

All these species appear to have been of a soft substance, and without exception, have been found preserved in nodules.

Stigmarioides truncatus, Sp. nov.

Pl. xxix, fig. 4.

A cylindrical root, about one inch in diameter, with a smooth surface, marked with small round cicatrices, without order of position. These cicatrices vary much in size, and are evidently scars, left at the base of short, horizontal, flat rootlets, scarcely one line broad, without mark of a vascular line. The vascular point is also absent in the middle of the scars, or marked by a mere cavity.

This species resembles the one published in vol. ii of this Report, p. 448, pl. xxxix, fig. 9, under the name of *Stigmaria Evenii*, which has the surface undulately ribbed and broader scars, and is also referable to this new genus.

Found at Mazon creek, in concretions of argillaceous iron ore.

Stigmarioides tuberosus, Sp. nov.

Pl. xxix, fig. 5.

I do not know any vegetable organ to which these peculiar remains could be compared. The specimen figured represents a nearly round or square oval tubercle, with a convex surface covered with small round points irregularly placed, resembling scars of hairs or scales. In its upper part it is

strangulated or narrowed into a broad, tubulous, plaited leaf? or stem? resembling a large leaf of *Stigmaria*. It may indicate the first development of a rootstock, or represent a tubercle like those found at the end of the leaves of *Stigmaria*. It is marked in its upper part by a large round mammillate cicatrice, resembling also that of a *Stigmaria*. Its peculiar form cannot be considered as some casual deformation, as it is not only distinct in the middle of a concretion, but we have two specimens of exactly the same conformation. The one which is not figured has the leaf longer, and the tuberule slightly smaller.

From Mazon creek.

Stigmarioides villosus, Sp. nov.

Pl. xxxi, fig. 1.

The form of this kind of tubercle is about the same as that of the former species, square, round in outline, appearing to have been cylindrical or inflated. Its surface is marked by two kinds of cicatrices: the one, numerous, punctiform, inflated, placed close to each other in irregular spiral order; the other much larger, auricular, with a mammilla and central point. The first look like scars of scales, the others like those of rootlets. This tubercle is, as seen on the figure, in close connection with a branch of *Pecopteris villosa*, Brgt.

But the union of both parts is not evident, for at its base the rachis is straight, and not curved to the root, by which the juxtaposition may be casual. Nevertheless the verrucose surface of the tubercle resemble so much that of the stem of the *Pecopteris villosa*, that it is scarcely hazardous to consider it as part of the rhizoma of this fern, and the same familiar juxtaposition of the same species of fern and the tubercle is marked upon the three specimens, which are all that have been procured as yet of this peculiar form.

Found at Mazon creek, in concretions of argillaceous iron ore.

Paleopteris relation of this genus. As seen from the figs in my plate 50, the Pal. can not be considered into the Neuropteridea on account of its fructification. This has some remarkable analogy to that of Staphylopteris asterides, which is nervation, straight veins is comparable to that of Triphyllopteris a copied same plat from Mett. which is also very closely allied to Eremopteris by its nervation and the division of its leaflets. Of the species which I refer to the Genus Pal. Bohemica (name should be changed as Schimper remarks that it is not the species name of Pal. Gueppertii) show how greatly variable are the leaflets which represent the species. My Pal. obtusa (Noeggerathia) copied from Gen: Report should be regarded as a species Schimper compares or unites it to Pal. hybernica from which it evidently differs by the enlarged lobes, generally undulate at the top but never dentate or crenulate as in Pal. Hybernica as it is shown by Schimper in his splendid plate 36. and for more enlarged at the top. My fig 7 is copied from a sketch of a large branch sent to me by Rev. of Montrose, Penn. Fig 5 of same plat, my Pal. minor is positively the same as that figured Pl. 50 with fruit. The species vary very much for the form of the leaflet and the thickness of the rachis. The rachis is that broad a theft flattened, but its subdivision are either for narrow branches as see in one of my figures a for theft ones as see for another figure where leaflet are much smaller. This one, I say compare to Pal. Roemer Goepp. and may be it is right. About if so, my species has the predominance being published is 55 while Goeppert is 59. The leaflet of both species are the same but there is a difference in the character of the rachis which is deeply wrinkled crosswise, a character remarked in Pal. Alleghaniensis of Mett. fig 9. pl. 49. while Pal. Sheets Andrew fig 8. 8a is positively the same as my Pal. minor fig 7 pl. 50. The single leaflet 697. for the same formation as 695 and from the same place but both from another locality as Pal. minor may be the only fragment referable to Pal. Hybernica, while spec. 695 is Pal. obtusa, as seen from the enlarging top of the leaflets. The fruit are distinctly marked as see upon the specimen a very good ones with the sporanges quite distinct. They appear either united bulb both then together ever some of them born upon a short pedicel, but the lacinia are oblinear obtusely pointed and when old appear separated from the bar and born upon a short pedicel. They are concave or convex, flatt, but without any trace of veins or ribs as marked upon Schimper fig. enlarged and thought generally born upon the upper surface of the pedicels. They are often seen upon old, either hanging or pressed downward as in the enlarged fig. a. A specimen 696 represent much branches of fructification without leaves. In this all the bundle of sporanges or mere sporanges are borne erect upon the upper somewhat flattened surface of the rachis (branches) curved upward like this. This curving of some of the branches

gives to them an appearance of circinate venation. But that is a mere appearance for a few only of the lower branches have this curve, towards the end which the upper shorter branches of the racemes are somewhat oblique to the main rachis and straight. In specimen 695 a form intermediate between Pal. minor & Pal. obtusa, the pinnae or leaflets are semitortes a character indicated by Schimper for his Neuropteris Gigantea but the addition of dilatata, a character which is not remarked on the forest specimen. In the small specimen 903 referable to Palaeopteris minor the pinnae leaflets are concave and appear at the base slightly enlarged and semi embracing. Figs. 5, 6, & 7. of pl. 49 show the mode of attachement of the pinnae or leaflets just as it is marked upon the specimen, the leaflets appearing sometimes as decurrent by the application of the upper border along the rachis. It is however evident that these pinnae are born along the borders of the rachis which is sometimes flat and in Pal. minor smaller per and then by a narrow depleure in the middle. In Specimen 698 a. I can see distinctly some of the pinnules semitorsa at the base which is apparently made by compression at the base in a direction perpendicular to the natural or normal one. If so the base should have been semi embracing or face, the rachis. The leaflet 697. which is figured show, the base as it seems to be really when in contact to the rachis; that is slightly emarginate or retuse — as in the leaflet of Pl. 49 fig. 4. Some of the specimens of Pal. minor one among other given to me by M. Rosencrow and which has no labels shows well the position of the leaflets as they are figured Pl 49 fig. 5 & 6. the rachis being generally marked in the middle by a deep line (I have figured it) bordered by or rather joined (the lobes) by the base of the leaflets which sometimes as said above seems decurrent but is not;

Stigmarioides linearis, Sp. nov.

Pl. xxxi, fig. 2.

A long, linear, cylindrical root, half an inch thick, slightly tapering downwards, obtuse at the base or broken, bearing narrow linear leaves or radicles one line broad, without medial nerve, leaving at their point of attachment small round cicatrices, placed without order and without visible central point. The rootlets or the first divisions of the root are also marked with round scars, fig. 2*a*, indicating a subdivision similar to that which is sometimes observable on leaves of *Stigmaria*.

Found at Mazon creek, in concretions.

Stigmarioides affinis, Sp. nov.

Pl. xxvii, fig. 9.

This species, represented by two specimens, appears intermediate between *S. tuberosus* and the following. It has a short cylindrical base, divided like a root in branches, tending obliquely downwards and diminishing to a point. This part, about one inch long, is covered with horizontal, half an inch long linear narrow scales, or by their scars, in the form of sharply elevated points. From its slightly strangulated *collum*, or top, it abruptly passes into a broad linear flat leaf or blade, marked on each side by two obsolete lines resembling nerves. Its surface is equally marked with distant points, basilar scars of scales, a few of which are still seen on its borders. These borders are straight, sharp, well defined, like those of a leaf of *Lepidodendron*, and the surface is minutely and irregularly striate lengthwise.

Found in the concretions of Mazon creek; by Mr. Jos. Even.

Stigmarioides selago, Sp. nov.

Pl. xxxi, fig. 3 and 3*b*.

An apparently cylindrical branch or root, whose essential axis, about half an inch thick, is tapering downwards, dichotomously forking, covered with long, narrow, linear hairs or scales (fig. 3*b* enlarged), bearing from the end of the divisions long, hard, quadrangular, tubular, thick, naked leaves?, with a thick, medial, vascular vein, and a narrowly striated surface.

These leaves or roots are similar in form to those of *Lepidophloios*, but much longer. The figure exactly represents the specimen, which is finely preserved in the middle of a concretion. But the union of these hard, smooth, cylindrical leaves with a stem or root entirely covered with hairs, and from the point of alternate divisions, is so peculiar, that nothing among fossil or living vegetables, that I know, can be compared to it. It is uncertain whether these hard leaves represent rootlets of some kind, or root-stalks or leaves, and possibly the specimen may be figured the wrong way. By its straight, horizontal, narrow, linear hairs, the part of the stem which bears them resembles the species published in vol. ii, of this Report, p. 446, pl. xli, fig. 3, under the name of *Selaginites uncinnatus* (1).

In a concretion from Mazon creek.

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(1) Under the name of *Rhizomopteris*, Prof. Schimper has published, loc. cit., p 699, two species formerly referred to *Selaginites*, one of them, *S. uncinnatus*, Lesqx., Ill. Geol. Rep., p. 446, pl. xli, fig. 3, which he considers as rhizomas of ferns. These two last species of ours should be referred to the same genera. *Rhizomopteris* (*Selaginites*) *Ardmanni*, Germ., has been found in the concretions of Mazon creek in well preserved specimens.

Rhizolithes.

1. Rhizolithes (cinnamaria) filicoides Lesq. Geol. Rep. Penna II 17 fig 19. This museum has many good specimens, two of which has the principal axis 15 millim wide. The form and mode of branching and division in the stigmarioides type are, but the trunks and branches do not bear any scars and the borders appear always as more or less inflated. This a root of common occurrence in the coal measures. The figure of the Rep.t is right, but the branches of the first division are oblique from the main axis and the branchlets in right angles only for from of the second division. The specimen figured in Penna Rep represents a branch of first division.

2 Rhizolites Zanichelloides? (or another name) spec. prop. nov. Primary axis narrower not wider than the divisions, pinnately divided in alternate branches or leaves, flat, nervous 1 to 1½ millim wide, curved in the middle, their branches or secondary divisions alternated at the point of union. No trace of scars. The species looks somewhat like a Zanichellia in its mode of division. It is then apparently being covered by a reddish pellicle which separates easily. The specimen represent probably a mere branch of a larger species.

3 Rhizolithes capillaceus Ll & H. Under this name I have put together a number of specimens which may represent some species of Rootlets but which can not be easily characterized.

4 Rhizolithes palmatifidus Lesq. Ark. Report. p 313 pl. 5 fig 4. Specimen type. No. 11.

256 c

1 { Sigmaloccanna Wollmanniana Gopp. Fa. 33. A smooth large branch covered with the thick yellow bark whose surface is smooth but distinctly striated or marked by distinct though very shallow furrows, and by three knots upraised where the bark is destroyed and where form is then undistinct. Thing comparable to Gopper's species which is from the transition formation of Germany. It is not positively identifiable.

1. Megaphytum McLayi Lesq. A splendid specimen though bearing only one scar was obtained for the Museum from Dr. Hand of Morris (20.5, 71). It shows more distinctly the form of the scar than the one published in the 2d. vol. of this report. The outline of the scar is round oval 3½ inches long or a little more by 3 inches broad. The outer ring ½ an inch broad, slightly narrowed downwards passes upwards and downwards into the ligule or medial blades which separates the two lobes. All the surface of the scar, border, lobes &c. are covered with well marked points irregularly placed. This scar has here apparently its normal form, the scar being isolated and not crowded and compressed at both ends. There is three inches above and below the scar where the stem is visible without any other trace of scar. (1.6.71). Morris. Shale.

2. Megaphytum [illegible] Goldenbergi Wein. Specimen N. 587.17 [illegible] [illegible] like that of Schimper atlas. The scars [illegible] distant, separated by a smooth [illegible] [illegible] [illegible] [illegible] [illegible] separated merely by the [illegible] of the border. The scars however are much larger, [illegible] more distinct. The [illegible] [illegible] [illegible] without [illegible] [illegible] what Goldenberg [illegible] scars [illegible] with the [illegible] [illegible] Spec. 545 (2x) should be engraved.

1 Genus Caulopteris. Grand'Eury (Bot mem. p. 6) thinks that the Protopteris can not be separated from the Caulopteris. But that a special group should be established as Rhychopteris with Caul. macrodiscus and a few others.

1. Megaphyllum McLoyi: vol. 2. p 452 pl 48 fig 1. nothing to rel.

STEMS OF FERN TREES.

Genus CAULOPTERIS, Ll. and Hutt.

Ill. Geol. Rep., vol. ii, p. 458.

Caulopteris obtecta, Sp. nov.

Pl. xxviii, fig. 1 to 4.

Stems of small size, varying in thickness from four to six inches, entirely covered with long, linear, cylindrical, ærial rootlets, attached to it without relative order of position, bearing at their base an elongated oval scar. Branch scars distant, oval obtuse at both ends, two to three inches long, one to one and a-half inches broad, marked lengthwise by broad striæ, or marks of ærial roots. The rootlets are regularly cylindrical, one foot long or more, apparently tubulose, without trace of a medial vascular line, closely appressed to each other, and upon each other in the same downward direction, and so entirely covering the stem that their cicatrices are rarely distinguishable. The branch scars are distant, as seen figs. 1 and 2, which show both sides of the same part of a stem, and indicate the relative position of the scars. The order of position appears to be as one to four, but is obscured by the flattening of the stem, whose thickness is, by compression, reduced to one inch at the upper part, and to two inches at the lower part. A branch scar and part of stem are figured, natural size, fig. 3. The distance between these branch scars is so great, especially toward the base of the stem, that a number of specimens, some as large as one foot square, were collected at Colchester, and, though closely scrutinized, did not show any trace of them.

These specimens are generally flattened to less than one inch in thickness, as if the stem had been of a soft texture. Generally the coat of superposed radicles is transformed into a pellicle of coal and these are marked on their surface by very thin parallel striæ, perceptible only with a strong glass. This coating of radicles upon the stem of a fern has nothing peculiar in it, as some fern trees of our time show the same kind of conformation. One species, *Polypodium armatum*, Swartz, from Brazil, is figured in Sternberg's Vers., vol. i, pl. E. But from the Coal Measures we have as yet nothing analagous to this species.

The beautiful stem represented, figs. 1 and 2, is from the shale of Morris, and belongs to Mr. Jos. Even, who kindly furnished me with splendid photographs of it.

Caulopteris acantophora, Sp. nov.

Pl. xxvi, fig. 3 and 4.

The species is represented by numerous specimens, some of them of large size, all of the same appearance. Their surface, either naked or coated with a pellicle of thin coaly matter, is marked by irregular elevated points, placed without regular order, evidently the basilar scars of spines, with which the branches or stems were covered. On the large specimens no trace of branch scars was discernible, but the oval line, marked fig. 3, running parallel to a broad depression seen at the corner of the figure. It is a kind of deep convexity in the shale, with smooth, irregular borders, resembling rather the impression left by the sides of a nodule than a branch scar.

Fig. 4 represents a branch of this species, apparently at least, for it has the same kind of cicatrices exactly on the surface, and still bears on its borders some of the hooked spines by which they are produced. The branch is attenuated into a conical point of attachment which does not resemble that of a branch of *Caulopteris*, and is also marked in the middle by a scar which, per contra, has the form of the branch scars of a fern. These specimens, all flattened, are therefore probably only referable to this genus.

It abounds, like the former species, at Colchester, and is also found at Morris.

1. Caulopteris acantophora Lesq. Of this species a specimen was obtained from J. S. Armstrong of Moores (20.5.71) on nodules from Mazon creek, which show scar of branches and seems to indicate it as referable to some new genus. These scars are small not more than one fourth of an inch long, oval-elongated, about 1/4 of an inch broad surrounded by a slightly upraised rim not quite 1/4 of an inch broad, smooth or without trace of point. They are placed at a vertical distance of about one inch ~~or~~ either single or approached by two or three showing an irregular relative position. The size of these scars would agree very well with the narrow base of the branch figured Pl XXVI fig 4. x same specimen at Strong.

2. Thinopteris crassa sp. nov. Specim. Di 56 + Di 100 upon nodules of Mazon creek. I had at first considered the species as Selaginites Erdmanni Gein. from Geinitz fig. Tab 1. fig 5. But from the mode of unfolding the branches in spiral it is probable that Thinopteris is right and that they represent merely opening stems or rhizoma of Ferns. The stem is broad 2½ decim at the base, slightly narrower upward. 45 decim long bearing three branches curving in spiral downward above the same size as the top of the stem. It is covered all over with thin straight or arched linear sharp pointed hairs 1½ mill. long which curve to the same side as the branches. These branches are better little and thought smaller could perhaps represent the species described here p. 417 pl 18 f 1 a Hymenophyllites Strongii. Both the specimens are much alike and can be compared neither with Lycopodites Erdmanni as figured by Geinitz Pl 1 fig 5 nor to the same species as figured by the author German Letter Selaginites Pl 26.

1b. Caulopteris? acantophora Lesq. The surface is generally covered by a thin pearl pellicule and then thin striated. The points marking point of attachment of the spines are somewhat distant but much less so than in Stigmaria Brevis. They are also smaller and not bordered by a rim. ~~Referable to the Genus Hemmatopteris~~

3. Hemmatopteris obtecta Lesq. Nothing to add to the description of this species as given p. 457

4 Hemmatopteris Cistii Bryt. A good specimen in all corresponding with description and figure of Bongniart pl 140 fig 2 fors. fl. #1. see 4a below

5 Hemmatopteris elongata sp. nov. Specimen S. 44 caule cylindrico subcompresso ~~radian~~ centro broad on the widest or flattened part, 5½ cent. on the other 5½ marked by elliptical scars 10½ cent. long only 2½ cent. wide, obtusely pointed at both ends marked in the middle by an oval internal scar as in S. Cistii but narrower and placed higher up within the general scar. This species may be a form of S. Cistii But the surface of the stem is smooth not covered by radicles and the scars are longer and proportionally narrower ~~Sphenopteris~~

6 Hemmatopteris punctata Lesq. Geni. Geol. Rep. pl 13 fig. 1. The specimen S 40. has the intervals of the scars remaining, the warts being thick close to each other and pitted at the point. This specie is probably referable to S. fuligiea Bryt. whose cicatrices appear to be about of the same form. They are somewhat narrower both in the specimen figured in Gen. Rept. and in the specimen of the museum which is not very good. It is better to preserve the species considering it as closely related to the European one.

7. Hemmatopteris ciliata? sp. nova? Specimen S. 60. Representing a single scar perfectly well preserved but detached from the stem and without connection with any part of it. Scar ovate, enlarged downward 6½ cent. long 4 cent broad in the widest part, surrounded by a fringe of short thick linear lanceolate pointed & curved hairs or scales. The margin is more than one cent. broad, the internal scar oval closed ~~but~~ the lower part, curved in horseshoe upward as see in figure 3 pag 529. Surface of the scar smooth

4b Hemmatopteris Cistii. The coll. of Lafayette college has a specimen with scars 2.5 cent long 3 cent. broad internal scar at top 1½ cent broad see fig. 8 p. 531.

1. Rachis or stems of ferns. Stem. 1.24 & 1.25 at a distance of about 4 cent. in articulations are slightly oblique, smooth like the stem which bears beside, either upon the articulations or above them what appears deep scars of the base of the petiole. They are about semicircular in form ( ) about of this size. 1.25 has only the oblique articulations.

Another stem, 1.44. is a nodule of horizontal white and scarcely small rectangular scars about 5 cent. long, scarcely half as broad ~~placed without apparent order and~~ without any cicatrice in the middle but an undistinct point. The scars are horizontally about 1 decim. distant and three in vertically. The order of disposition is marked, one of the cicatrices being a little above the other or in an oblique position. and vertically in a slightly marked spiral order. This may be referable to stigmaria or vigilaria or may be a small branch stem of fern?

1.45 is a nodule, irregularly striate stem bearing some verrucose ovoid of this size and form which appears to be some spherica under a thin cortex. These stems are in the drawer after the Megaphyllum &c.

2 Stemmatopteris Mansfieldi spec. nov. ined. The specimen No 92 represents a fragment 20 c. long. 12 cent broad with large oral proadly marginal scars truncate or in the form shown form at the top. These scars are placed in quincounce close to each other, two centimeters broad and nearly four cent. long without the borders which are more than one cent. broad ~~with the~~ are no more than ~~one cent~~ one cent distance laterally and surrounded by the flattened remains of rootlets which pass between and above the scars proving by their direction that they are the impressions of adventive roots as remarked by Schimper in Veg. Pal. p. 470. This fine species has some affinity with S. pelli listri, Brgt & S. pelli gere. from the first it differs by the more exactly oral scars close to each other proportionally broader marked at the top by the incurved horns left by the rupture surface of the central part and the direction of the rootlets or of their impressions which not merely pass between the scars but surround them. See p 459 b. (1).

3 Caulopteris Gifford. Specimen from Mr Wm Gifford Alta. Ills. Stem 17 cent. broad, flattened to about 5 cent. thickness in the middle marked around by 6 rows of alternate oral deep scars 7 cent. long 3 cent. broad in the middle, obtuse and joining at the ends marked in the length by deep vertical cortex three millim. broad, more or less irregular. The scars marked smooth upon the figure have had their fibrate coating destroyed. They are deep concave irregularly obscurely lined and rough showing the substance of the woody fibre. The bark between the scars is thick about one millimeter rough verrucose, the warts generally directed in the length and oral. This species has an analogy with C. Phillipsii. Sl. & Hutt. Vol 2 N. 1411 differing much however by the more elongated scars or bolsters more regularly and distinctly marked in the length and the bark rough verrucose punctulat, not smooth. The internal structure is composed of linear white cellulose coarse coatings intersected by black ones as marked in the figure. Specimen returned to the owner. It is comparable also to C. macrodiscus Phyl which has the cicatrices longer and narrower.

1 Caulopteris Manfredi sp. nov. Mr Bay Manf. Spec. 92 Pl. fig. 2, Surface broadly striate by (apparently) closely appressed rootlets crossing the stem and passing around the cicatrices and not merely between them. Cicatrices, large, 6 centimeters long 3½ cent. broad, including the surrounding borders or double ring which includes the internal or secundary disk which is 3½ cent. long 2 cent. broad. Cicatrices, exactly oval, the internal ones somewhat more enlarged at the lower end and emarginal at the upper part by the borders or margo curving inside in the form of a horse shoe, a form however which is somewhat obscure. Their discs are close, in quincunxial order or in oblique direction and alternate, their distance varying lengthwise from two to three centimeters. The nucleus or external cicatrices is convex, and rugose, the borders of the scars generally smooth and flat is often partly covered by the flattened rootlets either at the upper part or on the sides. On the surface when exposed and is partially under the cicatrices is punctulate. The form is related to C. (Sigillaria) pelligera Brgt. from which it differs by the form of the scars more exactly oval, the central nucleus smaller the direction of the rootlets which have evidently covered the stem when the branches were still attached to it, as the turn around them in passing down the stem. In the corticated specimen of Brongniart they are parallel and vertical. This however could not be considered as a difference worth mentioning, for what Brongniart considers as the decorticated surface may be the corticated without the rootlets which may have been attached only to the lower part of the stem while above the scars might have been free of them and open. The distance between the cicatrices is about the same in these and the Europe species.

2 Caulopteris (Sigillaria) pelligera Brgt. Prod. Pre. p. 583 & Lacoe Deposit. Stem is in the Museum a stem 150 cent long with part of the stem is four times more long. His flattened rootlets are 20 cent in length. The scars are nearly distant, 2½ cent. and attained in 4 ans. Cicatrices very long narrow at the upper part and rounded. The disk or inner including the ring 4-5 cent broad and 6 cent long. 5 to 6 cent long and 1½ cent broad. In the cicatrices between the scars the flattened rootlets, marked, deeply undulate, broad striae, marginal in width, which the scars rather is covered by the [illegible] not elevated or bound to those of the intervals. See fig. 6 p. 535 In a upper rother part of the stem median, the scars are only 3 cent long and 2 cent broad with long of scars and covered with striae continuous to those of the vertical intervals. See fig. p. 533 & 6. See p. 459 & (1).

3 Caulopteris Cistii Brgt. Lacoe Deposit. Prod. Pre. p. 583. Specimen. Depth this more specimen with narrowly oval scars. 8½ cent long 22 millim broad. Disk in vertical line 11 cent. in horizontal about 4½ cm. narrowed at base and the intervals surrounded by vertical somewhat undulate striae. Brongniart. This species may have been analogy with C. Manfredi. See fig. of 583 & 584. Deposit. The more p. 533 fig. 1. See 459 a (3).

4 Caulopteris [illegible] Pre. 585 Lacoe Deposit. Of this species or at least I consider the scar described 458 (B) as the same, there is a large specimen with [illegible] in scars. These are distant, tumetize and form as in fig. 9 p. 533. The surface between the scars 10 to 15 cent. in vertical 5 to 6 in horizontal measure is covered with impression of scale oval terminated with a hard point. [illegible] which render the surface scarcely roughened. May be the same as that in [illegible] figured [illegible] then? [illegible]

D. [illegible] Lacoe [illegible] Fig. 1 p. 515. [illegible] distinct. [illegible] irregular [illegible] Spec. 586. [illegible] of Lacoe.

[illegible] Lacoe. [illegible] surface [illegible] identical [illegible] trace of [illegible] striae [illegible]

D 3 Caulopteris Cistii Bgt. Another specimen of Lacoe No 712. Has the bolsters or general scars much smaller 4 cent long; 11 millim broad in the middle oval with a distinct horseshoe formed line as in the sketch of the border vertical distance 6 cent. horizontal 3½ with undulate striae sharply marked between and a smooth tail below terminating in point at the top of the lower scar.

D 4 Caulopteris ~~macrodiscus~~ var. of C. Lacoei var? Bgt. Lacoe Spec. No 713. Bolsters nearly ~~oval~~ round or broadly oval 3½ cent long 27 mill broad vertically and horizontally equally distant (6-7 mill) Surface of the scars and vertical distance between the closely (narrowly) irregularly striate (by thin wrinkles) horizontal space smooth by covering of a coaly ~~thick~~ epidermis ¼ of a mill. thick which easily removed and show then the whole surface, scars and interval, marked by the longitudinal slightly undulat, irregular striae; then are sharp and narrow like thick filaments scarcely half a millim thick. The form of the leaf scars horseshoe shaped are seen obscurely through the filaments, placed toward the upper part of the scars. See Fig. 14 of p 544b

CAULOPTERIS INTERMEDIA, Sp. nov.

CICATRICES elliptical, elongated, three inches long, a little more than one inch broad, narrowed downwards into a broad cauda, pointed at the top, irregularly ribbed or sulcate, with a central, elongated scar, and without definite marginal disc. Surface between the cicatrices apparently smooth, marked by points or mammillæ about one-eighth of an inch broad, half an inch distant, placed in an irregular spiral order. The space between the cicatrices is horizontally one and a-half inches, and two inches in the direction of the spiral.

This species is known to me only by a sketch lately communicated by the State Geologist, and received after the preparation of the descriptive part of this Report, and the engraving of the plates. It appears to be intermediate between *Sigillaria Marodiscus*, Brgt., and *Sigillaria Cistii*, of the same author. The form of the cicatrices is about the same size as in the first of these species, but they are disconnected at the base, placed in true spiral order, and at some distance from each other, as in the last species. It is a true *Caulopteris*, according to Schimper's definition of the genus, while most of our species of *Caulopteris*, viz., those whose internal cicatrices are surrounded by a flattened border generally opening inwards in the form of a horse shoe, are referable to the genus *Stemmatopteris*, of Corda.

In sandstone, over coal No. 3, one mile south of Rushville, Ill.

FRUITS OR NUTLETS.

Genus TRIGONOCARPUM, Brgt.

Ill. Geol. Rep., vol. ii, p. 460.

Trigonocarpum Nœggerathii, Ll. and Hutt.

Pl. xxxi, fig. 16.

This fine fruit is cut in the middle by a section of a nodule which only represents its internal part and structure. As the outside form is not known, and the internal disposition is slightly different from that of the fruit published by Lindley and Hutton, vol. ii, pl. 142, our species is doubtfully considered as identical with the European one. This fruit has three distinct walls or envelopes. The external one, more than one line thick, looks like a fleshy, soft exocarp, the part which it occupies being of the same compound as that of the stone, merely changed in color and intermixed with small pyrites. Its form is exactly ovate-pointed, slightly emarginate at the point. The second wall, transformed into crystallized iron, is irregular in thickness, ascends, first as high as the point of the central ~~rootlet,~~ where it divides, one part uniting both borders, the other ascending near to the point where it is joined in an obtuse top. The third envelope, as thick as the first, ascends to the point *c*, and is a compound of a black substance mixed with fibrous tissue. The internal nut is of a spongious compound like the third envelope, but is marked with more numerous, yellowish filaments, directed longitudinally, and irregularly broken across. Its point seems ascending into the first wall of the whole fruit. The English authors compare the fruit to that of a palm, and recognize in the middle of it, the place of the embryo, a depression which is not seen in ours.

Found in a concretion of Mazon creek, by Mr. Jos. Even, to whom the specimen belongs.

Trigonocarpum olivæformis, Ll. and Hutt.

Foss. Fl. 3 t. 222, fig. 1 and 3.

Collected from the sandstone of Eugene, Ind., by Mr. John Collett.

1. Trigonocarpus juglans Lgp. Ill. Geol. Rep.t 2 p. 460 Pl 46 fig 3. Specimens of T. Noeggerathi are represented in Fiedler's de fructibus pl. 21 & 22. which have some relation of form with my species especially tab 21 fig 6. but all these are abruptly pointed or otherwise while our species as seen from specimen T. 11 is taper pointed see figure 13 p. 529. which completes by the point that of the Ill. report which only shows the upper part. the part matted in a is dull red and appears to be the remnant of a shelly pericarp surrounding the fruit. By detaching the fruit the internal structure could be seen in parts. On other specimens, Ca 29. Ca 41 the shelly covering is evidently matted by a thinlt coat of coal and flattened borders.

2. Trigonocarpus Noeggerathi Brgt. I refer to this species without being perfectly certain of identity the following forms comparing them to figures in Fiedler's work except where otherwise mentioned. Specimen Ca 4 a flattened oval fruit 22 mill. broad 4 centim. long irregularly striated in the length and very obtuse nearly truncate at both ends. Ill. compare with Fiedler fig. 1. Tab. 21. & 6. Oval, obtusely pointed at both ends slightly striate, matted with three main ribs somewhat like fig 3 same plate, but more pointed not truncate at base. (Ca 14 are oval lanceolat pointed specimens which are scarcely referable to this species as figured. Fr. tab 23 fig 12. as this is T. Schlotheimii) T 18 just like some of the figures of tab 22. & 15 &c., Ca 55 referable perhaps to Carpolithes fasciculatus Lgp. Ill. Rep. 2 p. 467 but fruit separate large. They are crushed and not recognisable like those of Ca 59 which I put also with this species and many other nearly unrecognisable forms from Mazo-Cuellar. Ill. these fruits should be more carefully studied than I can do it now.

3. Trigonocarpum Hildreth Lgp. Penn. Geol. Rep.t p. 877. add to description: fruit (internal) 35 millim. long about 2 cent. wide, fig. p. 529 fig 14. I refer to the same species T 3 which has its covering pericarp or shell charred and three ribs marked at the fruit. The shell is not 1/2 mill. one millim. thick.

4. Trigonocarpus obtusiformis Ill. Two of our specimens. T. 22 & T 26 are from the form of the fruit and for its striae referable to this species as figured in Fiedler tab 27 fig 28. But we have some other well preserved specimens, especially T. 2 & T. 4 which have the same form but are entirely smooth. Schimper in his description does not mention the striae and says that it is distinct from T. Noeggerathi merely by its pointed form. If it is so these specimens represent evidently the species. See fig. 15 p. 529. One of these T 4 is much narrower see fig 6. has at the bottom an areola which the other has not. This specimen fig 6. is about of the same form as Fiedler pl 27 fig 21 on the right side.

5. Trigonocarpus subcylindricus n. prop. ined. Fruit cylindrical, conical oblong. 3 centim. long 12 millim. broad. matted with three narrow costae with a basal areol. at the base showing the internal of the fruit in spec. 95. Spec. T 8 has the same form and the same size but a species covered with its pericarp and has not any areol. but is pointed at both ends. See fig. 16 p. 529.

6. Trigonocarpus Montgomeri Lgp. Ill. Geol. Rep. 2 p. 443 tab 22 fig 21. in specimen, the only one T. 44 figured p. 529 fig 17. as seen by its ovate form to the figure given by Lgp. but it is not striate and contrary to Schimper's description Vol. Veg. p. 246. has three costae though the fruit is not angular and is more or less umbonate at base. The point is bifaciate and this may be the same kind of fruit with its covering shell? The surface is rough and with traces of striae. The dimensions are seen in the figure.

7. Trigonocarpus Dawsoni Ill. Ill. in Schp. Gen. Veg. p. 215. may figure p. 529 fig 18. a. b. From its form and large size the species answer the description of Schimper except that the three costae are very thick and therefore distinct. Lgp. mines distinctis: Compare Ill. & Hall 3 tab 221 The base has a small umbonate areola or rather a laceration of the shell showing the internal nut. Brown has in his collection many specimens of the same species. see p. 461 & 6.

8. Trigonocarpus Saffordii species propria. See figure 19 p. 529. A large fruit with its pericarpe, slightly triangular, ovate, acuminate-pointed or rather pointed round or truncate at its base with a very large round areola and three sharp costæ. The surface is narrowly and distinctly striate. Pericarpe two millim. thick. The surface under it is quite smooth. We have two specimens. Fig 19 indicates the form and dimension of the smaller S.I. It has its point crushed and broken. Its original size was more than 5 cent. long. It is slightly flattened, measuring 3½ cent wide at the enlarged part and only 2½ at the flattened one. By its taper pointed form and its large areola it differs evidently from the former species. Compare Trigon. Noeggerathi this vol. p. 31 fig. 16

9 Trigonocarpus cornutus? sp. propria. See figure 1 p. 530 show the form size and internal structure of this fruit as it is seen in our best specimen S. 29 from Mazon creek. The fact that when part with a point the two horns is smooth, like the internal pericarp. The point shows a deep depression, remarkable in form as this smooth surface. Pericarpe thick the borders more than 3 millim. wide. Internal part is filled with crystallized iron and the base where the border is broken is punctate and broken in two where the two borders are seen. The internal part is wrinkled around. The two horns appear like the broken borde of some wing or funnel shaped appendage overlapping the fruit. Appears to be the same as T. claratus this vol. p. 461 pl. 31 fig 11.

Dd/10 Trigonocarpus Schultzianus G. & B. I refer with doubt to this species a number of specimens showing oval fruit, more or less distinctly and broadly striate in the length. A surprising specimen which I have referred to Carpolithes multistriatus and other shorter, smaller whose ribs are generally more obtuse and less distinct which I called C. sulcatus? Stern. Carpolithes multistriatus? Stern is described and figured 2 Vol. Ill. rep. p. 460 pl. 46 fig. 2.

11 Trigonocarpus Saffordii? p. 531 fig. 1. This fruit figured as above is in a nodule from Mazon creek, sent to me by Edward W. Nelson of Evanston Ills. As seen from the figure, the fruit is narrower than the one of p. 529 fig. 19 though somewhat of the same form. Its round enlarged at its base, tapering up to a point. 3½ cent. long nearly 2 cent. broad near the base which is marked by a broad areola areola 1 cent. broad and nearly round marked in the middle by a central round scar. The surface of this nut is covered by a thin shell, apparently at least, but it is split horizontally in a a and show the shell to be less than half a millimeter thick. The surface near the base is smooth and polished. From the middle upward, it is irregularly wrinkled striated in the length. The tip is marked by a point or papilla. The impression is very deep and the fruit does not appear to have been compressed being 6 t. 8 mill deep. — Specimen exam. 25 Oct. 14 & returned to the owner. The specimen is marked N. 1.

12 Trigonocarpus oblongus Hildreth? See Nicholson figure. A nut 2½ cent long, 1½ broad oval, acute or pointed on one side rounded at the other, three costal. One of the specimens is large striate but without ribs.

13 Trigonocarpus cornutus? Nicholson? See fig 2 p. 532 natural size. The internal part is smooth crystallized iron.

1 Cardiocarpus ingens Lesq. Arkansas report 2 p. 311 pl 4 fig 4 & 4 a. nothing to add to description or to change except that at the point the fruit is not always so deeply emarginate.

2 Cardiocarpus affinis Lesq. Might be C. bicuspidatus 2 A but for its broad wing. It is figured right as seen in specimen B 14

3 Cardiocarpus annulatus Newb. am. sci. p. 152. fig 7. apparently the specimens have the specimens from the same place Cuyahoga falls. Though somewhat obscure the species of Newberry differs much from C. ingens or its young form, it cannot scarcely emarginate, its thickness of texture &c.

4 Cardiocarpus ~~[illegible]~~ favosus Lesq. I have not got the specimen on which this species is established. I think that Schimper is right in referring it to C. emarginatus Lesq. Lesq which I have not seen figured.

5 Cardiocarpus emarginatus Sitz. is very variable in form and most of the specimens not pedicellate, even slightly obcordate at base more or less broadly obtuse. Specimen B 6 from the same locality shows these differences & varying widths. The difference in size is also very great from 10 to 15 millim. wide.

6 Cardiocarpus (Nilocarpus Lesq) subrotundus Lesq. prop. see figure p. 530 fig. 12. fruit round, nearly 5 millim wide with a small and pointed nutlet 2 millim broad, with a sinus extending from the stone to point touching in emargination or split the wing surrounding it.

7 Cardiocarpus (Platycarpus Lesq.) triangularis Lesq. the sp. p. 493. The description is good enough, but I have made it by turning the specimen the wrong way. I think see figure 13 p. 530. But in examining these fruits I attached to common axis and also from the form of the nutlet pointed on one side, I see that the emarginate form of the wing which corresponds to the point of the nut should be considered as the point of attachment and not the round uninterrupted base called base partaking with the round and of the nut.

8 Cardiocarpus minutus Lesq. Arkt. geol. Rept. p. 313 Pl. 5 fig 8 & 8 b. nothing to add to figure & description. Left right.

9 Cardiocarpus annulatus Newb. Lacoe spec. N 2011 - 2014. I do not find any great difference between the specimen and the fig. and description of Newb. Cat. 1. p. 324 p. 43 fig. 8 & 8 a. The specimen may be a very. The nutlet is rather great sometimes nearly round slightly flattened or subtruncate or subcordate at the base averaging twelve millim broad and fourteen long generally slightly pointed and its surface plicate mainly thick toward the point, quite flat. The wing nearly equally all around 4 millim. broad, narrowly sinuate at its top and narrowly split for the upper border to the point of the nut, that upwards or both sides of the emargination and in the direction of the border. The emargination which descends from the top and border of the wing from the narrower emargination to the top of the nut and the flat border. These specimens appear well enough the species described by Newberry. But it compares it to a nut of Lycas and on the fruit the nut is or does not appear to have been a hard coat or even fruit for the wing seems to have been very thick and here we distinctly see a wing and not a compressed endocarp across which the nut could be seen as in fruit of cycas and no fruit of cycas is winged. This is rather referable to Compsis or to an intermediate genus.

10 Cardiocarpus simplex Lesq. N 284 & 285 dense see figure (112 enl.) fruit flat, surface polished 3 millim diam wing broad about 3 mill. nearly equal all around, sinuate at the slightly pointed top, cut by a straight line or division to the point of the subcordate nutlet which is slightly cordate or truncate or broadly round at the base. To this may be referred N 315 which is less distinct and may be the following species. The crease [illegible] and well [illegible] The central nucleus is longer [illegible] see 3. p. 461.

1 Rhabdocarpus maculatus Sigw. this report p. 461 pl 21 fig 12 & 15.
I have of this species only Ca 43, with the nutlet within the stone nothing to add to its description & figure. Ca 38 & Ca 19 are doubtfully referable to this species see 463 (21) 465

2 Rhabdocarpus clavatus Hen. In good specimen. Spinty ignis lacunes the
Wrong side. The seed is round ○ with an undulated border and convex in the middle which is smooth.

3 Cardiocarpus multiplicatus. Sp. nov. N: 286. 289. 290. 294. of Lacw. a
little longer than broad, 1 cent long about. Wing enlarged upward emar
ginate at the top with borders rounded both sides of the emargination inclined
outlet small oval acute at the upper part rounded below with one or two lines
of envelope or surrounding it.

4 C. - latum Newb. N: 282, 283, (304?) of Lacw. I do not see any difference
N: 283 has the nucleus a little narrower and more pointed and its wing less
distinct 282 has the wing more enlarged upwards with its point broken
but the nucleus of the same form and size. 304 is a separated
nucleus larger than in the species and figured by Ng more like the nucleus
of Cardiocarpon marginatum Newb by Conwy & Strahlbed may be
different.

5 Cardiocarpus Mansfeldi, sp. N. (post p. 33 from specimen No. 132.
splended large fruit exactly ovate, eight centim. long, four and half cent.
broad below the middle, flattened. Costat, regularly but not very deeply
with the costae more or less broad, from 3 to 5 millim joined at the
point a circular ring, apparently bordered by a flat margin which
enlarges to the base where it seems narrowly lineat. The whole is covered
~~[illegible]~~ by a coating of coal about 1 millimeter thick, with smooth
surface and of which only remnant are left. It may be a Trigonocarpus
and has some likeness to fig. 34. copied from p. 580 fig 4 Carpolithes
Horandi described p. 462 b. 4 The base is formed by a clay concretion covering the fruit
and which by being taken out gives the base, borders, apply, see below N: 7
6 Trigonocarpum Davisii? The collection of Mansfield has 6 or 7 specimen
comparable to fig 48 of my plate and also to 44 & 45. The fruit are oval 5-6
cent long 2½ to 3½ cent broad without a border which is 2½ or 2 millim broad
marking a epicarp generally totally destroyed except toward the borders
where it is seen very thin ¼ of a millim. thick or less and smooth like the
surface of the Decorticated fruit. It is generally pointed on one side a bearing
a short broken pedicel marked upon the surface by obscure striae or
by a strong redge as of a trigonocarpon of which the smooth part could
be seen merely. There may be two species and I separate them so. marking
N: 145 a. b. c. Trigonocarpum Davisii? 146 a, b. c. d, e. Rhabdocarpum
Boschsianum? Gopp. The ribs are broad sometimes obsolete the inside nut is smooth
without ribs narrowed 5½ cent long one, two centimeter broad.

7 Carpolithes Mansfeldi. May be a form of C. multistriatus but the
fruits are generally much larger. One form represented by 3 specimens corresponding
exactly with fig 4-7 of my sketches p. 580. I find even in the box of one specimen an enlar
ged border as marked at the point of fig 4.

8 Carpolithes membranaceus Berger. Two fruit 739 & 739 a of Lacw appear to represent
and the species the oval small nucleus same form and size as then described and figured
by Berger p. 25 pl. I fig 19-21. with the enlargement glued to them and mounted on 739 b
739 seem to have a ring and may be referred to Cary minus Newby.

Genus RHABDOCARPOS, Gopp. and Bergr.

Fruits oval or cylindrical oblong, marked lengthwise on their surface by narrow equal striæ.

Rhabdocarpos clavatus ?, Sternb.

Pl. xxxi, fig. 11.

Our specimen much resembles the figure given of this species by Geinitz, in Versteinerungen, pl. xxii, fig. 13, though it is much larger than the fruit figured by Sternberg. The endocarp is about round, elongated upwards in a *collum* resembling the neck of a bottle; its surface, which is somewhat convex, is a mass of coaly matter, out across by deep wrinkles, caused by disruption; the exocarp surrounding it is about one line thick, of the same shape as the endocarp, but slightly enlarged at the point and funnel shaped. It looks of a harder texture than the internal fruit.

In a concretion from Mazon creek.

Rhabdocarpos mammillatus, Sp. nov.

Pl. xxxi, fig. 12 to 15.

A fine small nutlet, quite entire and separated from the stone. It is apparently of a hard texture, oval, marked on its surface by regular, distinct deep striæ, running down from the borders of a smooth mammillate top to the base, as seen fig. 14 and 15.

The surface of the nut is a thin shell which, as seen from a small part which is detached, covers a hard, smooth fruit.

From Mazon creek, in concretions.

Genus CARPOLITHES, Sternb.

Ill. Geol. Rep., vol. ii, p. 460.

Carpolithes corticosus, Sp. nov.

Pl. xxxi, fig. 17.

A small flattened nutlet, oval, short pointed at one end, (the point turned on one side) and covered with a thin yellowish membranaceous pellicle. It is surrounded by a proportionately thick pericarp, having the same form, and being a compound of crystallized iron.

Mazon creek; in concretions.

Carpolithes persicaria, Sp. nov.

Pl. xxxi, fig. 18.

A small fruit, one-half of an inch long, only half as broad, oval elongated, pointed at one end, slightly emarginate at the other, with a thick exocarp, and an internal compound of the same form, but of a softer substance. The outer wall is preserved, while the internal part is nearly destroyed. It resembles a small kernel of a peach.

On shale found at Murphysborough; and poorly preserved.

162 b. #1.

Carpolithes vesicularis, Sp. nov.

Pl. xxxi, fig. 19 to 21.

This kind of fruit resembles a small bladder, which, by compression in various ways, has taken different forms. It is generally elongated, more inflated and obtuse on one side than on the other, cylindrical. Its surface is smooth, generally covered with a thin coating of coaly matter, marked with broad wrinkles and undulations, as in fig. 19. Fig. 21 shows a kind

1. Carpolithes vesicularis Lyg. I find these fruits? in plenty on some shale (museum of Comp. Zool. Cambridge) collected at Rotterville by Lanborn Feiney. They are borne at the end of a stem? resembling a leaf of Sigmaria and are very variable in form. They may be the leaflets of a fruiting fern? but rather appear a kind of bladdery organ attached at the end of some floating leaves like those of Sigmaria. Some of them are nearly square measuring 3 cent. long or nearly two cent. broad. They appear to have formed the nucleus of the carpolithic umbonata of Hemb. (15.8.71.). see 463 & 14

2. Carpolithes platimarginatus (platimarginatus in Schp pal.) ~~These two forms which I have described under this name in Att's report, Pl. 4 p. 312 Fig. 6 and in Penn. report 87. Pl. XVII fig 12.~~ slet appear referable to two different species. The one, the first, is oval oblong, larger in size. The other smaller is to be mounted most smaller. There are respective transitional forms but I think that they may be considered as identical, the first resembling Trigonocarpus Noeggerathi, the second T. amygdaloeformis. I mark them. The first as type, the second as a variety. The Museum has numerous specimens. The specimen as figured in Att's report is to be intended entire. There is an endocarp generally transformed in coal which extends upwards like wings as corrected in my copy of the Att's report. The species in the Penn. report is ~~certain~~ ~~Carpolithes~~ striated with a large rib or stria in the middle. Both are Trigonocarpi.

3. Carpolithes Jacksonensis Lyg. The figure in Att's Geol Rept. 2 Pl 46 fig. 4 is incomplete. I have completed it from better specimens in his vol p. 530 fig 2a which shows the nut as corticated and 2b which shows it decorticated. In center is a thin coal of carbonaceous matter (cont. fr. regimental). The size of these fruits is found at the same time as in the figures. A fine specimen in Lacoe coll. No 2236 shows the fruit 5 cent long, 2 cent broad in the middle with five broad costae, rounded at one end, narrowed and truncated at the pendulous end.

4. Carpolithes Horrenchianus Sp. prop.? Much like the former but nearly twice as large. The fruit in its integrity, as figured Pag 530 fig 3 is nearly 7 cent. long, 2 cent. wide ovate-linear slightly sub-the shaped more pointed at the top, rounded at base, marked by 4 parallel striae which in old fruit are deep and form elevated ribs between them. Nothing more can be seen of this fruit which especially in a decorticated state, much resembles the former by its elevated ribs. I do not consider it however as the same species.

5. Carpolithes species propria? I do not know as yet to what species are referable the four specimens figured. p. 530 fig 4. 5. 6. 7. Fig. 4 represents a flattened fruit, of the form and size of an uncooked egg, or nearly exactly oval, size of the figure, apparently enlarged at the point by a kind of small emarginate obtuse wing. It appears to have a large border, is marked on one side by a more distinct line, though not strong and its surface is thinly and obscurely striate. Part of its surface is covered by a very thin coat of coaly matter. Fig 5 is from a nodule, partly broken the point and base are broken or corroded. It is ovate in outline but contracted in the middle somewhat violin shaped. It is marked on one side from a. to a by a prominent ridge and has on the other side b another elevated ridge, less distinct than a or line. It is bordered all around and thinly and obscurely striate. Fig. 6 represents one half of a very large fruit? if it is a fruit. It is broadly ovate, with a broad border, irregularly striated ~~lines~~ of the striae nearly in the middle being very deep like folds in the stone. They most of them are converging to the base where they are lost in a deep cavity under the border as seen in the figure. Fig. 6 is from a specimen also imperfect and quite flat. It is equally striate or costate in its length and through broader may be referable to what there is Mansfieldi see below p 463 & 9

considered as Carpolithes multistriatus Stern. They specimens may represent only one species or perhaps four different ones. They are placed with the fruit described above, 5th, and their No's are marked with the figures

6. Carpolithes bifidus Lesq. Penn. Rept. p 877 Pl. 17 fig. 10. The specie is perhaps a new one and may be called bifidus. But I have probably represented it in the wrong way and from an incomplete specimen which is not on hand now. The form of this species are represented p. 530 fig 8, 9, 10, 11. Fig. 8 & 9 appear to be entire fruits surrounded with their pericarp, the point always turned to one side, at least apparently so; fig 10 & 11 fruit crushed and without pericarp, both probably turned the wrong way and the base apparently stem being broken remains of the pericarp. In its entire state the species is somewhat like Carpolithes diospiroides in Hemberg flora 1 pl 45 fig 4. see p. 463c 14.

7. Carpolithes dispandus Lesq. Penn Geol. Rept. p. 877 Pl. 17 fig. 11. I have only a broken specimen, counter part of the one figured as above. This probably the disjointed part of some fruit perhaps the internal nucleus of the forma species

8. Rhabdocarpus arcuatus Lesq. Ill. Geol Report vol 4 pl 2 fig 8 and see a copy of this plate in my U. S. Pl. 1130. The figure is good. Compare it with description. The fruit is evidently petiolate, the petiole very distinct and longer than figured. I have corrected it from specimen 30 another specimen 32 from the same place show a somewhat round fruit 16 millim wide 4 cent. long, without the petiole not narrowed in the middle, obtuse at both ends and slightly impressed with a short apex irregularly and deeply striate wrinkled in the length. A form of species.

9. Carpolithes sulcatus Lesq. Ill. Geol. Rep. 2 p 461 pl 46 fig. 5. Specimen somewhat broken. Nothing more to add but what I have described & figured see p. 466

10. Carpolithes regularis? Stern. 1 pl 7 fig 2. This small species is very doubtful. His oval as marked in p. 530 fig 14 with a central oval nutlet and apparently a thick narrow border which like the nut is plicate striate in the length. It looks as a diminutive form of C. Sadleriensis see p. 464c 2.

11. Carpolithes retusus Stern. The specimens referred to this species 4 in number show exactly the character of the figure in Stern 1 pl 7 fig 10 & 11. They are copied p. 530 fig 15. The fruit is thick, cordate obtuse, very thick and scarcely striate lengthwise, the same size as in the figure. In its compressed state it is very convex and in one of the stone its frontal is or the contrary deeply concave. Not mentioned by Schimper. Other set of specimens show a concave fruit of the same appearance but round oval, not emarginated only slightly pointed and slightly truncate at base. It is probably another species but specimens not quite decided. Fruit like with this species Martiny specimens? It is apparently Carpolithes ellipticus Stern as figured by Gaudry pl. Tat. 22 fig. 28.

12. Carpolithes minimus? N. an oval cylindrical seed obtuse pointed at both ends much like Rhabdocarpus minutus Lesq. and to the same size and matter. It is a mere of the same form and larger. May be referable to the same species. see p. 463 3

13. Carpolithes punctatus Lesq. N. branch of nutlets oval elongated obtuse at both ends folded in irregularly striate smooth appearing to contain a nut surrounded by a wing see p. 530 fig 16 c. These fruits appear attached upon both sides of an axis forming a third as panicle or racemes. Fig 16. represent fruits of apparently the same kind fully ripe and separated from the axis. They are very smooth and also surrounded by a border of which broken remains are seen. What is described in Ill. Geol Rep 2 p 461 pl 46 fig 7 represents a form or species of the same species. Fig 16c of the vol is apparently an immature form.

14. Remark. As the fruits that it would be useless to wait describing the fruits untill we have complete specimen. Fruits of the oval generally surrounded by a pericarp in their natural state have rarely been preserved in their entire form they are mostly flattened and if we have to know the exact and sufficiently it is necessary to describe what we have [illegible] and [illegible] under each species of the and

14 Carpolithes reticularis Lesq. Nothing to add to description &c. this vol. p. 462, pl. 31 fig. 19 & 21. The species is represented by a large number of specimens all of remarkable form and some twice as large at least as those figured here. See 463 & 2

15 Carpolithes bullatus Lesq. Add to the description of this vol. p. 463 that the fruit, i.e. the seeds are generally attached close to each other, or packed in long strings or bunches one to 1½ cent. wide. There is no trace of an axis. They are superposed and crowded and glued to each other. They vary in size from 1 millim. to 3 millim. but all of the same kind are of the same size. Branch formerly curved in various ways. They can not be considered as fruits or seeds, but what. They appear to have been when very wet with fluid within. Also referable to eggs?

See another note of Prof. in Grand Lake memoir p. 18, foot note.

16 Seeds. Scattered in shales especially at Nicomville Ohio. There are a large number of small 1½ mil. wide round seeds with thick coarsely rugose shell or surface which may be referable to some species of [illegible]? Besides we have a large number of medium size & large circle & more representing what I have considered and described in this vol. p. 463 & 31 fig. 25 & 25a as seeds of Trigonarca. They are generally grouped in bundles as seen in the figure. But the shale L. 13 b. is entirely covered with them or something of this kind. In front of the rosmary they rather appear vesicular and are not triquetro. They are perhaps referable to the same species.

17 Carpolithes brachiphyllus? or any other name. not described they appear to be a Carpolithus. Though we have a large number of these fructification in racemes or bunches I was not able to get to find a good one of the fruits separated for drawing. It is as seen in fig. 18a p. 530. If gotten by compression either upon the branches or when in the state of petrification these small round fruits apparently nestled in a kind of bag or sheet distorted and disfigured. The pericarp is therefore seen of various forms. Fig. 18b. shows it enlarged. These seed are placed horizontally around a main axis and pedicelled.

18 Carpolithes ~~[illegible]~~ ~~Dendrotrabus~~ macrocarpus. See ~~Lesquereux~~ p. 365 & 366; p. 530 f. 18 ~~Dendrotrabus~~ macrocarpus. Prof. Name to be changed? A remarkable fruit. Branches very long. I have seen one specimen at Prof. Shelburg at least 2 feet long. I have seen only one specimen of this species. The axis is 8 millim. broad, regularly always of the same size and form. The axis is marked in general by oval depression most of point of attach of the seeds and marked in general by truncate at base and terminate by their whole base. Fruit inflated, linear, truncate at base and terminate by their whole base. Fruit inflated, linear, truncate at the point, 16 millim. long, 5 millim. broad, pressed upon each other and forming a kind of long ear. Like the forma, this fruit or formation of fruit has nothing corresponding in our flora. It is only specimen to what family of plants they may assimilate. In 28 is the only specimen. In their compressed and flattened state these fruits are seen 1 millim. thick.

19 Carpolithes bifidus Lesq. There is in the collection of Hazleton, Lafayette college a specimen of this species (p. 530 fig.) which perfectly agree with fig. 11 & 11 of the same pay and also with the figure in Penna report. The fruit is curved, divided in two parts one separated from the other both either split or divided in two locules in a.a. The lower part appear to be a pedicel and the fruit is therefore turned in the right direction. The part of the pedicel is grooved 2 or 3 deep striæ.

20 C. fasciculatus Lesq. A branch or crushed cone is upon Hazleton spec. of which one of the fruits is represented p. 530 fig. 20. The top of the fruit is evidently pointed and the surrounding pericarp appear thick. Most of the fruits are flattened or crushed but the general form is like that of the figure see p. 465 & 31

21 C. (Arcelacarpus) mamillatus Lesq. There is in the coll. of Hazleton (Sisson Glen) a very fine specimen of this species. It is nearly exactly round, the point sinking into the stem covered a little marked upon fig. 21 p. 530, right side by a thin epicarpical envelope, not thicker than paper but thick enough to discover the striæ, marked in the length by 14 (upper side) regular deep striæ, obtuse at the top. The shade on the side of the nut, right side marks a deep ignitation caused by the convexity of the fruit. Another specimen has three fruits of the same species and size; more or less evidently otriate; their number seems rather to a racemes.

1. Carpolithes bifidus Lesq. The counterpart of the specimen described above N° 14 is figured 7, p. 531. This part is convex and indeed shows evidently the pedicel of the fruit. The part of the right hand representing apparently the pericarp detached from the fruit.

2. Carpolithes vesicularis. L. I find them also at Connellsville Beaver Co in the specimens of Mr Mansfield. They are here mostly quadrangular, elongated. The largest specimen p. 531 fig. 13. see N° 5.

3. Carpolithes ? ? Pl. p. 531 fig. 14. The fruit is nearly circular, slightly more elongated on one side than laterally, with borders somewhat wrinkled in the length or arcuate and the top marked by two semi-lunar obscure lines. Has convex in the middle, all smooth covered with a coating or pericarpe of waxy matter about the thickness of thick paper, destroyed in the middle as marked by the black lines upon the figure. In the same plate there are two other specimens one like 14b which indistinctly show a marginal line at a distance from the border diverging from a top pointed line as seen on the specimen. The other specimen fig 14c is oval, convex or inflated in the middle, surrounded by a flat border apparently a pericarp.

4. Carpolithes disciformis ? Gein. see specimens 16 cat. p. 63. There are 13 specimens from Sciote of Ohio which are like the fig. of Geinitz Pl 22 fig. 28 & 29. all round or irregularly circular, with a central small convex centre surrounded by broad inflated border, varied in size from one half to nearly two and a half cent. in diameter. Has a fruit or an organism of the same character as C. vesicularis; inflated and flattened by compression, but the form is regularly round. It is in number with the two species following.

5. C. vesicularis vesicularis, Lesq. N° 254 de. 25 spec of Lacoe coll. represent this species in its multifarious forms. Most of them are irregular, triangular or like bladders compressed in many directions and also of various size — a few are exactly and narrowly elliptical.

6. Carpolithes Lachronienis Lesq. Lacoe spec. N° 224 & 223 represent this species which is very common in our Coal measures and which is apparently the same as the one described or fig. by Newby. O. Rep. II pl. 43 fig 15. as regards its compression. See figure

7. Carpolithes elevatus ? H. Lacoe spec. 405 has a small carpolite represented p. 531 fig. 20b. Its form is like that of C. fasciculatus. But it is smaller, the internal nutlet fractured at the base and the nutlet distinctly seen with the border of its surrounding envelope. It also resembles C. elevatus of Steinh. Pl 7 fig 14 a but is smaller. It resembles Carpolithes minimus H. figured by Lacoe under this name.

8. Carpolithes. (inuguis). Lacoe 373. Pl. 34 fig 30. Fruit flattened to about one cent. thickness. rounded oval, 6 cent long nearly 4 centimeters broad slightly truncat at one end and slightly cuspidate at the other, with very smooth and black surface irregularly lineate the lines or striae being very shallow not even clearly definable. Both sides are convex and present the same appearance. This fine fruit has some analogy to the internal nut of C. multistriatus. But it is far different by its broadly oval, nearly round form, its smooth surface and its size. I do not find any in the

9. Carpolithes Mansfieldi Lx. is the specie briefly described p. 462b 5. This fruit represented by Ma 151c. an exactly oval fruit obtusely pointed at both ends and figured Plate, fig 33. The figure has not however the kind of top covering or crown observed upon this specimen and which covers the top like an inflated manille. The figure is great. The specimen is broader and far less deeply and distinctly striate than C. multistriatus

see Carpolithes p. 465c

of inflation or convexity, surrounded by a flattened border, resembling an endocarp and its exocarp. This form may be merely casual.

Morris and Murphysborough; abundant in the shales over the coal.

Carpolithes bullatus, Sp. nov.

Pl. xxxi, fig. 22 to 24.

An agglomeration of oval or round, small, wrinkled seeds, resembling vesicular spores, all nearly of the same size. Like the former, they appear to have been of a soft vesicular texture. Fig. 24 shows them enlarged.

In concretions from Mazon creek.

The surface of the stone transversely cut, is covered with them.

Sigillariæ ? Semina, (Seeds of Sigillaria?).

Pl. xxxi, fig. 25, and 25*a*.

The concretions of Mazon creek contain agglomerations of small seeds, united into cylindrical-ovate clusters, about one inch long, nearly half an inch broad, obtuse at both ends, without trace of any common receptacle to which they might be attached. These seeds are rounded upwards, triangular and tapering to a point downwards, as seen in fig. 25*a*, enlarged five times. The space which contains these seeds in the middle of nodules, is filled with a calcareous, white compound, in which the yellowish brown seeds are imbedded without any apparent regular order.

On the shales at Morris, where clusters of the same kind have also been observed, the agglomerations are flattened in irregular round patches, about one inch in diameter, no more than half a line broad. Though these seeds, by their form and size, are similar to those which have been figured by Goldenberg in his Fl. Sarr., 2, pl. 10, fig. 1 and 2, as seeds of *Sigillaria*, and also to those remarked under the scales of true cones of *Sigillaria* found in Ohio by Dr. Newberry, their generic relation is still uncertain. They are evidently referable to some species of the family of the *Selagineæ*.

Collected by Mr. Jos. Even.

ORGANS OF UNCERTAIN AFFINITY.

Genus PALÆOXYRIS, Brgt.

Ann. Sc. Nat., xv., p. 456.

Spindle-shaped strobiles, covered with closely imbricated rhomboidal scales, disposed in spiral order, the inferior ones passing to an angular pedicel, the upper ones lengthened into linear appendages.

This description is copied from Unger's genera, and though inappropriate for the classification of the species referred to it, this genus is preserved, with its diagnosis, for the good reason that, as will be seen hereafter, the true nature of these organs is unknown.

Palæoxyris Prendeli, Sp. nov.

Pl. xxvii, fig 10 and 12.

A spindle or bottle-shaped body, appearing like a flattened small bladder, enlarged in the middle, tapering into a long neck, more abruptly rounded and narrowed downwards into an obtuse point, surrounded by a double line of thin but deep filaments or striæ, scarcely half a line distant, often close to each other, ascending in spiral form from the basilar point, at first in an obtuse angle with the borders, but elongating upwards and ascending into the neck where they become nearly parallel to its sides. The surface of this capsular body is formed of a thin pellicle, and by its compression, the spiral lines of both sides are marked upon it, thus forming, by their crossings, a trellis of more or less enlarged rhomboidal divisions. In ascending into the neck, the spiral lines approach

1. Palaeoxyris. – Germar in his Versteinerungen has published Lx. 7. f. 95 tab 33 fig 3. Palaeoxyris carboraria Schimpe which is described by Schimpe Vogel tal. 2 p. 516. This from the upper carboniferous red sandstone or from the Permian as remarked by Schimper p. 517. The species resembles from the drawing only Palaeoxyris Prendeli but in my specimen the base is broader more truncate, the spiral turns more distant and the upper part more narrowed into a longer collum. (21.7.71

2. Palaeoxyris Lubbeyi John. sp. nov. This species is much larger than the others published here with. From the base to the top of the spike or bag it is 7 cent. long and its width is nearly 3 cent. the bases are broad. 5 millim with deep nerves or folds. The spiral appears to be formed by one bag folded at the point, the two parts remaining parallel for a length of 3 cent. and then going in spiral upon each side and crossing each other and forming a third of spindle shaped purse. The upper bases are broken perhaps and show the form and direction of the lower ones. Though this may be it can not be considered as a third of feet. This species is not as large as Spirangium Munsteri as figured by Schimper Atlas Pl LXXX fig 2. It is also little if by its double row of spirals crossing each other, but it is not quite as regularly spindle shaped nor as regular in its spirals. However our specimen is somewhat broken and the comparison can not be easily made. Di 104 from Mons. 44.

3. Spirangium indeterminatum sp. nov.? Dorty, short spec. to 3½ cent. long and narrow, 7 millim. thick. Spiral close. There are 17 turns formed by inflated twisted thick bands forming rhomboidal areolas. Bases broken distant. The ending band tapering gradually to an acumen. The body carries a thin of P. Prendeli. In these the spirals are more numerous and the areolas are not quite narrowed and thrilly apparently twisted. and P. Prendeli. The bands are twisted like twines, not flat.

4. Spirangium regosum? sp. nov. Di 104 from Mons. Palaeoxyris plicatus see above. The body with spiral is 6½ cent. long see and describe for figure which is exact. The terminal linear obtuse end is apparently thicker.

1 Cardiocarpus & Cyclocarpus. See Brgt. on Grand Eury p. 15. (1), Schpr. Tal. II p. 224 III p. 567.

2 Cardiocarpus (Carpolithes regularis) St. is right for figure 31. A slab of Mansfield is covered with a large number of these seed. They adhered mostly when seen with the glass. They have no border. The central nucleus is rarely distinct. The surface is a comparatively thick bark of Cordaites. From appearance these seeds have the character of Cardiocarpus but very small. They are exactly oval. Often as in any figure a little narrower, longer and slightly pointed. Some of them. They average five millimeters broad and seven long. They represent both C. ellipticus & C. regularis St.

3 Carpolithes minimus? St. fragment of shale of the Anthracite Ca. 21. Shamokin covered with small oval seeds alate at the base obtuse at the other end. round or very convex when half immersed in the shale 5 mill. long 2½ mill. broad or in diameter, surface very smooth polished. Have seeds covered like C. minutus of St. but smaller, especially narrower more acute without trace of border.

4 Cardiocarpus elongatus. Newb. I refer to this species a number of specimen 144a of Lacoe which are exactly like the fig. of Newberry except that the wing is large near the base and continuous to the basal point where it is abruptly rounded both sides and quite near as in the figure which is erect. N. Nev. fig is right this is another species. It is also like the Samarospermum tubacuta Gr. & Eg. Pl. 33 f 5 but the two parts of the wing are united at the top. Nev. 5 of Lacoe is like var. with nucleus smaller 5-6 mill long 3 to 4 broad.

5 Cardiocarpus late alatus is right as figured. But as some of the specimen have a concentrate zone and others none the characters are it seems near C. zonulatus and these species may be mere varieties of one. Lacoe p. 46 & 47.

6. C. zonulatus L. Lacoe 147 b. c. The typical specimen is 147 b. This can not be same as C. elongatus or C. late alatus. The nucleus is much longer rarely zoned and then as in f. 45 which shows it distinctly. It is of evidently a different character.

7 C. annulatus Newb. is represented in Lacoe coll. by N. 200 in hoeing specimen slightly variable as the more or less oval acute shape of the nucleus but exactly concordant in characters.

8 Cardiocarpus congruens, Gr. & Eg. I refer to this species a number of specimen of Lacoe N. 135 which agree entirely with Gr. & Eg. description & fig. Pl. Carb. p. 23, Pl. 26 f. 21. The seeds are ~~rarely~~ little variable in size five to 8 mill. long

Cardiocarpus ~~Carpolithes~~ fasciculatus Sp. Lacue specimen 612 represent a group of thin oral nutlets as described 463c & 462c. Ten of them turned in the same direction and as along an axis or branche are distinctly seen but the point of attachement and the beaut is not distinctly visible. The nutlet are oral, inflated, lenticent & convex in the middle averaging 1 cent. long, 7 millim broad, including a narrow flat border, one millim broad. The inside nut is harder & least it is not compressed and flattened like the epicarp and has the same oral form being obtuse at both ends.

1 Rhabdocarpus mammillatus Sp. I have two specimen N. 665a & b Lacue coll. one is 1 cent long 7 millim broad the other 1½ cent long 1 cent broad both oral broadly obtuse, imbedded into the stone so that the point (apiculus) is not seen. This is a Rhabdocarpus on the band on the figured specimen f. 32 of Ath. is rather a depression caused by the slipping of a fruit than a border. p. 463c (21). The three are obtuse very distinct. mostly regular & cont. nerves are shown but f. 33 & 34 Carpolithes lagenarius St. 1 Pl VII p. 16 represent it exactly but with a surrounding which makes it a Cardiocarpus and thus my figure 32 is wrong. The fig. is copied from Ludwig. [illegible] 133 a, b, c.

2 Carpolithes elliptica St. 1 Pl. VII f. 1. Lacue has three specimens ~~and the name of~~ thick oval which are referable to the species of St. N. 281. they are exactly oval, ~~with a some~~ ~~what super surface~~ ~~eight cent long five broad they are exactly like Carpolithes~~ ~~f. 2 of Pl. XVIII but smaller~~ only with an elevated thick border by compression and often applied in the middle four mill long, 2-3 mill broad described by Schimper, smaller than the number figure.

3 Carpolithes bivalvis Sp. nov. & B. is represented in Lacue by N. 156 a b c d. 5 variable in size & form C. minimus St. Hopf. 156 d. Jan. 1 iz. & C. membranaceus Gp. & B. by N. 156 e. f. equaling f. 20a & 21 of Goepp.

4 Rhabdocarpus Sp. nov. Spec. 153 a b c d of Goeppert represent a small species very much like B. Buchschicanus Goep & Berg but much smaller. The best specimen 153a is seven millim long three and a half mill broad surrounded by a narrow upraised border marked by two deep concentric furrows separating two obtuse costa or rather a middle broad costa with two furrows one on each side and the elevated border on both sides. The fossil specimen present about the same character only one has lost a counterpart, that is a deep medial obtuse furrow between two obtuse costa separated from the border by narrow furrows. I find nothing analogous to this except Rh. Buchsianus but the specimen is not half as large — Yes! it is like f. 10, 11, 12 of Weiss Pl. XVIII Carpolithes (not specific name) only slightly narrower.

5 Rhabdocarpus Danai Newby Lacue has a specimen 667b from the sub conglomerate which positively agree with Newby fig St. 44 f. 4. the internal nut only it is of the same size and form and the surface rough not striate or irregularly striate longitudinally, rather rough. five to seven mill broad as nearly as broad as long, ~~cordiform~~ the base retrencate or cordiform broadly obtuse on the side, acuta or minutely acuminate, hard with a polished or smooth convex surface. The author compares this to Cord. californicus Phil. It seem specimens are still more similar to St. VII f. 9 St. Pl. 1. which is not described.

6 Rhabdocarpus insignis Sp. nov. The fruit is exactly fig. 1 Flattened to 1/4 cent thickness. oval obovate to a short mucro or acumen. Surface smooth shining. Break length wise and wrinkled also. Two of the sides very thin nearly declined as well mucro about two millimeters distant (see relation)

Fruits of the coal.

These fruits are ~~often~~ surrounded by a thick pericarp which appears to have been somewhat fleshy. In that state it is difficult to see the relation of the outside tissue does not correspond to that of the ~~Many species~~ A good many of the fruits of the coal appear to have been surrounded by a ~~Pericarp~~ ~~testa~~ ~~fleshy~~ ~~and~~ or soft ~~and~~ fleshy ~~outside~~ ~~and~~ so by compression their part of the fruit is sometimes displaced and ~~to~~ frequently spread around it in lacunae. What of other specimens of the same species ~~has~~ remained entire than their surface smooth, polished irregularly wrinkled by ~~compression~~ as would be the soft fleshy of a fruit by compression. This is remarkably seen in ~~two~~ specimens from Cannelton, representing ~~large fruits~~ the same species. In other cases especially in Trigonocarpus the testa is hard easily separated and the endotest or inner dense fruit is separate differs in all characters and identity of the species is not recognized.

1. Cardiocarpus (Pachytesta Brgt.) Nucleus subcordate or rounded deltoid with at the base ovate, rounded to an acuminate corresponding to a long style passing through the testa. Testa large, five millimeters or thirds of the nucleus prolonged upwards eight millimeters above the point of the nucleus, both sides rounded and connected with short angular margin between the at the top. ~~Prolo~~ testa prolonged downward also eight millimeters lower than the base of the nucleus ~~abruptly~~ or curving into a short lanceolate acuminate tail or prolongation. This species is very fine and distinct represented by specimen 146. The nucleus and also the ring or testa is variable in size from 15 to 18 mill. long and 11 to 13 mill. broad with the testa comparatively thick. This is of the same general character as the fruits described by Brgt. as Pachytesta and belong to the same genus.

2. Cardiocarpus flexilaris (Samaropsis) Inc. of Lacw 139 c.d.e appears referable to this

more and more, nearly uniting into one. The whole surface is marked with close, very narrow lines, running in the direction of the twining, and discernible only with a strong glass. The borders are smooth or without any projections.

On the specimen represented, fig. 12, the spiral lines are erased in the middle of the body, which is there undulately and irregularly wrinkled like the outside of an empty bag. As the form, the distance, and the direction of the spiral lines from under the neck and upwards, where they are distinct, are the same, I consider this specimen as representing a modification of this species by age.

The best specimen found to the present time, of all those referable to this genus, is that represented fig. 10. It was kindly presented to me by Mr. Michael Prendel, of Morris, for whom the species is named.

It is, like all the others mentioned here below, from the concretions of Mazon creek.

Palæoxyris appendiculata, Sp. nov.

Pl. xxvii, fig. 11.

Body spindle-shaped, ovate in the middle, tapering and elongated at both ends, filaments placed at about equal distances from each other, distance averaging the twelfth part of an inch, turning at the middle in a nearly horizontal spiral, descending downwards in a more acute angle, and abruptly terminating above and in ascending, in a concave straight blade, where they become parallel with its borders. On both sides, in the middle of the body, the lamina or substance intermediate to the spiral filaments, protrudes outwards forming irregularly pointed triangular teeth or appendages, which, however, are not marked at some places. This shows them to be the result of a mere mechanical lateral projection, like those which would be produced on its sides by the compression of an envelope, either formed of twisted, concave, semi-cylindrical blades, or of a soft bladder, surrounded by strong spiral fibres. Our figure may be represented in a wrong direction, or turned upside down.

PALÆOXYRIS CORRUGATA, Sp. nov.

Pl. xxvii, fig. 13.

Its form is, like that of the former, spindle-shaped, more elongated, and gradually tapering to both its ends. Its surface, irregularly folded and wrinkled, has not any trace of spiral fibres. In its upper neck, the body appears passing into parallel blades, while downwards it is bordered by two leaf-like appendages of a coriaceous substance. These linear blades are somewhat concave, the one bending downwards, the other upwards, like the remains of spiral, still half bent laminæ. The folds of the body do not show any peculiar form like the outline of a hard substance inclosed, but they are mere irregular wrinkles, like those which could be formed upon the outside of a crumpled empty bag.

From what is said in the above descriptions, it is evident that the true nature of the organs placed under this generic name is unknown. They cannot have any relation to the flower-bearing spikes of a *Xyris*, for they do not show any trace of scale-like bracts, forming a flower head, or of points of attachment of such scales; nothing that could be compared to flowers or to their receptacles. If these bodies were more regular, and appearing as though containing some nutlet, they could be compared, by the rhomboidal marks of the surface, to some fruits of palm, like those of the genus *Mauritia* or *Lepidocarpum*. But in all the vegetable organs of this kind, the disposition of the scale-like surface of the walls is far more regular than it is in ours. It is not quite evident whether the spiral lines marked on the outside are formed by the twisting of leaf-like blades, or by mere thread-like filaments. The variety in the distances between these lines, as seen fig. 10, tends to support this last supposition, while the lateral projections of the borders, in fig. 11, and the leaf-like appendages seen at the point and base of our two last species seem, on the contrary, to indicate a conformation by the spiral winding of grass-like leaves. In this case, it could be supposed that these bodies represent rhizomas of some plant like *Cordaites*, whose unfolding of the leaves is in a spiral, and which might be seen already folded in that way in the embryonic or radiculose state? After all, they may belong to the animal rather than to the vegetable kingdom, and represent envelopes formed in that shape by some kind of insects for inclosing the larvas. Their irregularity seems to dictate this conclusion. The two figures given by Count Sternberg in Vers., 2, p. 189, pl. 59, fig. 10 and 11, of *Palæoxyris Munsteri*, represent a species far different from ours; but if the figures are exact, they distinctly show that the spindle-shaped body is an envelope, formed by the twisting of three or four leaf-like blades, for at the upper and lower ends, where the twisting ceases, these blades separate, and are seen

0 Palaeoxyris corrugata Dy. In Gurley & Gipsons specimens from Ill & Ind. there is a number of specimens of this species in nodules and none other. They all show the character as described. One specimen 75 of Gurley's is prolonged into a long twisted point or braided in three laciniae which however are impressions upon a single narrowed leaf 5 ½ cent long and very narrowly equally nerved or lined like leaves of Cordaites.

1. Carpolithes cistula Lesq. 238 (specimens 6) seem to represent the species but in different aspects according to the fossil immersed in the stone. One specimen has about the same shape as my fig. Ill. Rep. II p. 461 Pl. 46 fig. 5; somewhat smaller but the borders are covered. It is crossed lengthwise in the middle by a sharp narrow cord and thus appears a Trigonocarpus. P. 238 c is smaller also shows partly the borders and has its surface smooth only concave in the middle lengthwise without trace of cord. Probably the other specimen show the plan of the testa or the testa bursted in the middle. Two other specimens show the first bordered by a broad smooth testa with two furrows running from near the base where they are more distant to near the top where they are quite near as in this figure separated by an obtuse smooth ridge in the middle. Compare fig. 4-5. Pl. 1 of Fiedler. Much like it.

Supplement to Neuropteris 1626 4678

(1 Neuropteris (Cyclopteris) rarinervis Bunb.) I have a specimen from Strong. It represents a large stem or rachis 3½ cent broad, irregularly coarsely striate covered with Cyclopteroid leaves from 7 to 8 centimeters in diameter. These leaves do not seem to embrace the stem but are alternate attached by the middle on both sides of the rachis, covering it on one side and seemingly round, the point of attachement appearing as in the middle, round and small 5 millim in diameter. Unhappily the specimen is not very clear but however distinctly show the size form of the leaflet and their alternate position. The specimen has at its top a leaflet of N. rarinervis, less than one cent long. see below (3)

2 N. Europteris angustifolia, Bngt. There is in M. Strong collection a fine large fragment of a frond of that species. The rachis is six millim. broad alternately forking nearly in right angle and the ramifications or branches about as thick as the primary rachis, and 7½ cent distant. These lateral pinnæ are very long but none is preserved in its whole length. The pinna a is fifteen centimeters long, it bears distant alternate pinnules rarely simple mostly compound or trifoliolate, having as N. hirsuta two small oval pinnules at the base of the large ones. These are six and a half centimeters long in the middle of the pinnæ, shorter and smaller toward the base, oblong, gradually lanceolate or narrowing to an obtuse point, cordate at the base, basilar pinnules enlarged across, oval broader than long. The primary rachis also bears leaflets which however are simple and shorter. no trace of hairs is observable upon any of them. The distance between the pinnules of the main rachis is more than two centimeters. The pinnules are 1½ to 2 cent broad at the base where they are slightly enlarged. This ramification and arrangement is that of N. auriculata Bngt. see 4 Neuropteris rarinervis. Bunb. The position of the leaflets upon the main rachis of the above Neuropteris angustifolia indicates the place and relative position of those large cyclopteroid leaves remarked upon stems of M. Strong as described above (1). Another stem of M. Strong represents these leaves ten centimeters in diameter.

D Neuropteris Clarkii [illegible] to 4678 2

5. Neuropteris angustifolia Bngt. Butts specimen N 144 is a large piece of shale covered with leaflets apparently referable to this species. Though very variable in size from 1½ to 2½ cent broad at the base and from 2½ to 8½ cent long, they are all comparatively narrower than any form of N. hirsuta or N. cordifolia, all without trace of hairs. with very close nervilles 40 to 50 in one cent or 40 to 50 per centimeter at the border; base either equal or more generally inequilateral, leaflets either straight or curved to one side (scythe shaped). These frond appears to have been subdivided like those of N. hirsuta. The specimen has with the large leaflet some small oval or roundoval, eight millimeters long and 6 broad. — I have from Cannelton a very fine specimen No. 179. an ultimate pinna compound of a large middle terminal leaflet and two basilar ones. which is the same species as that of Clinton. The terminal leaflet is the exact copy of Brongt. pl. 64 fig 5 Neuropteris cordata Evidate. It is seven centimeters long, twenty three millimeters broad at the base and also at the middle, narrowed upwards to an obtuse slightly inclined point. The pedicel

467b is not detached from the middle leaflet, it is eight millimeters long flat, linear, two millimeters broad, marked in the middle by the continuation of the midrib of the terminal leaflet where it is distant from only two centimeters, dividing upward by anastomoses of the lateral veins just as it is seen in Brongniart. The pedicel bears at its base two oval oblong wide leaflets open or in right angle to the pedicel, 15 millimeters long ten millimeters broad unequal at the base and with a cyclopteroidal nervation. The veins of the terminal and lateral leaflets are many times dichotomous. Scarcely inflated toward the base, measuring as marked above 50 veinlets per centimeter at the border. This species represents exactly Neuropteris Cordata Bragt. and perhaps also N. acutifolia and angustifolia? 2.574 Brongn. 4

+1 Neuropteris spec. nov. N. Loschii affinis. Em. N. 27. This is represented by part of a penna, deltoid in outline, 7 cent. secondary pinnae nearly in right angle to the rachis, alternate, the lowest 7 cent long, rapidly diminishing toward the upper part, broken. pinnules subopposite, oblong oval-obtuse, the lower basilar part prolonged in auricle, altogether similar in form to N. Loschii; terminal pinnule oval obtuse, scarcely lobed, large as a, surface covered by a rough opaque pellicle of coal rendering the veins or nervation totally obsolete. A branch on the reverse of the specimen has this epidermis removed the the veins are there seen extremely fine and much curved backward near the base, nearly straight toward the point of the leaves, four to five times dichotomous, counting at the border 7-8 per millimeter which would make 175 to 300 per inch. The main rachis is convex a comparatively large, regularly lined in the length by parallel distinct ~~ribs~~ thin ribs or nerves. If this may be taken for a var. of N. Loschii, it is a remarkable one. This may be the species which is considered as N. orbiculata Boem. But the reference to the spec could be only for some fragments with rounded leaflets. Other pinnae have then lanceolate acuminate or pointed.

a.

2. Neuropteris Clarkiana fruiting. Large specimen a pinna 50 cent long 50 cent broad. but the upper pinnae dichotomous, the last pair forking. The upper pinnae are 25 cent long separated at base by differently formed leaflets as in my figure. The leaflet of 10 mm of the pinnae are fruiting. Otherwise figured p. 532 fig. The sori are linear oval or obtuse at both ends (enlarged) 1 millim long scarcely 1/4th millim. broad with a semi circular cross section as in a placed generally on two rows near the midrib in the direction of the lateral nerves. The specimen is 382a. fruit.

Neuropteris inflata, Lesq. A specimen from Jacob. N. 542 has leaflets long cut into lobes the terminal pinnule narrowly oval obtuse with a very short tooth at the [illegible] the species like the small specimen I have figured [illegible] (140 cent) than in N. inflata and thus may be merely N. tenuifolia.

Neuropteris imperfolia Lesq. Large specimen 550. has three leaves of the species 1 being from 13 to 21 millim at the base rounded, equal or inequilateral and from 7 to 10 cent long with nerves diverging to meet the rachis, the veins very thin and no lines, I venture to refer to this species. It may not [illegible] never divided in two as figured in Ca. 1st Rep. and a Cyclopteris

linear and parallel, each about one-eighth of an inch broad, with the same form, size and position, at both ends of the inflated body. Such a conformation seems far more the result of animal industry than of vegetable organization.

The species hitherto referred to this genus, are, with the first-named: *P. Munsteri*, of Sternb., *Palæoxyris regularis*, Brgt., loc. cit., which, by its regular scale-like scars, is different from ours; *Palæoxyris multiceps* and *Palæoxyris rhombea*, two species of F. Braun, merely enumerated in Unger's Genera and Spec., without description. The two last species, like that of Sternberg, are from the Keuper Lias: that of Prof. Brongniart, from the Permian. Our species, represented in the lower part of the true Coal Measures, are therefore interesting to science, from their geological position.

Mazon creek, Grundy county.

The following species have been found and communicated to me since the preparation of the plates: and have not yet been figured:

Neuropteris microphilla, Brgt.

Foss. Flor., p. 245, Pl. 74, fig. 6.

Represented by two specimens from Mazon creek, which, though showing the characters marked by the author, do not distinctly indicate whether the species is truly a distinct one, or merely a small form with obscure nervation of *Neuropteris Loschii*, Brgt.

Neuropteris angusti-folia, Brgt.

note p. 484? 467?

Foss. Flor., p. 231, Pl. 64, fig. 3 and 4.

The specimen is an exact representation of Brongniart's figures of this species. The surface of the leaflet is smooth or without hairs; the veinlets somewhat coarser, and not quite as distinct as in *N. hirsuta*, are marked at the upper part of the leaf and at the base of the veinlets by the same kind of swelling or tumor which is seen in the author's species, and has been considered by him as remains of fructification. The leaf at its base is elongated on one side in a kind of auricle, and abruptly narrowed or truncate at the other, linear lanceolate, obtusely pointed with a comparatively broad pedicel one-fourth of an

inch long. This last character seems to unite this species to *Neuropteris Scheuchzeri*, Brgt., which the author considers as probably identical with *Neuropteris angusti-folia*. I have lately received from Mr. S. S. Strong, and also in a concretion from Mazon creek, a splendid specimen representing the top of a pinna of *Neuropteris hirsuta*, Lesq., in the process of unfolding, or still curved in spiral, whose leaflets, very hirsute on one side only, are narrow, linear lanceolate, and unequal at base, exactly like the leaflets of *N. angusti-folia*, Brgt. I am, therefore, not yet satisfied that this last species is a distinct one, and still believe that it may represent a form of *N. hirsuta*, as it has been explained, Geol. Rept. Penn., p. 857.

Concretions of Mazon creek; from Mr. Even.

Neuropteris crenulata, Brgt.

Foss. Flor., tab. 64, fig. 2.

I refer with doubt to this species a specimen procured by Mr. S. S. Strong from the concretions of Mazon creek. It represents the upper end of a pinna bearing oblique, oblong, obtuse leaflets, attached to the rachis by the narrowed base, forming a broad pedicel, and of the same form as those figured by Brongniart. The upper leaflets are simple, the lower ones compound, or bearing on each side at their base a round, small, cyclopteroidal pinnule. The medial nerve of the leaflets is obscurely inflated, the veins and veinlets are distant, arched, distinct, not inflated, forking once or twice; the borders are slightly crenulate by a contraction of the epidermis at the point of the veinlets. Our specimens agree well enough with some of this species obtained from Pennsylvania, as also with the description of the author. There is, nevertheless, a difference especially marked by the division of the inferior leaflets with small round pinnules at the base, like those of *Neuropteris hirsuta*, a division which has not been heretofore noticed in this species. The teeth of the borders are also less prominent and distinct on our own specimen.

Callipteris Sullivantii, Lesqx.

Ill. Geol. Rep., vol. ii, p. 440, Pl. 38, fig. 1.

Some specimens, in concretions from Mazon creek, show the lower divisions of the pinnæ more elongated, and pinnately cut-lobed, as in species of *Alethopteris*. This kind of subdivision would therefore indicate the place of this species in this last genus, as admitted by Schimper, Paleont. Veget., p. 561. But the peculiar nervation of this fine fossil fern, which is half neuropteroidal, has

1. Callipteris sullivantii Lgy. The specimen Cal 5 of the museum has the middle leaflet more than one inch long or still longer for the top is broken off. Both the lowest or rather the lowest on both sides of the pinna are deeply undulate - broadly lobed, the inferior lobe attached to the point of junction of the main with the secondary rachis is broadly reniform with the nervation of a cyclopteris and therefore without trace of a medial nerve; the other lobes have trace of the medial nerve ascending to the middle. The specimen should be figured. 20/6/71 —

2. Callipteris sullivantii Lg. A specimen Mc 112 show this species with small leaflet, the ultimal pinna long linear lanceolate pinnules only 12 millim long 6 millim broad towards the base, leaflet slightly enlarged same character of nervation as in C. sullivantii.

469b H. A

1 Alethopteris longifolia (Gomoptera) A small specimen of an ultimate pinna with clear nervation. N: 192 of Lacoe is figured 5. p. 532. with the nervation enlarged. It corresponds exactly to that of Brongniart. The pinnule is of nat. size.

a close analogy with the species admitted by Brongniart as the type of his genus *Callipteris*. When better known it may probably indicate the character of a new genus.

ALETHOPTERIS LONGIFOLIA, Brgt.

make a drawing

Foss. Flor., p. 273, Pl. 83, fig. 2.

The specimen, a fine one, represents the upper part of a pinna, with a broad half round rachis, bearing alternate, horizontal, narrow, linear, simple pinnules, attached to it by their whole base, but not connate, with entire or scarcely undulate borders. The nervation is exactly as figured and described by the author. The leaflets are marked by round scars of *sori*, placed near the border, one only upon each middle vein; the details of their structure cannot be seen, but they greatly differ in form and position from those of *Alethopteris emarginata*, Gopp.

Concretions of Mazon creek; Mr. Even.

ALETHOPTERIS PENNSYLVANICA, Lesqx.

Penn. Geol. Rept., p. 864, Pl. ii, fig. 1 and 2.

In the shales of Morris; Mr. S. S. Strong.

ASTEROCARPUS GRANDIS, Sp. nov.

UPPER end of a pinna, two inches long, a little more than one inch broad at the broken base, evidently part of a large frond. The lanceolate pinna is simply divided into alternate, open, lanceolate, obtuse pinnules, one-fifth of an inch broad at their connate base, and one-half of an inch long, with a smooth surface or with merely an obscure medial nerve, without other traces of nervation. The fructification is marked by large starlike *sori*, placed near the borders of the pinnules, four on each side, one at the top, with six to ten sporange-cells pointed towards the center, obtuse to the outward. The form of the sporanges is the same as in *Asterocarpus Sternbergii*, Gopp., Foss. Farn., p. 188, pl. 6, fig. 1 and 2, but they are

larger and more distant from each other. The form of the pinna and of its division is also totally different in our species.

Mazon creek; S. S. Strong.

A number of specimens, representing fruiting pinnæ of *Pecopteris* or *Alethopteris*, have been recently obtained from Mazon creek, but are left undescribed, the essential characters, form and position of the *sori*, nervation, etc., being too obscure for a satisfactory diagnosis.

Hymenophyllites furcatus, Brgt.

Veg. Foss., p. 179, Pl. 49, fig. 4 and 5.

A few small specimens of this species have been collected by Mr. S. S. Strong, from the roof shales of Morris. It is rather a sub-conglomerate species, being found most abundant at the base of the mill-stone grit, or the top of the red sandstone, in the anthracite basin of Pennsylvania.

Stigmarioides? rugosus, Sp. nov.

As much as can be seen from two specimens obtained in concretions at Mazon creek, by Mr. S. S. Strong, the stem is cylindrical, two to three inches in diameter, marked with circular depressions, points of insertion of branches, or rootlets diverging from it all around, enlarged at base, cylindrical, flattened by compression, tapering or diminishing in size from the base, half an inch broad to the top, one-fourth of an inch in diameter, where these rootlets are broken, two and a half inches from the points of insertion. Their surface is wrinkled and narrowly striate in their length, and marked by small round holes, which appear as the basilar points of attachment of branches of rootlets. The cross section of half a cylindrical stem is obscurely seen, and appears to be marked by broad tubercles like those of a stem of a *Calamites*, only much larger. There is nothing published as yet, which can compare with these fossil remains, but the roots of *Equisetum Mougeotii*, Schp., Pal. Veg., pl. 13, fig. 9. I consider them as representing the rhizomas of some *Equisetaceæ*.

1. Odontopteris Sub crenulata? Brgt. Specimen No 1580a from Valenciennes of the Sup M Lebon Bremont has a small specimen representing a narrow linear part of a pinna with 8 pairs of alternate lateral oblong, distant, enlarged at base with the whole truncate base with entire borders or borders slightly crenulate. This form recall the specimen described from Lorenz p. 390c (?) which has also distant leaflets and same veins all from the base, their straight distant, as in O. schlotheimii but with borders more distinctly crenulate than this. I find however in No 1583 with a small fragment similar to that of 1580a fragment of pinna bearing at its base short, half round crenulate leaflet truncate at the base attached to the rachis by a broad width and with distant veins parallel at the base and forking once or twice and parallel for the parts to the crenate borders. The leaflet above this and upon the same pinna become longer, lanceolate tapering pointed, twenty one millim. long nearly eight millim. broad near the base with its narrowed abruptly or rounded, then leaflet having a thick flattened decurrent midrib from which the lateral veins forking once or twice go out in an acute angle of divergence, having the same form with also the same nervation exactly as in Neuropteris crenulata Brgt. From this it would appear that Neuropteris crenulata Brgt may be the same species as Odontopteris crenulata Brgt. for from Lorenz specimen which can not be separated from the leaflet just below the lower leaflet of the pinna and attached by the whole truncate base to the rachis have the nervation of an Odontopteris, the veins being parallel at the base and the middle vein not more distinct than the others. These modifications seem to ally this species to Neuropteris Zamii and to the genus Cardiopteris of Schimper, some of the leaflets being true Cardiopteris. See for this Schimper Terrain Houill. de Vogesen and his Veget. Pal. — This form positively represents the three Genera Cardiopteris, Neuropteris and Odontopteris.

Odontopteris Sub crenulata? Brgt. The same as above is represented in Spec. No 1621 a pinna with oblong obtusely pointed pinnules. The largest 2 cent long one cent. broad at base or less the lower leaflet is right angle the upper ones inclined upwards. These slightly decurrent and joined to the inferior one near the rachis, the lower ones separated to the base which is truncate at base at the lower decurrent part but generally rounded in the upper half of the border. The mid rib is very distinct, the lateral veins forking once at the base and once near the top, coming out from it and slightly curved toward the border, generally inflated, the lowest veins only coming out of the rachis along the decurrent lower border while in the upper basal border they pass from the mid rib close to the base of the leaflet as marked in my figure of the U. S. flora. Though the borders are not crenulate or are only indistinctly so, I consider these as the same species Neuropteris or Odontopteris crenulata and the veins are only inflated per place while at others they are thin and slightly divolet. This might be also a form of O. pachyderma which is however not probable, the veins being generally clearly marked. Sp. No 1622 is a mere leaflet of the same species, showing still more distinctly the odontopteris nervation at the base of the lower side of the leaflet where it is more enlarged and the Neuropteris on the other side. Spec. No 31 of Lorenz has the nervation of the specimen as above indicated see p. 471c.

Odontopteris subcuneata, Bunb. is not always tossed at the base of the leaflet but the leaflets are sometime decurrent as seen No 1624 the lower leaflet only being boned 1623 shows the terminal leaflet very long 6 cent. long lanceolate, obtuse pointed. ~~See Schimper description and the specimen which I have figured of this species Pl. 211 and in 1649 the Mem. Geol. There is still more in that for Morris is the same character~~

Odontopteris & Neuropteris pachydermata form a peculiar group which might be separated without regard to the nervation which is evidently indifferently Neuropteroid and Odontopteroid in the same specimen even and generally on the side of the base of the leaflet Neuropteroid and Odontopteroid on the other more decurrent pod. This is seen in many Neuropteris species of Brgt. Neuropteris Duponnoyi, Elegans, Villerii etc. These could be separated in a peculiar genus to which might be added the species which I have regarded as Lescuropteris, yet unpublished, and to that Pachydermata I could put Neuropteris crenulata, N. Pachyderma, N. avonica, N. Agassizii etc. This all species clearly allied by their inflated derma and disposition to pass from Neuropteris to Odontopteris in their nervation.

D1 Odontopteris Schlotheimii Brgt. I have seen at Morris a pinna of the species 35 centimeters long with secondary pinna alternat 7½ centimeters long open. The characters are the same in one figure of the U. S. carboniferous flora.

D2 Odontopteris Worthenii Lesq. Lacoe spec. N. 178. is a small terminal pinnule of this species. I have figured it p. 532 fig 6 in specimens 5.22 & 1624 for nervation contained in the borders. Specimen of Lacoe N. 178.

3. Odontopteris ~~Pennipinnata~~ abbreviata Lesq. n. sp. Pl. fig. 2. Bipinnately divided; pinnae apparently open, parallel close, alternately pinnate; pinnules distant joined to the rachis nearly by the whole base, open, (nearly in right angle to the rachis) which is narrow, regularly undulately ~~three or four lobed~~ on each with three to four obtuse short entire lobes on each side; terminal ~~pinnule~~ lobe broad, entire obtuse; middle nerve thick toward the base, effacing toward the point of the pinnules; veins oblique to it, parallel, slightly curved backward, simple or forking once, equal, more distinct toward the borders when they are inflated. This species may be some peculiar variety of O. Schlotheimii somewhat like the pinnae in Goppert Permian Pl. XIV fig. 3. The lobes are very short however as also the pinnules and the main rachis very narrow, comparatively other. It has also a distant likeness to O. obtusiloba Naumann as figured by Goppert Permian, same plate XIV. fig 6 the form of the pinnules being somewhat alike. The nervation is however more regularly Odontopteroid in this new species than figured in that of the German author.

D2a. Odontopteris Schlotheimii Brgt. I have not until now, I think remarked upon the peculiar character of the rachis of this species. It appears to have been exactly cylindrical and hollow, for it is sometimes flattened and wrinkled, is exactly flat and regularly linear with both sides parallel. It is regularly lineate striate, quite as regularly as the leaves of some species of Cordaites and in some case the large rachis of this fern may be taken as Cordaites. On specimen or shale from Morris 1620c. has two fragments of rachis of this kind, one quite flat bearing alternate horizontal pinnae. It is seven millimeters broad with 27 to 31 striae nearly equal and equidistant; the other nearly two and one half centimeters broad has not any pinnae but is striate in the same way, some of the striae slightly more irregular.

D4. Odontopteris heteromorpha Lesq. I have received Oct. 77. five specimens of this species from Mansfield and Hankel figured 321, 322 & 325. These represent more leaflets however of much larger size than those of the Ill. Rep. Vol. II. The largest leaflet is 10 cent. long, rounded at the base to a narrow point of attachement and enlarged apparently lunate on the other, from the base to the middle it is strong, a little widening upwards and entire. At the middle it divides in lateral irregular lanceolate lobes obtuse pointed and turned upward and the middle part is narrowed nearly linear irregularly lobate, not more than 5 millimeters broad, the terminal lobe being comparatively very long 3 cent. narrow 1½ cent. entire or slightly undulate, linear lanceolate obtusely pointed. Fig 310 is a minor part of a leaflet, the upper, lobate part

double as long as the top leaflet 325 and therefore part of a leaflet at least 20 centimeters long and four cent. broad, toward the base or in the entire part, supposing that the form is the same. The other leaflet appear terminal. It is short, only 2½ cent long, rudimentary or truncate at the base, divided a little above in four lobes, varying in size and length, more or less divergent palmately and representing a hand with four fingers, the middle one longer and narrower. These figures are so different from those of Illinois, at least in size and general outline. I believe however that they may be referred to the same species. The nervation is the same, the lateral veins forking generally twice and distinct and somewhat distant 12-20 in one centimeter at the borders. (see below (c))

1. Odontopteris ~~[illegible]~~ Brongn. I have figured two specimens of this species. These detached pinnæ agree with Schimper's description and Brongniart's figure. No 211 is from Butts. The largest 24649 is from Mazon creek. There is still another upon shale from Morris showing the same characters and a small one from Cambridge Museum O. 411 also exactly of the same character. The plant or rather the pinnæ are of hard coriaceous or subcoriaceous consistence, coarsely veined; but the surface is generally covered by a thick epidermis obliterating the veins in 24649. The nervation is quite distinct, as it is also upon the shale of Morris. In No 211 the nervation is clearly seen through the surface waxing of coal. Spec. No. 359 is a large pinna of the same species; it is evidently a coriaceous sp.

2. Odontopteris heterophylla? as described p. 470. It seems to be a different species. The veins are thinner, not inflated, closer, and often mixed with short very numerous hairs as in O. Worthenii; may be a new species.

3. Neuropteris (Odontopteris) ~~[illegible]~~ cuneata Lx. Two good specimens from Cannelton No 302 A & B represent this species distinctly. Both are simple pinnæ. The second, the larger one is 14 cent long, bearing eleven pairs of alternate rounded oblong leaflets attached to the rachis by half their base, just as in my figure; 12 millimeters broad, 14 millim long at the base, gradually diminishing toward the top all separated and nearly in right angle to the rachis; without any trace of nervation. They are concave impressions representing leaves of thick substance. The other is the upper part of a smaller pinna with pinnules exactly of the same character nearly four cent. long and as broad. In none of the specimens is any trace of nervation discernable. This is a true Odontopteris, Neuropteris Pachyderma being quite a different species. (w. Lx) see specimens

4. Odontopteris britannica? Gutb. Em 15 a represents the upper part of a pinna, bipinnately divided at the base, simply pinnate in the upper part. The upper leaflets are lanceolate pointed or obtusely pointed; the lower pinnæ are pinnately lobed with the lobes rather obtuse like those of Odontopteris ~~[illegible]~~ Brongn. Ellis's indistinct No 16 is a mere fragment of a pinna with lobes or pinnules divided to the base, rounded upwards, and directed obliquely towards the point of the pinna as in the other specimens. It seems different from O. ~~[illegible]~~ Brongn. though the leaflets are less pointed than in O. britannica.

2 Neuropteris orbicularis, ? Brongn. No 191 has a small pinna 4 cent long with narrow half-round rachis bearing 3 or 4 pairs of alternate round pinnules one cent. each way in diameter with an obscure flabellate nervation without trace of middle nerve. The surface is somewhat rough and the nervation indistinct. appears to be the same as that described by Ruehl.

DISTRIBUTION OF THE FOSSIL FLORA OF THE ILLINOIS COAL FIELDS.

The following table enumerates all the species of fossil plants known to this time, (March, 1870,) from the Coal Measures of Illinois, and indicates the location where the specimens representing them have been found. This synopsis of the fossil flora of the Illinois coal fields may serve to elucidate the remarks which have been suggested by the study of this flora. The figures marked on the table show approximately the proportion of specimens which represent each species: 1, for example, for a species represented by less than five specimens; 12 for a species represented by one hundred or more.

List of Fossil Plants.	Duquoin.	Murphysborough.	Colchester.	Morris.	Mazon creek.	Other localities.
1. Chondrites Colletti, Lesqx	....	....	....	....	....	Lodi, Indiana.
2. Neuropteris hirsuta, Lesqx	2	12	4	4	12	
3. " angustifolia, Brgt	....	....	....	....	1	
4. " fasciculata, Lesqx	....	....	....	....	1	Neeleyville.
5. " Collinsii, Lesqx	....	....	...	1	1	
6. " flexuosa, Brgt	....	6	....	1	...	Alton.
7. " fimbriata, Lesqx	....	1	....	....	1	
8. " rotundifolia, Sternb	...	....	....	....	....	Alton and Grayville.
9. " capitata, Lesqx	....	1	....	....	1	
10. " plicata, Sternb	....	....	....	....	1	
11. " Loschii, Brgt	....	2	....	....	2	Abounds at Grayville.
12. " microphylla, Brgt	....	....	....	....	1	
13. " tenuifolia, Brgt	....	2	2	2	2	Grayville.
14. " vermicularis, Lesqx	....	2	....	....	2	
15. " rarinervis, Bunb	1	4	4	6	6	
~~16.~~ " ~~Villiersii, Brgt~~	....	1	....	....	....	
17. " Clarksoni, Lesqx	....	....	...	....	2	
18. " inflata, Lesqx	....	....	....	....	2	
19. " ~~coriacea, Lesqx~~	....	....	....	....	1	
20. " heterophylla, Brgt	....	...	....	....	....	Rock Island.
21. " Desorii, ? Lesqx	....	....	....	....	1	Still doubtful.
22. " Evenii, Lesqx	....	....	....	...	1	
23. " verbenæfolia, Lesqx	....	....	....	....	2	
24. " crenulata, ? Brgt	..	....	....	....	1	
25. " pachyderma, Lesqx	....	....	....	....	1	
26. Dictyopteris rubella, Lesq	....	6	....	....	....	

	List of Fossil Plants.	Duquoin.	Murphysborough.	Colchester.	Morris.	Mazon Creek.	Other localities.
27.	Odontopteris Worthenii, Lesqx	....	....	....	...	2	
28.	" heterophylla, Lesqx	....	3	....	....	1	
29.	" subcuneata, Bunb	....	....	....	....	1	
30.	" Bradleyi, Lesqx	....	....	....	....	1	
31.	" Schlotheimii, Brgt	....	....	....	4	1	
32.	" æqualis, Lesqx	....	....	....	....	1	
33.	Alethopteris serlii, Brgt	....	6	....	3	6	
34.	" aquilina, Brgt	3	....	2	2	....	
35.	" Pennsylvanica, Lesqx	....	....	....	1	....	
36	" Massillonis, Lesqx	....	....	....	....	1	
37.	" Mazoniana, Lesqx	....	....	....	....	3	
38.	" Owenii, Lesqx	....	....	....	....	1?	
39.	" crenulata, Brgt	....	....	....	....	4	
40	" hymenophylloides, Lesqx.	....	....	....	....	1	
41.	" Hallii, Lesqx	....	....	....	....	1	
42.	" inflata, Lesqx	....	....	....	....	1	
43.	" erosa, Gutb	....	....	....	3	....	
44.	" cristata, Gutb	....	....	....	1	....	
45.	" muricata, Brgt	....	....	....	....	1	
46.	" nervosa, Brgt	....	1	....	1	1	
47.	" Plukneti, Brgt	....	....	...	1	....	
48.	" callosa, Lesqx.	....	2	....	1	....	
49.	" spinulosa, Lesqx	1	....	....	....	....	
50.	" falcata, Lesqx	....	....	....	....	1	
51.	" lanceolata, Lesqx	....	....	....	....	1	
52.	" emarginata, Gopp	....	....	....	....	2	
53.	" longifolia, Brgt	....	....	....	....	1	
54.	" solida, Lesqx	....	....	....	....	1	
55.	" stellata, Lesqx	....	....	....	....	1	
56.	Callipteris Sullivanti, Lesqx	....	....	6	8	4	
57.	Pecopteris Strongii, Lesqx	....	....	....	3	2	
58.	" Sillimani, Brgt	....	....	....	....	1	
59.	" squamosa, Lesqx	....	....	2	2	2	
60.	" arguta, Brgt	....	....	....	3	1	
61.	" Candolliana, Brgt	....	....	....	....	1	
62.	" cyathea & arborescens? Bgt	....	....	....	....	1	
63.	" aspidioides, Brgt	....	....	....	....	1	
64.	" lepidorrhachis, Brgt	....	....	....	....	2	
65.	" hemiteloides, Brgt	....	....	....	....	1	
66.	" villosa, Brgt	1	2	4	6	12	
67.	" velutina, Lesqx	....	....	....	....	....	?
68.	" oreopteridius, Brgt	....	1	....	3	2	
69.	" Bucklandi, Brgt	....	....	....	....	....	Little Vermilion riv.
70.	" pteroides, Brgt	....	....	....	....	1	
71.	" Cistii, Brgt	....	....	....	....	1	
72.	" polymorpha, Brgt	....	....	....	....	....	Abounds at Grayville
73.	" abbreviata, Brgt	....	....	....	...	5	
74.	" unita, Brgt	3	....	3	....	12	
75.	" elegans? Germ	....	....	....	....	3	
76.	" dentata, Brgt	...	....	....	2	2	
77.	" plumosa, Brgt	3	...	3	6	1	
78.	" flavicans? Presl	....	....	....	....	2	
79.	" Murrayana, Brgt	....	....	....	....	1	
80.	" chærophylloides, Brgt	....	....	2	2	....	
81.	" Newberri, Lesqx	....	....	....	....	1	
82.	Asterocarpus grandis, Lesqx	...	....	....	....	1	
83.	Staphylopteris Wortheni, Lesqx	....	....	....	....	1	
84.	" asteroides, Lesqx	....	....	....	1	....	
85.	" sagittatus, Lesqx	....	....	....	....	1	

(1) Pecopteris aspera Brgt. I.S. 2012 Coll. of Cambridge is a fine specimen of this species. Leaf tripinnate or tripinnatifid: primary pinna in right angle somewhat distant, (three centimeter, the width of the pinna being a little less) linear lanceolate secondary pinna ~~nearly~~ right angle short 1½ cent long at the base of the primary pinna very gradually shorter toward the apex, parallel, ~~equally~~ divided the lowest in big pairs then in pairs toward the apex in fine etc ended t 1. equal round lobes cut ~~nearly~~ to the rachis when they are connate in acute times. lobes entire; terminal pinnul broadly ovate larger, nervation slightly marked except the middle vein distinct in each pinnul pinnately branching in generally single or eight ~~[illegible]~~ ~~approaching further~~ a the base one ~~approaching~~ further. The texture of the pinna is rough, as described by Brgt which however frequent smooth. Fig. 2012 from Morris that has no trace of primary rachis it being buried in the stone. Another specimen ~~[illegible]~~ in the collection of Prof A. H. Worthen shows it rough. The substance of the leaflets though not coriaceous is somewhat thick, the veins being buried into the epidermis.

Marsh + ? are the species seen at Mr. S. S. Strong. Oct. 76

	List of Fossil Plants.	Duquoin.	Murphysborough.	Colchester.	Morris.	Mazon creek.	Other localities.
? 86	? Sphenopteris scaberrima, Lesqx	....	....	....	1	....	23
87.	" gracilis, Brgt	....	....	....	3	....	
88.	" mixta, Schp	....	....	....	4	....	
89.	" paupercula, Lesqx	1	....	....	....	....	
90.	" irregularis, Sternb	....	....	2	....	....	
91.	" obtusiloba, Brgt	....	1	....	....	....	
92.	" latifolia, Brgt	....	....	....	....	1	
93. +	" trifoliata, Brgt	....	....	2	....	....	
94.	" abbreviata, Lesqx	....	....	....	....	1	
95.	" elegans, Brgt	....	....	....	....	1	21
96.	Hymenophyllites alatus, Brgt	....	....	1	1	2	
97.	" spinosus, Gopp	....	....	2	....	....	
98.	" pinnatifidus, Lesqx	3	....	....	....	....	
99.	" + fruit. tridactylites, Brgt	....	....	....	1	2	
100.	" trichomanoides, Bgt	....	....	....	1	....	
101.	" myriophyllum, Brgt	....	....	....	1	....	
102.	" Schlotheimii, Brgt	..	1	....	1	....	
103.	" delicatulus, Brgt	....	....	....	1	....	
104.	" tenuifolius, Brgt	....	....	....	1	....	
105.	" splendens, Lesqx	....	....	6	6	...	
106.	" furcatus, Brgt	....	....	....	1	....	
107.	" hirsutus, Lesqx	..	....	....	1	....	
108.	" inflatus, Lesqx	2	....	....	....	....	
109.	" adnascens, Ll. & Ht.	....	....	....	2	....	
110.	" lactuca, Gutb	....	....	....	....	2	
111.	" arborescens, Lesqx	....	....	....	1	...	
112.	" Clarkii, Lesqx	....	....	....	....	8	
113.	" Gutbierianus, Presl.	....	....	1	....	....	
114.	" thallyformis, Lesqx.	....	....	1	1	....	
115 +	" Strongii, Lesqx	..	....	....	....	1	
116.	" mollis, Lesqx	...	....	....	....	2	
117.	Pachypteris gracillima, Lesqx	....	....	....	2	...	?
118. +	Cordaites borassifolia, Ung	2	4	2	2	2	
119.	" angustifolia, Lesqx	6	....	2	1	1	
120.	Sphenophyllum Schlotheimii, Brgt	2	2	4	6	2	
121.	" emarginatum, Brgt	2	....	2	2	2	
122.	" filiculme, Lesqx	...	....	....	....	1	
123.	" cornutum, Lesqx	....	....	2	1	....	
124.	Annularia longifolia, ? Brgt	....	....	...	....	2	
125. +	" longifolia, Brgt	1	1	2	2	6	
126.	" inflata, Lesqx	...	...	....	....	4	
127. +	" sphenophylloides, Brgt	....	2	2	3	3	
128.	Asterophyllites rigidus, Brgt	....	....	....	2	2	
129.	" longifolius, Gopp	....	....	....	1	...	
130.	" grandis, Ll. and Hutt	....	....	....	3	...	
131.	" equisetiformis, Brgt	1	....	1	2	1	
132.	" sublævis, Lesqx	....	....	....	....	1	
133.	" lanceolatus Lesqx	....	....	....	...	1	
134. +	" ovalis, Lesqx	....	....	....	2	....	
135.	" foliosus, Ll. and Hutt.	....	....	....	....	4	
136.	" tuberculatus, Brgt	....	....	....	2	....	
137.	Equisetites occidentalis, Lesqx	....	....	....	....	1	
138.	Calamites Suckowii, Brgt	....	....	...	....	2	and Carmi, abundant.
139.	" ramosus, Brgt	1	2	2	2	1	
140.	" cruciatus, Brgt	1	....	....	2	....	
141.	" nodosus, Brgt	....	....	....	2	1	
142.	" Cistii, Brgt	....	....	....	....	1	and Grayville.
143.	" pachyderma, Brgt	....	....	....	....	....	?
144.	" bistriatus, Lesqx	....	....	....	....	....	?
	—60						

List of Fossil Plants.	Duquoin.	Murphysborough.	Colchester.	Morris	Mazon creek.	Other localities.
145. Calamites approximatus, Brgt.	1	....	1	2	1	and Carmi,
146. " undulatus, Brgt.	....	....	1	....	....	
147. Artisia transversa, Sternb.	....	....		....	1	Grayville.
148. Selaginites uncinnatus, Lesqx.	....	....	2	....	....	
149. " carifolius, Lesqx.	....	....	1	....	....	
150. " crassus, Lesqx.	....	....	....	....	2	
151. Lycopodites annulariæfolius, Lesqx.	....	....	....	....	1	
152. " Meekii, Lesqx.	....	....	....	1	....	
153. " asterophyllitæfolius, Lesq.	....	....	....	....	1	
154. Schutzia bracteata, Lesqx.	....	....	....	....	1	
155. Lepidodendron rigens, Lesqx.	....	....	....	....	1	
156. " Morrisianum, Lesqx.		....	....	1	....	
157. " forulatum, Lesqx.	1	....	....	....	....	
158. " Tijoui, Lesqx.	2	....	....	....	....	
159. " diplotegioides, Lesqx.	....	....	1	....	....	
160. " Worthenii, Lesqx.	....	2	....	....	....	
161. " turbinatum, Lesqx.	....	....	....	....	....	Carol's place, Chester group.
162. " costatum, Lesqx.	....	....	....	....	....	
163. " obscurum, Lesqx.	....	....	....	....	....	
164. " radicans, Lesqx.	1	....	....	....	....	
165. " simplex, Lesqx.	....	....	2	....	....	
166. " modulatum, Lesqx.	....	....	....	1	1	
167. " clypeatum, Lesqx.	....	....	....	....	....	Rock Island.
168. " rugosum, Brgt	....	....	....	....	....	Little Vermilion.
169. " obovatum, Sternb.	....	....	3	3	1	and Rock Island.
170. " gracile & elegans, Brgt.	....	....	3	4	1	
171. " Veltheimianum, Stern.	....	....	....	....	....	Chester group.
172. " dichotomum, Sternb.	....	....	....	2	....	
173. " mammillatum, Lesqx.	....	....	....	2	....	
174. " cruciatum, Lesqx.	....	....	....	1	....	
175. " Greenii, Lesqx.	....	....	....	....	....	Mercer county.
176. Ulodendron majus, Ll. and Hutt	....	....	1	4	....	
177. " ellipticum, Ll and Hutt.	....	....	3	4	....	
178. " elongatum, Lesqx.	....	....	....	2	....	
179. " punctatum, Sternb.	....	....	....	....	....	Vermilion co., Ind.
180. Lepidophloios? auriculatum, Lesqx.	2	....	....	....	....	
181 " laricinum, Sternb.	....	....	....	3	....	
182. " protuberans, Lesqx.	....	....	....	2	....	
183. " obcordatum, Lesqx.	1	....	1	....	....	
184. Lepidostrobus species	....	....	....	....	1	
185. " princeps, Lesqx.	4	....	1	1	....	
186. " ovatifolius, Lesqx.	....	....	....	....	2	
187. " oblongifolius, Lesqx.	....	....	....	....	2	
188. " hastæfolius, Lesqx.	....	....	....	....	1	
189. " lancifolius, Lesqx.	....	....	....	....	1	
190. " truncatus, Lesqx.	....	....	....	....	1	
191. " connivens, Lesqx.	....	....	....	....	1	
192. " ornatus, Brgt	....	....	....	....	1	
193. Lepidophyllum lanceolatum, Brgt.	....	....	....	2	1	
194. " majus, Brgt.	....	....	....	2	....	
195. " auriculatum, Lesqx.	2	....	1	....	....	and Neelyville.
196. " rostellatum, Lesqx.	....	....	....	....	1	
197. " striatum, Lesqx.	....	....	....	....	1	
198. " foliaceum, Lesqx.	....	1	....	1	....	
199. Knorria imbricata, Sternb and Gopp.	....	....	....	....	....	Chester group.
200. " Selloni, Sternb.	....	....	....	2	....	
201. Sigillaria monostigma, Lesqx.	....	....	3	1	....	
202. " sculpta, Lesqx.	1	....	....	....	....	

1. Sigillaria auriculata, Brgt. from p. 483 c (3) There is some discrepancy between the species as represented here and that of Brongniart. I do not believe however that the differences are essential enough to separate the species. Brongniart's are larger, he says: cicatricibus discoideis latitudine costas subaequantibus. In our specimen, they are scarcely half as large. But the costa are larger a difference of size of costa and of scars is often remarked. In Brongniart also the vascular scars are just near the top of the bolster while in our specimen they are rather near the middle, and both vascular lateral scars are longer, remarkably longer indeed. As we have however the same form of scars and the same kind of wrinkles, parallel to the bar, I can not see the difference or specific. I find often upon large specimens a notable difference in the position of the scars and therefore take this as a mere local variety. It should however be figured.

2. Sigillaria elliptica Brgt. from p. 446 b (4) Lawe specimen 706 appears to represent this species of which Brgt has three figures 1–3 pl. 152 none of which however shows the character of the decorticated surface. Goldenberg represents it also by three figures and one for a scar all also without decorticated surface. The species is allowed to my sigillaria attenuata fig. 2 & 3 Pl. 2 of Cat. (1772 p.) but has the lower angles of the scar rounded or scarcely angulate. The ribs are narrow, 1 cent. broad more or less, plane convex, (moderately furrow straight) surface epidermis smooth, with the intervals between and under the scars slightly wrinkled horizontally in the specimen of Lawe the wrinkles are distinctly seen in the furrows with the glass especially in the upper part or above the scars. Scars close (but called distant thorny) variable in distance from three to seven mill, variable also in size from 7 to 9 millim. long from 4 to 7 mill broad, broader toward the bar, oblong at the top, rounded at the base either oblong or slightly angular at the lower corner with the vascular scars three, placed on the upper part near the top the lateral ones semilunar the middle on a point (or) toward the bar of the lateral ones. Decorticated surface very slightly obscurely lines the lines not perceivable to the naked eyes, decorticated scars oval are manilla 0.2 p mill long 1 millim broad. This species has also a relation to S. Cortei Brgt pl 147 fig 3-4 which has longer and narrower scars etc – see also S. cortei in Geinitz. Pl 8 fig 3. I consider 716 as the true specimen of Brgt.

3 Sigillaria orbicularis Brgt. Spec. 616 of Lawe. Ribs flat 11 millim broad furrow straight, narrow. Scars much smaller than the ribs, broader than long 7 millim. broad nearly round slightly narrowed at the oblong top, rounded at base. Vascular scars three, the lateral ones semilunar the middle a bar or point in the middle. Decorticated scars, of the vascular scars of the same form but without surface smooth both corticated & decorticated. Distance of the scars 12 mill. Agree exactly with Brgt fig. & Schimper description merely differing by larger scars broader ribs and greater distance. All proportionate – see p. 474 b 13.

4 Sigillaria obovata Sw. Lawe spec. 621 c. corresponds with the specimen remarkable by the width of the ribs, the depth and width of the furrows. The decorticated surface is obscurely lines. The bark half a millim thick its surface rough. See

474 b

decorticated scar is oval small or marked — my figure of the Gen. Repl specimen 617 has the same in both of ribs but the cortical scars are obscure, apparently of the same form but larger and the decorticated scar also obscure but apparently oval (m) but often with two parallel lines corresponding to the lateral vascular scar. I find nothing similar unless it be S. Bradley but the shield surface of this species and its decorticated vascular scar is different perhaps. S. Lorgati Brgt. The bark is 1 mill thick.

D. 1. Sigillaria Lorgati Brgt. The above number 617 of Lacoe seems to represent this species. Ribs slightly convex 22 mill broad, furrow deep, canaliculate or sealed surface smooth. Scar as seen above or (m) with decorticated scar slightly marked by two lines. Bot surface smooth. See 475 f 12.

+ 2 Sigillaria orbicularis Brgt (fig 474 c 3). Refer still to this species 616 a of Lacoe which has narrower ribs and smaller scars like those of Brgt. The decorticated surface is more distinctly lined or evidently so and the decorticated scar is marked by an irregular oval mamilla sometimes replaced by a small groove or by a patch of coaly matter more generally the form of the cortical vascular scar is preserved (m). One specimen 621 from the same locality shows the same disposition of ribs narrower however, as narrow as in Brgt fig. with the furrow broad and obtuse the scars slightly more elongated or rather oval the wound and the cortical surface evidently and distinctly striat. The inside surface and the decorticated scar are of the same character as in 616 a. It seems to be a variety.

+ 3 Sigillaria sp. nov. or S. tessellata Brg. Lacoe spec. 734 see f 1 & 2. Flat ribbed. Ribs 2 cent broad flat, intermediate furrow somewhat deep or channeled two mill broad. Scars large 1 cent long and 1 cent broad at the outside corners hexagonal, the upper side narrower than the lower, the others are oblique or truncate the lower truncate and the other in right line upper & lower side 5 mm broad. lateral ones 7 or 6, all the corners angular, lateral vascular scar (m) made pointed or transverse oval. Decorticated surface transversally wrinkled in the length or undulately irregularly striate, scars marked about like those of the cortex; cortex thin scarcely ½ mill thick. This form is most like fig 1 of my plat N 72. The scars of the same hexagonal form, separated by a deep wrinkle and irregular transversal smaller lines or wrinkles which are not seen upon the specimen of that fig. 1. The scars are also more distant, lengthwise 5 mill from each other and are not more than half as broad as the ribs which are 1 cent while the ribs are 2 cent. In the fig. of my plate the scars are just as large as the ribs and the bark has not been any trace of transversal wrinkles. I believe however that both represent the same species but that it does not represent S. tessellata but a new species.

(120) see end of this. 4754

Sigillaria leptoderma Lyy (The name might be changed but it is appropriate).
A specimen of Lacoe. 715 has the bark slightly thicker, surface of both corticals and decorticated less distinctly though evidently lined; scars still smaller 5 cent. broad at the lower corner and as long though the ribs are 2 cent large. Scars decorticated double, parallel narrow, linear oblong obtuse. 4 mill long less than one mill. broad. In the middle of the ribs and in the line of the scars there is on this specimen a depression same width than that of the scars as in S. marginata. Pl. 71 fig 5. which however differs by broader ribs, more elongated scars, subcortical scars ~~as~~ larger and longer united but thicker. The relation of these two species is close. It seems however that this N. 715 should be referred to S. marginata Lyy. It is described p 481 c (2) – This 71 5 is evidently sig. marginata exactly described 481 c (2). The bark is thicker than in S. leptoderma the subcorticated scars closer and generally connected the subcorticals scars longer or indeed little differing. Both species might be one or more var. of one. The specimens described as leptoderma being with narrower ribs being of a more recent part of the tree.

2 Sigillaria laevigata, Brgt. ? Lacoe specimen 617. may be referable to this species. Ribs 2½ cent, furrow cortic. 5 mill. broad. surface both cortical and decort. quite smooth, scars large same size and form as those figured by Brongniart, 2 cent. distant ~~decort scars~~ the cortical scars ~~double~~, linear oblong joined in the middle ~~some~~ smaller than in Brgt figure. Bark thick, one millimeter, not less. Much like the former specimen but without ~~dep~~ longitudinal depressed line in the middle of the furrows, and with thicker bark quite smooth like the ~~second~~ outer surface the scars of the decorticated part are close apparently joined in the middle but the middle became remarked in Brongniart figure are not seen; or at least not very distinctly. they appear ❶ closely joined at the top. In this as in Brgt figure the cortex bears the inflated ❶ double scars and the subcortex the hexagonal ones. It is the contrary in the plate of Sigillaria reniformis, or my plates or specimens also. This character if it is one might relate my fig 5 of Pl 71 A to S. leptoderma to the species.

3 Sigillaria ~~reticulata~~ Williamsii Brongn. Lacoe spec. 710. Add to the description of p 466 d (27) from a specimen of Lesley. Ribs forming half round, slightly canaliculated lengthwise or flattened, 1 cent broad. ~~1½~~ 3 mill. canaliculate 3 mill furrow deep narrow carinate. Scars very small, distant 3½ cent. in vertical order, ovate, emarginate at the top, rounded at the base 4 mill. long 3 mill. broad. fig 2. p. 531 is good but too short and too broad ❸ vascular scars two linear and one pointed between. Surface rugose or wrinkled between the scars along the middle depression distinctly lined on both sides, bark thin as thin paper some surface regularly distinctly striated, the striae sharp, parallel regular, about 30 per width of ribs. vascular scar single a double small deep linear cavities. Distantly related to Sigillaria Deutchiana Brgt.

	List of Fossil Plants.	Duquoin	Murphysborough	Colchester	Morris	Mazon creek	Other localities.
203.	Sigillaria Brardei, Brgt	1					
204.	" tessellata, Brgt		1				Carmi.
205.	" intermedia, Brgt						"
206.	" spinulosa, Germ.?						Marseilles, Ill.
207.	" corrugata, Lesqx						Big Vermilion.
208.	" Massiliensis, Lesqx						?
209.	" Yardleyi, Lesqx						
210.	" reniformis, Brgt						
211.	" alternans, Ll. and Hutt				1		
212.	" Cistii, Brgt				1		
213.	Syringodendron pachyderma, Brgt						?
214	" Porteri, Lesqx						Gallatin county.
215.	" pes-capreoli, Brgt						Grayville.
216.	" cyclostigma, Brgt						Alton.
217.	Sigillarioides radicans, Lesqx					1	
218.	" stellaris				1		
219.	Halonia tuberculata, Brgt						Chester group.
220.	Stigmaria ficoides, Brgt	2	2	6	6	2	
221.	" elliptica, Lesqx	1			2		
222.	" umbonata, Lesqx			8			
223.	Stigmarioides Evenii, Lesqx					2	
224.	" truncatus, Lesqx					1	
225.	" tuberosus, Lesqx					1	
226.	" villosus, Lesqx					2	
227.	" linearis, Lesqx					1	
228.	" affinis, Lesqx					1	
229.	" selago, Lesqx					1	
230.	" rugosus, Lesqx					1	
231.	Pinnularia capillacea, Ll. and Hutt	2	2	4	4		
232.	Megaphytum protuberans, Lesqx						Chester group.
233.	" McLayi, Lesqx	2				1	
234.	Caulopteris insignis, Lesqx	1					
235.	" Worthenii, Lesqx						Carmi, White co.
236.	" obtecta, Lesqx			6	4		
237.	" intermedia, Lesqx						Fulton county.
238.	" acantophora, Lesqx			8	2		
239.	Trigonocarpum Nœggerathii, Ll. & Ht.					1	[co., Ind.
240.	" olivæformis, Ll. & Ht						Eugene, Vermilion
241.	" juglans, Lesqx		1				
242.	" rostellatum, Lesqx						Grayville.
243.	Rhabdocarpus clavatus, Sternb					1	
244.	" mammillatus, Lesqx					1	
245.	Carpolithes multi-striatus, Sternb			8	3	1	
246.	" Jacksonensis, Lesqx		2			1	
247.	" cistula, Lesqx		1				
248.	" fasciculatus, Lesqx						Grayville.
249.	" corticosus, Lesqx					1	
250.	" persicaria, Lesqx		1				
251.	" vesicularis, Lesqx		1		2		
252.	" bullatus, Lesqx					1	
253.	Sigillaria semina?				1	1	
254.	Palæoxyris Prendeli, Lesqx					2	
245.	" appendiculata, Lesqx					1	
256.	" corrugata, Lesqx					1	

This table enumerates 256 species of fossil plants, or more than double the number of those which were known from Illinois at the time when the second volume of the State Geological Report was published. The catalogue of the American fossil plants which served as a point of comparison for the table prepared for that volume, p. 464, enumerates 280 species, (~~120 from Illinois~~) even comprising some pertaining to the Devonian strata. It is, therefore, evident that the assertion, concerning the insufficiency of our knowledge of the flora of the Coal Measures of Illinois and of the future discoveries promised to continued researches, is fully corroborated by facts. Of the recently discovered species, seventy-nine are considered as new, and forty, though known already from Europe, had not been recognized before in our American Coal Measures.

The species marked in the table as from Morris and from Mazon creek, are from the same geological horizon. The bed of shale overlaying the coal at Morris covers, apparently, the whole extent of the Coal Measures of Grundy county. At Morris, this shale contains but few nodules or concretions, while at Mazon creek these nodules are found quite abundant, having been washed from the shales into the bed of the creek. The two localities are separated in the table merely to indicate the proportion of species preserved in shale or in concretions, and to show the difference in the nature of the fossil remains. About 180 of the species enumerated in the table have been found at Morris and Mazon creek. This remarkable predominance is due to peculiar circumstances:

1st. It is at and around Morris that an uninterrupted series of researches has been pursued by the two ardent and clever investigators, Messrs. Jos. Even and S. S. Strong, so often named in this Report. Researches of this kind, in which the miners often become interested and afford valuable assistance, offer the best chances to make new discoveries. They also enable the observer to obtain, when still in place and before the fragments are scattered, specimens of the different parts of a plant; to compare the different organs, or the same organs in different positions, and thus to become better acquainted with the true nature, and with the variations of forms of the same vegetable.

2d. In the shale of Morris, there is not only a great abundance of remains of plants, but the coal which it covers is opened either by shafts, or by drifting at numerous and distant places, and therefore the flora is exposed in its local varieties. The distribution of plants in the coal epoch was evidently governed by the same laws as is now the vegetation of our swamps. There was a general uniformity of species, with a constant diversity of groups on small areas. As we see now in the peat bogs, here the ferns, there the grasses, or the rushes or the mosses, according to the degree of humidity of the surface, which varies at every step, we find, in examining the fossil plants of a given area, a con-

Questions to be treated in the Plan of the Coal flora. Leaf 511. 476 6.

1. History of the coal, its discovery, its exploitation, its progress in the various basins.
2. What are the carboniferous measures. where is the lowest coal. where is the upper.
Distribution & ecological of the coal measures in different states. Trip stages.
3. Extent of surface occupied by " "
5. Relation of plants to the different stages. How far it may be admitted.
6. an exposition of the essential characters of each stage.

The purpose of this work is not to scientifically examine difficult and unsettled question of vegetable paleontology of the coal, to fix by long researches the character of the generic division, of their relation to living plants etc. but to represent the flora as it is seen everywhere in the N. American coal basin and to give representation and description of those fine materials, vegetable remains found everywhere around us. The coal is one of the most important indeed the most important mineral treasure of this continent. The coal fields are of immense extent, the coal measures of great thickness and not only the intrinsical value of the coal but its nature, its composition will be constantly and more and more studied and the question to offer proposition now on the character of its plants will become more pressing. This work is therefore intended as an answer to all the questions which may be made by those interested in fossil botany in regard to the species and relations of the fragment which the mines the prospector &c may furnish and may gather as collection either proved for mere ornament or for study by imitation of N. American. It has therefore to give an exposition of all what has been seen and published until now upon the coal plants or the vegetable of the coal. Even that not all the species can be represented in figures. Though this would have been very advisable for those published already, many of them the works where they are found described and figured are rare and can not be obtained at any price. (see our day where the plants (American) have been described

Asterophyllites (Calamodactus) grandis Stern. The specimens which I refer to this species are numerous enough, but not easily distinguished from A. equisetiformis. It differs by narrower nearly linear leaflets, more open slightly curved up and a slightly marked mid rib. The stem are more evidently striat than in A. equisetiformis and the internodi longer, about as long as the leaves.

stant recurrence of the same species at the same place, and a diversity only at a distance in various directions.

At Mazon creek, the meanders of the stream have dug a broad bed through the same bank of shale, and the water, washing for centuries, has uncovered great numbers of concretions and scattered them for miles from their point of origin. As a whole, therefore, the concretions represent the characters of the flora of a large area. No other place in the Illinois coal field has afforded the same advantages for research.

The shales at Colchester, Murphysborough and St. Johns, are rich in vegetable remains; but little has been done there in the way of collecting specimens of fossil plants, except by the assistants in the Survey. And from the above remarks it is easy to understand that researches made in passing, or remaining at a place only for a short time, are far from affording the chances of valuable discoveries. It is, therefore, very probable, that these last named localities have still in reservation a good many species of coal plants which are now unknown to us, and that the fossil flora of Illinois is far from being fully known at the present time.

The Report on the Flora of the Coal Measures of Illinois should have been closed here, but for the recent publication of a remarkable work on vegetable palæontology. (1) Among other matters of general interest, this work is prefaced by some discussions on the cause and nature of phenomena attending the preservation or fossilization of vegetable remains. It also describes and critically reviews most of our new species published in the 2d vol. of the Ills. Geol. Report. This, of course, is a reason for considering, from American observations, some well established facts which corroborate or invalidate the conclusions of the celebrated author. It also provokes a discussion on the value of some of our species, and on their affinity with the flora of the Carboniferous Measures of Europe. And further, it now becomes of importance to review the conclusions which have already, or should be hereafter drawn, on the geographical and stratigraphical distribution of our species of fossil plants in relation to geology, and to fix some reliable points of reference for future researches on the subject.

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(1) Traite de Paleontologie vegetale par W. Ph. Schimper. Paris, Bailliere & fils, 1869.

MODE OF PRESERVATION OF VEGETABLE REMAINS IN OUR AMERICAN COAL MEASURES.

§ 1st. REMAINS OF PLANTS IN COAL.

It has been erroneously asserted that the coal itself does not contain any recognizable vegetable remains, it being merely a mass of bitumen, independent of any of the plants which are found in the shales overlaying or underlaying it. Our bituminous coal is generally a compound of supposed layers of crystalline matter, about one-eighth of an inch in thickness, separated by a thin coat of pulverulent coal, or mineral charcoal, which is a mere compound of cellular tissue and of vessels of plants. (2)

Generally, this agglomeration of broken tissue preserves some outline by which the genera, even the species to which the remains belong, can be recognized at first sight: leaflets of ferns, stems of *Calamites*, bark of *Stigmaria*, *Lepidodendron*, etc. But besides this, the coal itself, though more rarely, is marked with distinct prints of the plants of which it is a compound. This case is especially observable in a kind of hard, laminated, flint coal, obtained in Mercer county by Mr. H. A. Green, which bears on the horizontal surface of its crystalline lamellæ, however thin they may be cut, the outline and nervation of leaves and branches of ferns, and other vegetables of the coal; and these are so distinctly marked, that the most delicate parts are as easily identified as those of plants preserved in shales.

The great abundance of these remains show that the whole mass of this coal, which is true coal and burns freely, is a compound of them. In the cannel coal which has been formed under water from more decomposed vegetables, the forms are more rarely recognizable. Yet the cannel coal of Breckenridge, Ky., is marked through its whole mass by stems and leaves of *Stigmaria* and *Lepidodendron*, rendered distinct by infiltration of sulphuret of iron. Even in the anthracite coal of Penna., whose matter has been subjected to heat and

(2) This fact is easily ascertained by microscopical examination. Prof. J. W. Dawson, of Montreal, has closely examined this charcoal, and published, as results of his interesting researches, numerous forms of vessels of plants. The same kind of researches had been already pursued by Prof. Goppert, who had recognized, in this pulverulent coal, remains of plants of every family hitherto known to occur fossil in the coal. (Quat. Geol. Jour., vol. 5, mem., p. 17.)

Cordaites Noeggerathia. from p. 361, 420 a. 538 478 a

Cordaites a grand-fils

1. Cordaites ~~Noeggerathia~~ spec nov. (dilatata.) Leaves large, narrowed to the point of attachment where they measure only 6 millim. broad, rapidly enlarging upward fan-like being already three and an half cent. broad at 4 cent. from the base and at 30 cent. measuring 9 to 10 cent across diverging upwards in lacinia (41) of equal width two and an half cent. broad apparently divergent also fan-like after their separation. The largest leaf is entire to about 26 cent. from its base (L. 14 a.); the leaf appears thick distinctly veined, the primary veins separated by one or two ~~or three~~ very thin and distinct veins primary see 538 which sometimes are not visible at all; then the veins appear 3 than, 6-8 in two millimeters distance, the furrows between them being also obtuse or convex. There is no trace of cross veinlets as in C. principalis. One of the leaves, the largest one L 14 a is covered in the upper part with round or oval spots either convex or concave, which evidently represent epiphyllae or rather the spirobis carbonarius. The forms are merely impressed upon the leaves which are thick and coriaceous. The veins are also not regular across upon their backs as mentioned in Noeggerathia Beinertiana Göpp. as figured by Geinitz Pl XXI fig 18 A ~~and~~ especially as figured by Göpp. in his Gottingen V. VI, p 108 Pl XII fig 2. which by description however does not agree with these leaves of ours as the specimen 14 a. is laciniat in the upper part. It is also not apparent that the leaves a French are surrounding or half embracing. They are narrowed to the base which in all the specimens, C Nat. this showing the base is apparently truncat. The veins are rather simple sometimes separated by one or two obscure veinlets especially toward the base of the leaves where they become more distinct and alternately thick and thinner or alternately thickened. It may be N. Beinertiana as Göppe may have seen only a small leaves. Of the specimens of Lacoe one only is larger and shows the upper part laciniat, the other are smaller of the same size as that of Göppert but the top of the small ones is broken a destroyed. Noeggerathia Beinertiana is not mentioned by Schimper who rather confuses than clears the subject of N. & Cordaites. — I have pasted out the last box of specimens of M. Lacoe and there found large and numerous fine specimens of this species which does not appear to have been described. His N 456 represent nearly a whole leaf whose base only is broken. Counting from its true base, as seen from another leaf N 330, it is 37 to 38 cent long gradually enlarging upwards to its rounded top where it is 16 ~~millim~~ cent wide cut into four or five lacinia or split, the lacinia either separated or connected merely marked by a line of division passing down 4 to 8 cent. In all these leaves the nerves are more distinct toward the base very thin and becoming obsolet in the upper part. Two other leaves have also been preserved. It is no more than 6 to 9 millimeters broad, flattened, as if it was broken from a long petiole. Indeed one of the specimen 331 bears the concave print of a long linear stem widened in the length with a sems embracing base. ~~[illegible]~~ eight millim. broad. 17 cent long to the point where it is broken which seems to belong to the same leaf or leaves of this species covering both sides of the specimen. If this stem was that of these large leaves they should be considered as floating leaves. One of the smallest leaves preserved in its integrity is 32 cent long; 6 millim at its base which is truncate 15 centimeter broad at the top which is a small half round, undulat and more or less distinctly laciniat. The same specimens bears a round one of the fruit figured for them in the conglomeral manner, especially the Sporocarpus nucleus and the small Cardiocapsi and capsel the vesicularis etc. Leaf of specimen 331 is also 32 cent. long rapidly widened to 28 cent. below its rounded top.

Noeggerathia species Im 35 a. Two specimens fragment of leaves apparently referable to the species by the enlarging of the leaves upwards, the largest of these fragments 11 (eleven) cent. long being seventeen millimeters broad at the base and forty five at the top. The nervation is that of a cordaites. The primary veins are shown in the middle part of the

478! Co

1. Cordaites borassifolia. Specimen No. 90 for the leaves and another with racemes of flowers as figured. The characters indicated for the nervation of these leaves p. 360 & 361 are right. The distance of the nerves in the middle of the leaves averages 16 in 5 mill. or a little more than three in one millim. towards the borders the average about 20. or four in one millim. In all the cordaites the veins are closer towards the borders. They are round obtuse not as sharp and narrow as in the following species. The length of the leaves as seen upon a specimen broken in two is 43 cent. the top being gradually narrow to an obtuse point which is split in lacinias in one specimen ~~that~~ also split downward in the middle to 5 cent down from the point. The base half embracing and semi-lunar ( ) measuring 13 millimeters broad. see also

2. — (from other page). The leaves, deeply marked, the intervals convex or carinat one millimeter apart with four distinct intermediat veinlets. On the borders of the leaves, as in Cordaites. The veins become flat and less distinct and also somewhat closer to each others. The nervation agree with that of Cordaites principalis as figured by Geinitz but no trace of cross nerves are remarked.

+1a. Cordaites Borassifolia. One leaf perfectly entirely preserved No. 158 in the collection has the base and nervation like that of my figure, extremely thin and narrow but is only 25 cent long gradually enlarging towards the middle to 4½ cent and gradually narrowing to an obtuse point. No. 395 measures 17 cent broad

+2. Cordaites ? Dawnii William, Dawson No. 159 Stem about 7 very large millim. broad convex by compression forty cent. long. ~~apparently covered in the lower part~~ covered by appressed narrow leaves 4 mill. wide whose length can not be seen as they appear as superposed upon each others and very thinly striated ~~so that the base of the leaves~~ The leaves are attached only on one side of the stem and all along it, close, decurrent and imbricated at the base, ~~from~~ the inclined direction on an angle of 70° to the stem linear subulate narrow, ~~Decurrent from a narrow base at the point of attachment to about 13 millimeters~~ forming a long tapering base applied to the stem and in this way it is formed the appearance of a stem covered with leaves as mother here. The length of the leaves appears to have been very great but none is preserved in the whole fragments measure from point of attachment 30 cent to the border of the specimen where they are broken. The nervation of these leaves is peculiar extremely thin, veins so thin and close that except near the base of the leaves they are undistinguishable with the glass, ~~twenty in 5 millimeters~~ four per millimeter. The leaves are not thin. The epidermis being somewhat thick but the veins are not more marked on the surface above than below the epidermis. The leaves have been placed very close and imbricate 30 to 40 in a length of 30 centimeters along the stem. I have a specimen of this but small. see p. 479 a 1.

1 3. Cordaites. Mansfeldi. Sigw. see figure of the specimen No. 148. There is a few branch of the species whose diameter is only 4 millimeter. The leaves are very oblique as upon the large stem, semi to the slightly narrowed base which is rounded both sides so that they appear slightly auriculat on the lower side about as in this sketch. The characters are indicated in. But the stem is covered by a somewhat thick ~~cuticle~~ coat which when taken out leaves the surface as marked by ~~deep stria~~ cross nervules ~~like Calamites~~. This specimen not separable to this as also the one counterpart of my own in mother 160. On the small stems the leaves are semi-embracing. I see them slightly auriculat only at the borders of the large stems

1 Artisia sternbergi or Sternbergia approximata. Smith collection has three specimens Sm 49. One of them the largest is 23 cent. long, 4 cent. diameter, slightly flattened, the mould with horizontal ribs or striae covered with a layer of bark transformed into coal two millim. thick with smooth surface. A fine specimen. The ribs are not perceptible upon the coal bark.

2 Cordaites (Dicranophyllum embryanum) 161 of Mansfield a large specimen representing still another species apparently of the same type as N. 159. vide above p. 478 b (2). This one has the trunk or branch also marked only by fragment of leaves, mixed with appressed leaves, 6½ cent. cent. broad. Leaves much narrower than in N. 159 4 to 6 millim. only, slightly enlarged above and then narrowed to the point of attachement with the stem or the margin; very narrowly thinly and obscurely striate, still more indistinctly than in the specimen 159. They do not curve backward from the stem as in 159 but are very oblique to it as in the C. mansfeldi and directly attached to it by the sub amplectiving base. See p. 539. (1)

3 Dicranophyllum (Cordaites) contortum. Grand'Eury or Dicranophyllum specimen of Ma. 162. The stem seems a compound of narrow leaves twisted together and diverging from the stem either irregularly in bundles of three a four or more regularly toward the upper part in single leaves close parallel ~~divergent laterally~~, all linear, ~~[illegible] and~~ leaves ~~two to three~~ millimeters broad very thinly lineato veined, the veins very thin and close more distinct however than in the former specimen 161. at least when the heavy coating of waxy matter is out of the surface. These leaves closely resemble those of Grand'Eury published as Dicranophyllum? (see) Another specimen which seems to represent a bundle of three leaves separating and curving (twisted) are a compound of very thin filament or nerves which dessimilating or separating toward the point match like a pencil by a hairy subdivision of these veins. The sketch here is very small compared to the specimen. See correction p. 535 (6)

1a. Artisia transversa or A. sternbergi at least some specimens of this stem belong positively to Cordaites. Mansfield has a number of them in connection with Cordaites the stems varying in diameter from 1½ to 2½ cent across. The smallest of these stems seem to be continuous upwards by or into a leaf of Cordaites, which is perhaps only the bark marked or ribbed only. It is however flattened in coming out from under the fragment of stem. The branches are all short rounded on one end, flattened on the other, perhaps representing short branches lateral and deciduous to which were attached a tuft of leaves. 2 narrow specimen, that small remarked above. The horizontal striae are deep and irregular, cut by irregular vertical cracks. The cortex is smooth. When present the horizontal striae are not marked but the surface is vertically thinly nerved like the leaves of Cordaites. One of the specimens is flattened and resembles a long linear leaf striated across like the stem. Wi 22 cent. long 12 millim. broad, perfectly linear convex in the middle flattened on the border marked across with equal ribs or wrinkles 1½ millim. broad but not quite or always continuous some of them breaking in the middle; all disappearing at the borders.

(4) Cordaites Mansfeldi. Where a specimen of a thin branch which explains the appearance of the stem as largely striate. This is formed by an inflated at the ~~[illegible]~~ nothing ~~[illegible]~~ the leaves. See it. I have found one of the leaves in its whole length. It measure 24 cent.

5 Cordaites costatus. Ma 329. A branch one and a half cent broad deeply marked or irregularly costate by the inflated and elongated base of the leaves, leaves linear a slightly enlarging upwards 5 millimeters broad toward the base 8 to 10 millimeters broad in the upper part, distinctly nerved. Primary nerves

somewhat variable in distance, wider in the middle of the leaves averaging 3 in two millimeters, separated by 4 or 5 very thin reinlets, cut by very thin cross wrinkles. Flowers in one sided decurved racemes somewhat thick, hard, ~~apparently from the axils of the leaves~~, more or less ~~extended~~ on one side inflected below at the point of attachment of the flowers; flowers ovate oblong compound of apparent narrow linear lanceolate acuminate scales as seen fig. a. Compare difference with those of specimen No. 2. of Mansfield and of that of Clinton. See comparison and rectification p. 534 (2)

+ 1. Coralloides Tamiophyllum decurrens from p. 478b 2. I have another very large specimen of this species apparently Ma 305 In this the stem or trunk is fifteen cent. broad convex covered on one side by the decurrent base of the leaves but naked or deprived of its bark in the largest part of it. On the naked part the base and point of attachment of the leaves is marked by a linear mamilla convex, wounded at base, a little more than 1 millim. broad, gradually diminishing upwards and flattening to ~~one~~ 1½ or 2 cent. from the base where it gradually disappears on the border the decurrent part of the leaves are imbricated forming a thick bark at least 1 millim. thick, transformed into coal and the leaves forming outside or an open angle of divergence from the stem are crowded and their width scarcely ascertainable. They are thick with a shining surface and the nerves equal and so thin that they are scarcely discernable with a strong glass. This species is of a same group as the following see p. 533, (5)

+ 2 Coralloides Tamiophyllum inflexum Ma. 307. Stem or branch narrow. 1½ cent broad flattened by compression irregularly obscurely striate leaves crowded sessile semi-embracing, perfectly linear very long nearly in right angle to the stem; 1 cent broad 37 cent. long as far as they can be seen upon the specimen where the end of none of them can be seen. Surface semi opaque, veins extremely thin and close at least 18 to 20 in one millimeters, reticulated or wrinkled across, so that the surface appears under the glass somewhat rough. This species differs from the former by the surface of the leaves not smooth, by their leaves not decurrent by the veins all of the same size and doubly more crowded or close to each other; in both the surface is wrinkled across however. The species represented by specimen ~~164~~, ~~162~~, ~~169~~, ~~307~~ Ma 307 represent evidently a peculiar and separate group of the coralloides far different of that with leaves which are distinctly veined see for comparison p. 534 (4)

+ 3 Coralloides Tamiophyllum fasciculatum Dermophyllum sp. nov. Ma 258. To this group may be added also this form which is figured. It is a branch 12 millimeters broad irregularly costet in the length, smooth leaves either single, half embracing or fasciculate, grouped three or four together from a common point of attachement resembling articulations. The leaves are linear but narrower at the point of attachement where they measure 2 to 3 millimeters and gradually becoming broader to 8 to 10 millimeters at a distance from 8 to 10 centimeters from the point of attachement where the specimen is broken. Their full length can not be ascertained. The veins are as in the former species about 20 in 1 millimeter all equal and crossed by cross wrinkles. See p. 536 (8) Coralloides p. 498a.

fused to cohesion after the transformation of vegetable matter into coal, one can easily discover an abundance of remains of plants whose genera and even species are sometimes recognizable. These facts, which cannot be overlooked, may be taken into account in examining new theories in relation to the formation of coal.

§ 2. VEGETABLE REMAINS PRESERVED IN SHALE.

It is in the clay or silicious shale that the fragments of plants of the coal epoch have been more generally preserved. When a bed of vegetable matter heaped for the formation of a coal has begun to cease its growth, its top indicates a greater scarcity of vegetable remains, mixed with a larger proportion of earthy or clayey matter. The coal then becomes a less homogeneous mass, easily separating in layers of heaped fragments of vegetable and foreign matter. By and by, the vegetation becoming scarcer by superabundance of water upon the surface of the bogs, the clay is more thickly deposited, and the vegetable remains, more rare and scattered, are more distinct and more easily recognizable. When preserved in that way, the plants or their fragments have been first slowly decomposed and softened by humidity, and then more or less flattened by compression. All the naturalists who have examined the coal formations are well acquainted with the appearance of the remains found in shale, and sometimes admirably preserved. Generally, the woody tissue of the plant has been destroyed, and the surface of the stems and branches only are preserved in a thin coat of coaly matter, bearing impressions of scars of the bark, etc. For the leaves, the coaly matter represents the whole substance, and for the ferns, especially, it preserves the exact form of the vegetable and is marked by the impression of veins and veinlets, mostly distinct to their last divisions. Some leaves of a coriaceous texture have their epidermis hardened by mineralization, and separable from the shale like a transparent pellicle. It can then be easily examined under the microscope, and all the details of structure recognized. It is especially the case with our *Dictyopteris rubella* of Murphysborough, as also with the leaves of *Whittleseya elegans*, Newb., of Ohio. Sometimes the leaves of *Neuropteris hirsuta* have been heaped and compressed together in such quantity, that the pinnules are separable from each other as a carbonaceous cuticle, preserving traces of the primitive organism.

The shales, according to the amount of vegetable matter mixed in them, and the depth at which they have been formed under water, are of a more or less dark color; whitish or yellowish when of fresh water origin, and with few remains of plants; black and generally more homogeneous when formed in deep

water, and having for a larger proportion of their compound, broken remains of organized beings. In this case the remains are either animal or vegetable mixed together, both fragments of moluscs and fishes with fragments of plants recognizable on the same piece of shale, or mere remains of animals or only plants. These various appearances are easily explained in considering the phenomena accompanying the formation of tha coal strata, from deposits analogous to those of our existing peat bogs. For the surface of these bogs, even in our time, shows the same differences in the superposed deposits, according to the depth and chemical compounds of the water by which they become covered, either by casual inundation in the interior of the land, or by slow immersion near the borders of lakes or sea shores. Even where the coal and shales, from the amount of remains of fishes which they contain, appear to have been formed in water of a certain depth, the matter always bears evident traces of its origin from land vegetation, and never from marine plants. The lower part of a bed of coal, worked near the mouth of Yellow creek, Ohio, is a kind of cannel coal, or very bituminous compact shale, full of the remains of fishes, whose entire skeletons vary in length from one inch to one foot. Yet this shale has an abundance of the remains of land plants mixed in its compound. The same case is observable in Kentucky—for example, at Airdrie, on Green river, where the upper coal (No. 11 of the Kentucky section,) is overlaid by a bituminous laminated shale, containing teeth of large fishes with trunks of *Sigillaria*, *Lepidodendron*, etc., and branches and leaves of ferns. Those who have examined our immersed peat bogs along the shores of New Jersey, have seen in activity a formation of the same kind, where logs of large trees are fished from a depth of ten or fifteen feet, out of beds of peat submerged in water deep enough to feed a variety of fishes; while here and there, small islands, half floating fragments of wood or heaps of mud, are covered with a luxuriant growth of ferns, reeds or bushes, which throw their debris to the surface, to be conveyed to the bottom and there mixed in the bed of mud, an incipient shale, with animal remains.

Among the various metamorphoses to which remains of plants have been subjected in the shale by compression, decomposition and other chemical and mechanical agencies, one peculiar phenomenon is worth noticing here. In the shale covering the bed of anthracite of Rhode Island, the whole carbonaceous matter of the plants has been destroyed by heat, and the mere skeleton of the leaves and other remains is marked upon the shale as a more or less distinct mould, often covered by a whitish incrustation of selenite. In this process of fusion, the vegetable fragments have been distorted in such a way that they often present an appearance far different from that of the species to which they belong. For example, in some branches of ferns, the leaflets have been, on one side of the pinnæ, extended to double their original length, and narrowed

1. Sigillaria mamillaris? Brgt. A number of fine specimens of Lacoe 475 figs 464 & 474 answer to this species as figured by Weiss. As seen from the figure 5 pl 25a the cicatrices are very variable, either for their distance or for their form; at least being in the lower part of the figure more enlarged and nearly round and oval elongated in the upper part. The different scars in the middle forming an interruption like that of fig. 3 S. tenellata must resemble a circle those of Brgt. S. Uhrii Pl. 162 fig 6. It appears to be the same for S. mamillaris as figured by Weiss has the cicatrices with obtuse base, some nearly round other oval like ones; while in Brgt they are mostly angular. This shows that the scars are very variable indeed more so than are those of S. clavodendron. The same difference is marked in S. tenellata and indeed considering merely the form of the cicatrices and not their size this species is very like S. mamillaris as figured in the lower part of the fig. Sigillaria attenuata Lgy. Cal fig. 1 perhaps 2. which Schimper refers to S. Decaisnii but the scars are as the one here figured. Fig. 2 has the scars far more distant. But in specimen which is figured in Pl. the scars are generally quite close as in the figure. However are separated by three millim. space. The same difference is marked upon Weiss' specimens or figures. See p.

2. Sigillaria Polzii Gr. Given specimen of Lacoe pl. XXV a f. 6. & 494. The species appears identical. The ribs in the Ar specimen are only somewhat broader the scars corresponding little larger, but I consider the character identical. The scars are also somewhat more oblique at the base. But most of our specimens of American Sigillaria have the scars more oblique than the analogous or identical European species.

3. Sigillaria? silurica. Spec. nov. Lacoe specimens N. 461, 470, 472, 473. (See 480b (Coelostigma? Sigillarioides)

4. Sigillaria Lacoei. Spec. nov. Bark very thick 2 & 4 millimeters in thickness according to the width of the ribs. Ribs one and an half to two and an half centimeters broad very convex, separated by a deep furrow marked in the length and in the middle of the ribs by a concave longitudinal groove in the middle of which are marked the elongated rhomboid cicatrices with two opposite semilunar scars in the middle half enclosing an obscure point. (Pl XXV d. fig. 11 (461). The cicatrices are distant, not quite four centimeters in the large ribbed specimens, five and a half in the narrow ribbed ones. The cortex transformed into compact anthracite coal has its surface smooth except inside of the medial longitudinal groove where it is irregularly striate (see figure). In the decorticated state, the ribs are nearly flat regularly narrowly lined or very narrowly striate. The cicatrices marked by a long linear or lanceolate slightly obtuse at the lower part gradually narrowed to an obtuse point, about 8 millim. long and 1½ millim. broad in the large ribbed specimens. In the narrow ribbed ones the cicatrice is marked by a mere linear very narrow needle form projection in the middle of a depression 3 & 4 millim. long and no more than half a millimeter broad. I find no relation whatever to the species. In its decorticated state it resembles S. Gaudryi, with the surface of the ribs less distinctly striate. See p. 482a 4

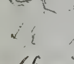
5. Sigillaria lepidodermis Spec. nov. Lacoe spec. 497. Ribs flat, 1½ centimeter broad with the surface narrowly lineate as well corticated as decorticated. Scars regular in decorticated state. Cortex very thin not thicker than strong paper. Cicatrices small, somewhat slightly emarginal at the upper end enlarging to below the middle rounded at the lower end 5 millim. broad in the middle and 8 millim. long, comparatively very distant, 1 cent. or more. Decorticated cicatrice double, half cylindrical, linear lanceolate, parallel somewhat distant broader and round at the base. This species is by its small surface scar the large double subcortical one, its striated surface of the cortex of the stem formerly known

480b ribs a variety of this polymorphous species for the under side of the specimen here & the subcortical scars distant from each other broadly oval and in irregular rows. There are important differences in the very thin cortical scaly surface. Another specimen decorticated N 467 has the ribs twice as broad and the double cicatrices or bolsters as rather smaller not larger. There is still a difference here S. reniformis where the corticated scars are wider and much larger than those corticated. See p. [illegible]

1 Sigillaria Pittstoniana Sp. nov. (name may be changed) Lacoe specimens No 481, 471. 468, 469. Deeply ribbed. Ribs flat at the surface, 15 to 17 millim. broad, separated by a deep furrow, rounded at the borders &, ~~mostly~~ all of the same width; at least no variety remarked in the large specimen which we have, surface of the ribs flat minutely irregularly lineate. Cicatrices all at the same distance, a little more than two centimeters from center to center, comparatively small seven to eight millimeters long five millimeters broad nearly exactly oval, truncate or slightly emarginate at the upper end. vascular point in the middle, between two semilunar appendages disconnected at both ends. Bark two and a half millimeters thick, Decorticated surface more obscurely and irregularly lineate, mostly with one or two well marked line and the others obsolete. Subcortical scar a small ~~double~~ ~~simple~~ simple convex papillae, one and one half to two millim. long and scarcely one millimeters broad. This species see fig. Pl XXV. a fig 4. is very closely allied to S. rugosa Brgt. Hist. Pl 144 fig 2 which has also a thick bark, flat ribs separated by deep furrows and cicatrices nearly of the same form. It differs by the surface which is not rugose, the cicatrices smaller especially in the decorticated state and the less evidently striate surface of the decorticated part.

Dd. Sigillaria Sillimanni? Brgt Lacoe spec. 460, 465, 615 Ribs narrow ~~[illegible]~~ seven to nine millimeters broad, the costae either slightly undulate or straight; scars three to four centimeters distant oval oblong slightly emarginate at the upper end rounded at the base with the lateral borders either nearly parallel as in fig 8 Pl. 25 enlarged scars or gradually enlarging omitted figure toward the lower rounded end. as in f. 2. b. 25b. The surface is slightly rugose above and below the scars in this last specimen, while on the other the smooth surface is marked by a point just above the notch as in the fig. of this species in Goldenberg. The point is however very small, often imperceptible. The decorticated surface is marked by ~~double~~ simple small papillae as not larger than in the former species but in double ~~[illegible]~~ parallel and grouped in the middle by a point. Both surfaces are

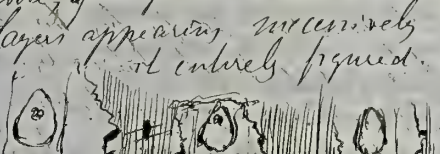
Goldenb. II Sometimes slightly lineate or narrowly striate. the corticated ~~but more generally smooth~~ ~~or~~ wrinkled above and below the cicatrices ~~except~~ in the decorticated state ~~which~~ it is lineate as far as I have seen it. Differs essentially and greatly from the former by its thin bark, the distant scars, sometimes the lower surface scars are double but very thin and united at the base in a V. The scars are similar [illegible] but always ovate in upper part scarcely emarginate the lower [illegible]



[illegible] which I consider a var. has [illegible] distant [illegible]

Specimens 615 & 615b of Lacoe show the species just as described by Goldenberg with a large round point at the top or above the scar. with scars however somewhat longer and narrower. common at Pittston.

1. Sigillaria tricostatopliceta spec. nov. (or another name) Pl. XXXV b 1. Lacoe specimen 466. Surface undistinctly costate and quite flat, the costae marked merely by obscure lines sometimes marked by a narrow and shallow furrow, at other place not marked at all. Costae 1 centimeter broad. Cicatrices one and an half centimeter distant, nearly exactly ovate, the upper end narrowed to about 2 millimeter broad and obtuse or slightly truncat, the lower enlarged and rounded. Vascular scar placed near the upper end in the form of a horse shoe with a deep point in the middle. The space between the cicatrices is transversally irregularly and minutely regulose or smooth, while the decorticated surface has the costae still less marked or rather not at all marked. The surface regularly deeply lineat with parallel close lines, 4 in one millimeter in width. The vascular scars an oval papilla or small oval tubercle two and an half millimeter long and less than one millimeter broad. This specimen present a very remarkable composition, it being formed of five successive layers of bark, each just one millimeter thick, the upper ones with distinct well preserved surface by well defined cicatrices transformed into shining, crystallized coal, the lower of the same thickness, the surface striat and the vascular scar oval as described above, of compact dull colored black shale and they in following the four different layers appearing successively for one hide to the other as follows. But I must have at entirely figured at least a cross section of the. — See Pl. XXV 1. 1 a. The relative of the species considering the form of the cicatrice is



with S. elliptica Brgt. Pl. 152 fig. 1. The scars are however more distant, more acutely narrowed upward. The surface is distinctly wrinkled across etc. It is apparently a good specie.

2. Sigillaria marginata n. nov. Lacoe specimen 466 reverse. Surface ribbed, ribs large, two and an half centimeter, flat separated by distinct furrows. Decorticated surface a thin coaly layer distinctly striat lined. Scars double oblong ovate, 8 millim. long, two millim. broad, parallel close, generally connected in the middle. Decorticated surface in double rows. Middle one eight millimeters broad, regulose or rather irregularly punctulate, same width as the cicatrice, which are four centimeter distant, truncate at the top, diverging laterally by two straight lines to the middle where they meanwhile seven millimeter and hence rounded to the base measuring altogether nine millimeter in length. The middle row which is slightly lower is bordered on both sides by two concave irregularly lineate margins both of the same width as the middle one, eight millimeters so that the cross section of the surface would show it thus ⌒. The vascular scars are indicated by a circular depression with two lateral minute hat elongated parallel appendages as marked in the figure. The specie is related to S. rugosa Brgt. Pl. pl. 144 fig. 2. by its border and the thickness of the corticated scars, but different totally by the double tubercle of the decorticated surface. By this last character it has some analogy to S. lavigata Brgt. Pl. 143 fig. 1. but the form of the cortex scars are different. I consider it as a good specie.

3. Sigillaria alternans H. lerigata, Brgt. from Sigillaria reniformis. I have a large number of specimen from Lacoe, which show this specie as positively different from S. reniformis. The costae are very large, four to five and an half centimeter or more with corticated surface smooth and the furrows comparatively narrow, carinate

The surface scars are comparatively very small, in my specimen only seven millim. long and about as large near the base where they are largest, obtuse hexagonal subemarginate at the top with the borders diverging outside and the base rounded. The figure or form of our specimen is about like that of Brgt. but the base is rounded (while the Brgt. figure it is angular forming a wedge with the other lines an hexagonal cicatrice) as Stimpson describes it. The lateral cicatrices are subarcuate and the middle is minute, punctiform. In regard to the subcortical cicatrices it is nearly impossible to describe them so great their variety. Our fig. 6. shows the great difference represented upon the same specimen sometimes between the surface cicatrice and the subcortical one. Some other specimens represent it still at least double than in the specimen and binate either both part separate or united in the middle. These subcortical scars fig. 7 and 8 and 486 show very different and queer form and possibly fig. 5 may be even referred to the same. The surface is deeply broadly striate, like the surface of a Calamite, the scars rhomboidal but there are binate 18 millim long, distant from each other 4 to 7 millim horizontally and vertically with a deep concave notch in the middle and the borders deeply wrinkled fig. 5 represent them exactly. Except for the striae (deeply) surface and the wrinkles of the scars it could be easily compared to fig 8. It may be new but is not describable from the subcortical scars only.

(1) Sigillaria reticulata Ste Artis Dep. I have in Albert specimens from Alabama Al. 5 a specimen whose scars are exactly like those of the Artis Report. S. reticulata, or large and so distant, the longitudinal striae quite as distinctly marked but no cross wrinkles. It might be referred to appear referable to the species. See course one of the specimen of Lesley of Sigillaria Brardei as figured in a sketch (see paper in portfolio) has scars of about the same form and somewhat distant, striae but have between them. The relation of these forms is quite close. However S. Brardei seem to have always double cicatrice. While the Alabama and Artis specimen have them simple. S. reticulata goes to the relation of the Brardei specimen.

(2) Sigillaria pseudo nova. S. reticulata affinis. Hypodrophloios, Sigillaria vicina N. 2008 of Bureau. A large specimen representing a trunk or branch, 19 cent. broad flattened to a thickness of a little more than one centimeter, marked with scars on both sides, scars ⬭ about this size and form half cent. distant, marked at the top or below it by a fourth point, space irregularly black or smooth surface coating of coaly matter there. Under the scars preserve the same form still more enlarged and are merely split a mark by a split in the middle ⬭ This resemble more a Hypodrophloios than a Sigillaria. It has a distant affinity to S. monodrymia.

3. Sigillaria? laevis. N. 2012 of Bureau is a fragment of a stem covered with parallel large linear leaves apparently referable to Sigillaria. They are exactly linear, six millim broad apparently very long, concave and smooth in the middle which is three millimeters broad and bordered on both sides near the borders by two broad smooth nerves concave on one side, convex on the borders. In the middle there are two obscure intermediate nerves distant 1 cent. ~~not~~ should be figured.

in proportion, while on the other side they have been relatively contracted and widened. Without an examination of the shale at Newport, it would be difficult to account for such a metamorphosis. At this locality, the shales present along the shore a series of low undulations, resembling slightly elevated waves; and there one can see that, in the state of fusion of the whole mass, the remains of plants, following the force of upheaval, have been, at peculiar places, drawn upwards and therefore elongated on one side, and of course drawn on the other towards the rachis. It is peculiar that the rachis and stems do not show any appearance of flexure and of deformation, and it is remarkable also that the same phenomenon of dimorphism is not observable on the plants found in the shale of the anthracite basin of Pennsylvania, where the flexures of the veins of coal are often abrupt, and where traces of tortion are frequently seen upon fragments of the combustible mineral. This deformation of vegetable remains may give an idea of the difficulties encountered by the palæontologist in studying, as he has to do, mere fragments of plants in their fossil state. Not only do these remains generally insufficiently represent the whole vegetable, but often they are deformed by various forces and influences, to which they are subjected in the process of mineralization.

§ 3. VEGETABLE REMAINS PRESERVED IN FERRUGINOUS CONCRETIONS.

As far as we know, from the specimens abundantly found in Illinois, the mode of preservation of fossil plants in concretions is somewhat different from what it is in argillaceous shale. These concretions are found, especially in the shale of Grundy county, irregularly scattered from top to bottom of the strata, in the form of oval, more or less elongated, generally slightly flattened concretions. They appear to have been formed by superposition of concentric layers of slowly deposited carbonate of iron or ferruginous clay around central nuclei, which are most commonly parts of plants, bones of fishes or the remains of insects and crustacea. Their size and form vary according to that of the body around which the deposit has been made. Some small leaflets of ferns are found in nodules which are not larger than a walnut; pieces of calamites are inclosed in cylindrical concretions varying in length from two inches to one foot or more; pinnæ of ferns or of *Asterophyllites* have been discovered in flattened concretions measuring about one square foot and only two inches thick, their form agreeing more or less with that of the body around which they have originated, though always showing an oval or round outline, by superposition of concentric layers. It is not yet clear whether the flattening of some of the specimens is the result of compression. Generally, the nodules which have cylindrical pieces of stems, or nutlets for nuclei, are round or exactly oval, while they

are flattened for pieces of ferns, in proportion to the breadth of the fragments which they have entombed.

The origin of these concretions has been explained in admitting a general tendency of some mineral bodies to *concentrate around centers, whether solidifying from fusion, solution or vapors.* (1) This explanation may be satisfactory in regard to other kinds of concretions, but from their peculiar position, their form and size, varying according to the nature and outline of the bodies which they contain, the nodules of Mazon creek rather seem to be the work of infusoria or *Bacillaria* concentrating molecules of iron around some centers, as it now happens in the formation of the bog iron ore, or in other deposits, in springs or pools, whose waters contain a solution of iron. This supposition appears confirmed by the manner in which the bodies in concretions have been preserved and selected for preservation. Though generally mere fragments, their integrity is complete, and yet some of them are of very soft texture. The pinnæ or leaflets of ferns are always found in them in a flattened position, their axis or rachis extending through the center of the elongated nodule, with the divisions on both sides; the surface of the pinnules, slightly swollen, as when in their living state, is marked by recognizable hairs or fruit dots, with distinct veins and veinlets, and their appendages, like the scales, are seen in the various modifications which they present in living specimens; for example, long, straight, flat, diverging, on primary rachis, and becoming shorter, ruffled and curled on their upper divisions. The small organs of plants appear, therefore, in a better state of preservation than in the shales. With small animals like crustaceans, scorpions, insects of a fleshy and very delicate texture, the preservation of form is still more remarkable. They are found entombed in the middle of the nodules just as if they were in life, or as if they had been transformed into stone while still living. The fruits or nutlets are not flattened. By the section of the nodules, which generally break into two equal halves by hard strokes on their edges, the middle and internal part of the fruit is exposed to view, while the outside surface is immersed in the stone. The numerous cones also of *Lepidodendron* found in these concretions are equally well preserved, either whole or in part, by horizontal cross sections. Some specimens not only show distinctly the pedicels of the sporanges and the blades in their natural position, but even sporanges with their seeds have been found in them, without perceptible alteration. In the cross section of these *Lepidostrobi* the sporange cells form a central row, which is surrounded by the blades in the form of a star.

Peculiar species of plants and animals, or their fragments, seem to have been selected as the nuclei of these nodules. They contain, for example, an

(1) Dana's Manual of Geology, p. 626.

[illegible] [illegible], [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. The [illegible] [illegible] [illegible] [illegible] distinct, [illegible], [illegible] [illegible] [illegible] [illegible]: [illegible] [illegible] [illegible] [illegible] in the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] in the [illegible] of the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] by the ~~ex~~ buds of the [illegible] or what [illegible] [illegible] [illegible] [illegible], [illegible] the oval buds show the surface marked by irregular wrinkles, diverging from a central oval depression or cavity, [illegible] the upper part being smooth and the middle narrowly ridged. [illegible] [illegible] [illegible] [illegible] or [illegible] [illegible] [illegible] or [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] the beginning of a new vegetation [illegible] [illegible] by new buds opening into leaves. On another [illegible] the distance between the [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], marked by a [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

9\. S. Lescurii, [illegible]. In looking over the numerous specimens of S. [illegible] and comparing [illegible] to S. Lescurii, this species seems [illegible] the other [illegible] [illegible] [illegible] [illegible] [illegible] the difference between the [illegible] [illegible]. Lescurii [illegible] [illegible] [illegible] specimens represented is not marked [illegible] [illegible] [illegible] [illegible] [illegible], the [illegible] are [illegible] [illegible] [illegible] the [illegible] [illegible] [illegible] which are more distinct [illegible] [illegible] [illegible] the [illegible] [illegible], oval [illegible] round 0 not u o. S. Lescurii [illegible] by intermediate to a [illegible] [illegible] [illegible] with small form of S. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

3 Sigillaria ~~[illegible]~~ fissa. Lx

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible]

Sigillaria obliqua [illegible] differs as I have [illegible] [illegible] [illegible] scars oblique [illegible] lateral lines [illegible] [illegible] [illegible] [illegible]. The [illegible] the top rounded, not emarginate. Spec. 574 of Lacoe represent this species upon a surface of [illegible] two square feet. All the scars [illegible] [illegible] of them with the [illegible] of S. [illegible]. With [illegible] [illegible] also [illegible] [illegible] [illegible] character, [illegible] [illegible] from a different locality. [illegible] [illegible] [illegible] of [illegible]

11 Sigillaria Lacoei [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] 1½ to 5 p cent. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. The upper scars [illegible], the [illegible] [illegible] ½ p cent distant, [illegible] [illegible] [illegible], 6 to 7 [illegible] long, oval, rounded at the base emarginate at the top, 4 [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] fig. p. 546 (9.) These scars present a remarkable character [illegible] [illegible] difference of size from the scars under the bark for while the upper [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] the [illegible] [illegible] [illegible] the largest [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] by figs 1 [illegible] [illegible] [illegible] [illegible] 3 4 [illegible], while in one specimen [illegible] fig. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] scars are [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] in the middle [illegible] [illegible] 5, 6, 7 [illegible] 8, 9, 10 [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

The of the character which at first [illegible] in [illegible] conjun
smooth lined under surface.

[illegible] 11. [illegible] (14 [illegible]
[illegible] 11 [illegible] centimetres [illegible]
[illegible] the [illegible] not marked [illegible]
[illegible] horizontal distance only 12 millim. [illegible]
[illegible] quite [illegible], narrowing [illegible] the lower surface [illegible]
[illegible] elliptical, pointed at both ends, [illegible]
[illegible] connecting [illegible] fig 1, p 546. The line a [illegible]
[illegible] cut into the stone 6 [illegible] decorticate [illegible]
[illegible] surface [illegible] same [illegible] without any trace of [illegible]
[illegible] rounded [illegible] length. The result [illegible]
X [illegible] ~~lepidodendra~~ [illegible] number of decorticated [illegible]
[illegible]
[illegible]
[illegible] horizontal, [illegible]
[illegible] very [illegible]
[illegible]
[illegible] elongated (M) [illegible]
[illegible] the same [illegible]
[illegible]
[illegible] the [illegible]
[illegible] is not
very large though it appears to [illegible] place by the [illegible]
they vary from two to three cent. The bark is somewhat [illegible]
[illegible]
undulately [illegible], the bark very thin (M) [illegible]
[illegible] (M) [illegible]
[illegible] (M) [illegible] S.
[illegible] see 4756
[illegible] Pittsburgiana 471a & [illegible] ~~lepidodendra~~ [illegible] [illegible] 11 millim. [illegible]
[illegible] the normal form surface [illegible] (M) [illegible]
[illegible] the normal form [illegible]
+ 4 [illegible] 45 + 6, 2.) [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] specimen of [illegible] No 568a [illegible] stem
[illegible] 12 to 15 cent [illegible] 50 cent.
[illegible]
[illegible] measured 50 cent [illegible]
[illegible] nothing at its [illegible]
[illegible] and the [illegible] very distinct. [illegible]
[illegible]
[illegible]
[illegible] oblique? [illegible] (512) ~~Two specimens from~~
Aldrich [illegible] No 52 have exactly the same [illegible] as this one but they are ~~deeply~~ impressed into
the clay the [illegible] at the base the [illegible] surface smooth giving to ~~it~~
a peculiar appearance somewhat like that of S. [illegible] from which it ~~possibly~~ differ by the [illegible]

[illegible] described at p. 482ᶜ. 1. is merely an old stem of [illegible] 483c

various specimens of S. reticulata or alveolaris

[illegible] lower [illegible]

2. [illegible] I have figured p. 546 (4) the top of a large specimen of [illegible] which seems to represent the [illegible]. It must be compared [illegible] scars are somewhat large [illegible] about 1 cent. [illegible] at the top [illegible] surrounded by a smooth [illegible] 617. See p. 483ᵇ 1.

3. Sigillaria cuspidata Brgt. ~~name may be changed~~ Lacoe N. 622. Fig 5 p. 546.

A large specimen. [illegible] 1 cent broad [illegible] grooves decorticated surface [illegible] the line thin but distinct to [illegible] scars smaller [illegible] truncate [illegible] striae in the upper part parallel to the band of the scar [illegible] more acutely [illegible] between them [illegible] very [illegible] 3. [illegible]

[illegible] See p. 474ᵃ. (1) Leigh & Penn Exch. 617 1.

+ [illegible] 85 cent long 40 cent broad, flattened to about 5 cent. the ribs are 17 milli broad [illegible] 8 to milli long  6 milli broad with [illegible]

[illegible]

N 623.

+ 8. Sigillaria [illegible]

[illegible] Cordaites leaves [illegible] from the [illegible] [illegible] has not any trace of scar [illegible]

[illegible]

[illegible] deeply and regularly, without the length the width varying the [illegible] [illegible] [illegible] elongated or smaller than mentioned being slightly [illegible] by epidermis. Other measures 24 for Monocrans show that it can [illegible]

[illegible]

2. Sigillaria Serlii, Brgt. from p. 436 b. (3). Ulodendron. Leave specimen 521. There is a larger specimen described 436 b. (4). This one is fragment of a small, branch only two cent broad with very distinct scars of leaves and of ones. The bolster (pulvinuli) are convex or elevated, transverse, rhomboidal; disposed in quincunx 4½ to 5 millim. broad, 2½ to 3 millim. in vertical space. Vascular scars marginalis smaller, of the same form, at the top of the bolsters; vascular scars three horizontal points, the middle one more distinct and often the only one distinct and deeply marked. Scars of ear small round or transversally oval five millim. transversally, 4 millim. vertically. Central point a small mamilla half a mill. broad, surrounded a border of parallel thickish conical altered scales forming a star around it, and a second row of larger more irregular scales immersed at the borders or passing to the half scar or bolster, which cover the whole branch. Ear scars 2½ cent. in vertical distance. One row only in matrix. Compare this with S. Serlii as figured and described by Brongniart and Goldenberg, it is easy to see that this is the true species of Brongniart, which he says that this is one of the species the most doubtfull of the Sigillaria and to evidently intermediat between Sigillaria & Lepidodendron that one may be in doubt about the place which it ought to occupy. Comparing the bolster to those of Ulodendron Magnei. pl. XXI fig 4 of this vol. Bolsters taken from good specimens of Ulodendron Magnei both corticated, half corticated and decorticated, it is easy to recognize identity of this specimen with that Ulodendron, the decorticated surface being exactly represented in Goldenberg figure 6 of Pl VII. of the Flora Saraepontana. This small specimen give also evidence of the nature of those scars of Ulodendra showing that they are scars of ears, probably flowering ears attached already in small branches and with a merely punctiform point or very small axis bearing at the base the primordial scales perfectly distinct and placed star like upon one specimen. These scars like those of the leaves increase in size with the enlarging of the stems preserving however their form and character. For in some of the larger scars one cent. in diameter a more the bands impressions of the scales different in form of that of the leaves is evidently recognized. Sigillaria dubia Gold. is the same.

Sigillaria continued p. 474 a.

abundance of leaflets of various species of *Neuropteris*, especially *N. hirsuta*, of *Alethopteris Serlii*, of *Pecopteris villosa*, *P. abbreviata*, *Hymenophyllites Clarkii*, *Annularia longifolia*, *Stigmarioides*, etc., which are either rare or have not yet been found in the shale at Morris, while these shales are rich in the remains of *Odontopteris Schlotheimii*, *Alethopteris erosa*, *Ulodendron*, *Carpolithes multistriatus*, scarcely or not at all preserved in concretions. As the bank of shale bordering the bed of Mazon creek has not yet been opened, these differences may result from geographical distribution. Yet, as the animals and plants of soft exture, like the species of the genus *Sigillarioides*, have not yet been found in the shale of our American Coal Measures, it is evident that these remains have been generally destroyed by maceration, and only escaped total destruction by their entombment in these nodules. The same can be remarked on the remains of small animals. The remains of fishes found in these concretions are merely bones, scales and coprolites, while of molluscs, they have afforded only some agglomerations or very small shells.

§ 4. VEGETABLE REMAINS PRESERVED BY MINERALIZATION OR TRUE PETRIFICATION.

This kind of fossilization is performed by slow infiltration of mineral matter into the substance of the vegetable, when in a soft state of decomposition. The phenomenon is produced either by a total destruction of the vegetable substance, for which sand, clay or oxyd of iron is substituted by infiltration, or by a slow, still unexplained mineralization of the vegetable substance, by silex or lime. By the first process, the whole texture of the vegetable is destroyed, except the surface, preserved as in a mould, which shows the original outline of the vegetable, and bears the cicatrices of the bark and other external characters, which often render it recognizable. These moulds, generally covered by a coat of coaly matter, are rarely flattened by compression, and mostly represent trunks or branches of large size, sometimes fruits of a hard consistence, rarely branches and leaves of ferns. They abound in the sandstone beds of our Coal Measures, and some of our new species of *Lepidodendron* and of *Sigillaria* have been described from specimens of this kind. In the second case of petrification, on the contrary, the surface or outside of the vegetables is generally obliterated, as if it had been more or less decayed while subjected to mineralization, while the internal structure is preserved in its minutest details, and so distinctly, that it can be studied under the microscope when lamellæ of the fossils are detached, and polished thin enough to become transparent. Specimens of wood fossilized in this way, though often remarked in the Carboniferous formations of Europe, and very common in the more recent formations of

this continent, have rarely been found in our Coal Measures, and none as yet have been obtained, except from Southern Ohio and Northern Kentucky. Both these processes of fossilization have acted upon vegetables already separated from their support, and more or less decayed, or upon trees still standing or still living, when they were surrounded by the mineral substances which caused their petrification. Though not quite as abundant as prostrated fossil trunks, petrified standing trees are not unfrequently obtained from the sandstone of our Coal Measures. Near New Harmony, Ind., some petrified trees, varying in size from six to twelve inches in diameter, have been obtained from a sandy shale, and transferred to his museum in their standing position, and with their roots attached to the trunks, by my lamented friend, D. D. Owen. Though entirely metamorphosed into sandstone, their mould preserves remarkably well the scars of the point of attachment of the leaves, the wrinkles of the bark, etc., and show the gradual variations which modify the form of the cicatrices in passing from the stem to the roots. True petrified forests have been observed in banks of sandstone of the Coal Measures of Pennsylvania and of Kentucky. This phenomenon should, therefore, demand but a passing notice, if it did not give rise to some discussions concerning the mode and cause of dislocation or fracture of these fossil trees, and also concerning the causes and agents of their petrification.

Fossil trees, except when observed in their standing position, still half inclosed and sustained in the matter in which they have been originally buried, are always found in pieces or broken. This is observable as well in the fossil wood of the Carboniferous measures as in that so abundantly found in more recent formations; for example, in the Cretaceous and Tertiary beds of our continent. The fracture of the pieces is of two kinds: either irregular, in various directions, like the breaking of mineral substances produced by hard strokes, or horizontal, as if by a kind of cleavage, the separate pieces forming disks or regular cylinders of various length. Generally, in both cases the fractured surface is clean, smooth, distinctly angular, and showing that in most cases, at least, the breaking of the trunks has been effected after the fossilization. Prof. Goppert, who has visited the fossilized forests of Egypt, south of Cairo, and has published the result of his researches*, has found there the trunks subjected to a kind of multiple fracture, produced at various times and in various ways; some of the trunks having their fractured surfaces obliterated as if by decay, others showing on their fragments, still closely approached to each other, evidence of recent separation. He therefore explains their fracture as due to mere atmospheric influences, especially to sudden changes of temperature, which are not rare in those regions. This explanation could be admitted for

*Der Versteinerte Wald by Cairo, &c.; Acad. der Weiss: zu Wien. vol. 33, 1858.

1. Sphenophyllum primaevum. sp. nov. Whorls deeply four to five-lobed, the lobes being cut to near the central axis or sometimes only to half the distance between the border and the center; lobes cuneiform truncate at the top, crenulate or obscurely undulate, tridentate, variable in width, sometimes acute. Veins thin very distinct when the carbonaceous surface is destroyed; otherwise obscured simple at the base and divided dichotomous, forking once or twice. The whorls are small either close or distant upon a thin pedicel, about one cent. diameter of a hard consistence and in fig 4 & 5 covered with a thick wooly matter. Fig. 4 is the one sent by M. Micklebourough a teacher of Cincinnati. The pedicel is distinctly seen from one central point to the other and borne but distinguishable only with a glass and was not marked in the figure. Fig. 5 is one of the two specimens communicated by M. Dyer. each of them representing only one whorl. Fig. 6. is copied as far as possible from four small specimen in soft-blue clay from the base of the Cincinnati group. In these the carbonaceous matter in maceration has spread around or rather colored the clay in such a way that the form of the whorls and of their leaflets is ~~one~~ not quite clearly discernable. Fig 6 represents it as well as it may be seen. The relation of these branches to a sphenophyllum or to a genus same as the others is certain. It is only impossible to determine if these fragment represent a different species. I have united them all under the same name. The leaflets appear much smaller and the veins undistinct. Fig. 4 is the best preserved specimen It is upon a kind of hard reddish ferruginous clay. The specimens of M. Dyer seem to have been found at the surface. At first they look as if partly covered by a thin coat of stonely chemi of recent growth; but this is mere appearance; that is caused by a thin deposit of muddy matter apparently by the drying of a basin of water where the plant was in vegetation. The same case is marked with the specimen of Sphenophyllum which I have upon grand and where the plant are represented especially by their skeleton or by the borders and the nerves.

2 Sphenophyllum? Roemingeri. (Sp. nov. Specimens found by De Roemingen in the Lower Heldeberger limestone of Michigan.) This species. fig. 1. (1c enlarged) is not quite positively referable to a Sphenophyllum. The stems are numerous, straight, scarcely one millim. broad, articulate, articulations distant. 8-10 millimeters, slightly inflated either branching or rather forking or bearing whorls of small leaflets oblanceolate obtuse or truncate, whose form as seen fig. 1c. enlarged seems intermediate between those of Annularia or Sphenophyllum. These leaflets are very small, scarcely discernable, and mostly fragmentary. This organism covers a piece of limestone with numerous small shells, similar to Spirorbis carbonarius; one of them c2 is enlarged and also small glomerules or oval punctate bodies resembling seeds as seen b.b. These could be referable to seeds of Chara if they were marked by spiral lines, but they are not and probably refer to species of Prototaxites Newberry as figured by Dana manual 2d Ed. p. 257. The stems in whorls their mod of branching and the position of the leaflets is evidently of a Sphenophyllum or an Annularia, the shells fresh water shells.

separately and replaced in their order of [illegible]
in its original position. At Carbondale, [illegible]
been crossed in the opening of an
bank of sandstone to a bed of coal underlying it. [illegible]
case taken care of this passage [illegible]

the irregular fragments of silicified wood, found in connection with our recent formations, and which, in some countries—in Arkansas and Mississippi, for example—are in some places strewn upon the ground in profusion. Agglomerations of silex are rarely homogeneous or regularly compact throughout. They are interspersed with fissures or soft veins which, when penetrated by water, expand under the influence of frost, and determine fractures in various directions. But fossil wood broken in that way is rarely found in our Carboniferous measures. Generally, the fossil trees of this formation, when separated from the mineral substances in which they were originally imbedded and petrified, show the fracture by horizontal divisions, as by cleavage, and when in a standing position, and taken out of the matter which surrounds them, they separate in disks of various lengths, and can thus be taken out in pieces, which superposed afterwards rebuild the whole trunk, without marks of any other mode of disconnection, but horizontal through fissures. In that way the different parts of the trees mentioned above, as found by Dr. D. D. Owen, have been taken out of the sandstone separately and replaced in their order of superposition, to rebuild the vegetable in its original position. At Carbondale, in Pennsylvania, a true forest of *Calamites* has been crossed in the opening of an inclined tunnel through a bank of sandstone to a bed of coal underlying it. The fragments of petrified stems taken out of this passage are in such abundance that they have been used for the construction of a kind of gangway for running the coal cars out of the mines. These fragments, nearly without exception, are mere disks, varying in length from one to four inches, without relation to the size or diameter of the stems, which measure from three to six inches; the differences in the length of the sections being as marked for the large as for the small stems. All these fragments represent only as far, at least, as I could determine from the examination of hundreds of specimens, two species of *Calamites: C. Suckowii* and *C. approximatus*, Brgt. The walls of the tunnel are adorned by a number of these trees, still in their standing position and half imbedded in the sandstone. Though these stems are continuous, they show, at various and irregular distances, horizontal fractures where they break or are dislocated at their separation from the surrounding sandstone. Some of these trunks of *Calamites*, which in their natural state were evidently hollow, have been abruptly folded or crushed, like hollow cylinders in bending under their own weight, or by some external force; but even at the point of inclination or tortion of these stems, the fracture is horizontal or perpendicular to their erect position. At Paintsville, Johnson county, Kentucky, the bottom of the river, which at some places has been cleanly washed, is marked, as in a kind of irregular mosaic work, by the broken tops of large trunks of *Sigillaria*, still in their original standing position, all horizontally fractured. One of these trunks measures twenty-two inches in diameter. The same peculiar kind of horizontal

fracture is generally observable on the silicified trunks so abundantly found in some parts of Southern Ohio, especially in the bed of Shade river, near Athens. They are, most of them, pieces of stems of fern trees (*Psaronius*), varying in diameter from three to twelve inches, broken in disks from two to fourteen inches long. A few of these pieces of silicified wood are irregularly broken and disfigured on the outside by maceration; but generally they preserve their cylindrical form, and when of some length show here and there, at various distances, horizontal splits, uninterrupted all around the trunk, where a disruption is easily produced by a hard stroke. From the great bed of sandstone overlying the Pittsburg coal, near Greensburg, I have received, from Rev. W. D. Moore, large specimens of fossil wood, most of them long, irregularly broken, much decayed pieces, evidently representing sections of trunks broken lengthwise. These were found in various positions in the sandstone, and were mostly broken before they were imbedded in it. But among them there is one which bears, attached to a short stem, three diverging branches of its roots, a proof that it has been buried in its original standing position; and this one has its top horizontally broken and flat.

From these data and a number of others, which it is useless to mention, being all of the same kind, and bearing the same evidence, it appears that the fracture of the fossil wood is of two kinds: irregular, for trunks fossilized after prostration or in a decaying state, as they are generally found in our Tertiary and Cretaceous strata; and horizontal, by splits perpendicular to the natural direction of the stems and the roots. If the cause of fracture in the first case is, without doubt, essentially due to atmospheric agency, that of the second, which has acted upon the vegetable while it was still subjected to the process of petrification, is certainly different, and can be explained, I think, by the difference of density of both the surrounding mineral matter and the imbedded vegetable. Evidently, all the stems in the process of fossilization have been subjected to a softening process of their whole mass. The outside pressure of the surrounding mineral matter must have been felt, and can have acted only in one way, that is, vertically, as it happens in the forcing of a body of less density out of water; and the result of that action cannot but have been a tendency to dislocation, and therefore to splitting of the trunks in a horizontal direction. It might be supposed, perhaps, that a gradual accumulation of sand or other mineral matter around standing trees, in burying them, has formed layers of different density, whose action may have produced, in the fossil vegetable, zones of petrification also varying in density, tending, therefore to cleave from each other, and horizontally separable. But the roots of fossilized trees which tend downwards in an inclined direction, or even are nearly horizontal, should be split in an inclined plane and not perpendicularly to their axis, as they are, at least, on all the roots of standing trees which I have had opportu-

Organs unknown to me or of uncertain relation.

N. 429. of Lacoe's specimens. is sketched p. 532, fig. 9. It looks like a long linear capsule, 13. to 14 centimeters long obtuse or truncat and slightly narrowed at the upper end. a little more than two centimeters in width, gradually narrowing and curved (hooked at the base where it is broken and slightly inflated in the middle, showing like the fragment of a hooked pedicel. The middle from top to the base is irregularly very thinly striate, on both sides. the border are slightly wrinkled in right angle to the axis which is slightly convex and indeed resemble to some fruiting capsule. It is distantly comparable to my Rhabdocarpus arcuatus of the Mg. survey. Pl. 30 f. 8 of my figures and I believe that this may represent a fruit of the same genera division which can not be a rhabdocarpus.

4876 It would seem as if the nature or genus of the wood subjected to petrification might have had some influence on the nature of the agent which have caused mineralisation. I have in the following page alluded to the petrification of the trunks of Gallipoli. Now, it is remarkable that on yet all the trunks found silicified at or near Athens O. belong to ferns or fern tree at least as much as can be seen from specimen collected. How is it that all the silicified specimens are ferns? It is difficult to account for an exclusive kind of vegetation in a place or in a locality under atmospheric circumstances which have their influence over the whole extent of the coal measures by great abundance of humidity. Indeed, in the that of the coal though the remains of ferns are abundant, we never find them separately, or in themselves without being mixed with others. In the sandstone, the same remark strike the observer. All the trunks transformed in sandstone are Sigillaria, Stigmaria, Lepidodendron and scarcely any Trees. It is possible also that water over charged with silica may have favoured the growth of ferns and then petrified their remains. A great deal of questions are still open to examination in the process of petrification and in the distributions of the trees of the Coal.

nity to examine. Moreover, the silicified stems which have been noticed above as marked by horizontal splits, are of the same compound in their whole length.

The silicified wood of the Coal Measures of Ohio, as that also of more recent formations of our continent, furnish us some valuable data for the examination of another vexed question: concerning their mode of fossilization, or rather the origin of the silica which has produced their transformation. Two opinions, above all, have been advanced on this subject. Prof. Goppert thinks that the process of petrification has been very slow, of long duration, and that to explain it, it is not necessary to suppose that the water in which the vegetable substance has been transformed, was richer in silica than it may be now in its normal state. Prof. Schimper, on the contrary, asserts that the water in which wood has been silicified should have been of a higher temperature, more abundantly saturated with silica, and therefore, he concludes that the kind of mineralization has happened in a much shorter time than is generally supposed, and by volcanic agency, as is now the case in the vicinity of the Geysers of Iceland. (1) To sustain this assertion, the celebrated professor says: that the progress of the fossilizing process should have been rapid enough to reach the whole substance of the wood before its decomposition by putrifaction. But the woody tissue, when entombed and protected against atmospheric influence, is unalterable for a considerable period of time, and slowly passes, by emerecausis, into coal. It is, therefore, conceivable that in the first stage of this slow burning, when the whole vegetable has been reduced to a soft matter, it may be penetrated by mineral fluids which, by crystallization, transform it into stone. In the valley of Locle, Switzerland, large prostrate trunks, more than fifty feet long, were discovered some years ago in a bed of sandy clay of the upper Tertiary. These trees, most of them Dicotyledonous, had their bark still in a good state of preservation, their woody tissue admirably preserved, and looked indeed as if they had been recently buried. Yet their wood was soft enough to be cut through with the knife without effort, like butter. Beds of lignites, in Germany, where the emerecausis is in a more advanced stage, contains large trunks of wood, softened in the same degree, and already blackened. In that state, the woody tissues are easily impregnated by dissolved mineral substances. But to omit theoretical discussion and merely consider facts observable around us, it is evident that our silicified wood, as well in our Coal Measures as in the more recent formations, is found in connection with strata which show no trace of volcanic agency. The silicified trunks of Southern Ohio have been washed out by the creeks from the Mahoning sandstone. The area covered by this formation, and over which the trunks are found in greater

(1) Traite de Pal. Veget., p. 38 and 39.

or smaller quantity, extends from Athens southward, to the Ohio river, and in Virginia, as far up the Great Kenawha river as Charleston, or about one hundred miles in a direct line. There is no trace of any volcanic agency in that country. No distubance of any kind is observable in the strata, which have their normal, slightly-marked dip to the eastward; nor does the sandstone itself indicate, in its appearance, by a variation of its compounds or of its density, any trace of metamorphism. At Gallipolis, near the mouth of the Great Kenawha, a number of fossilized trunks, still buried in the sandstone, are seen protruding from the bank, in which they have been petrified in a prostrate position. As these trees have been examined already by other geologists, and mentioned as indicating a peculiar direction of a current, by which they have been brought and deposited, a short account of them here may not be uninteresting. There are five of them, from four to fifteen inches in diameter, their length unknown, lying, two in a southeastern direction, one due east, and the two others due south. The part seen out of the sandstone is much decayed, the outer surface, where it is preserved, is covered by a coat of coal varying in thickness from one-half to one-fourth of an inch. What is most remarkable, and bears directly on the question of their petrification, is that they appear to have been transformed into stone by different substances, showing a different kind of mineralization. In one of these trees the internal texture has been destroyed, and the woody tissue is replaced by a hard calcareous sandstone or clay, separating in layers of about one-fourth of an inch in thickness. A second is a compound of small crystals of iron flint, its interior being perforated lengthwise by a number of irregularly placed cylindrical apertures, filled with small iron crystals, forming regular stars of more than twenty rays. A third, of which I have obtained large pieces, it being of smaller size, four inches in diameter, is transformed into a compact, opaque, black silex, which does not preserve any trace of organic structure. (1) As these trees, of course, have been petrified where they are found now, it would appear as if different mineral substances, held in solution in the water, had acted upon the woody tissue in different ways, according to its nature. In any case, it is evident that the petrification has been performed in various ways, by the slow action of the liquids penetrating the sand, and not by the uniform crystallization of silica as it is now produced in the hot springs of volcanic origin. This is more evident, in considering silicified wood of our more recent formations. Neither in the plains of Kansas and Nebraska, nor in Eastern Arkansas, nor in Missis-

(1) It is marked by inflated articulations, like a species of *Anarthrocanna*, Gopp., and is as yet the only specimen found in our Coal Measures which might be compared to the trunks seen by Prof. Brongniart in the coal mines of St. Etienne, France, and compared to Bamboos, from their inflated articulations. (Lyell. Manual, 4th ed., p. 319.)

(1) Psilophyton (see for description of the genus Schp. Pal veg. III p. 548.

(2) Psilophyton (cornutum?) spec. nov. Specimen from lower Heidelberg by Oberminger. Branches comparatively thick at the lower part. three millimeters diameter, dichotomous, rapidly diminishing towards upwards, ultimate branches short. — The divisions (dichotomous) of this vegetable organism refer it to Lycopodiaceae and like the forms described as Sclerophyton it may be compared to pieces of Psilophyton. The substance does not appear hard at least though imbedded into limestone. Their surface is flat, indistinctly striate and here and there marked transversally by wrinkles or roughness. It does not bear any trace of leaves or other organs. The fragment on the right does not appear belong to the same species at least it is not branched and the surface is more distinctly wrinkled across or by the. It has the appearance of a slender rhizome and may be one of the species same species.

2888

Sclerophiton Sp.

Stems very hard, and small, slender. ~~Secondary~~ dichotomous division slender. the upper or ultimate ones very thin filiform simple and curved. This definition is taken for a plant of the Silurian of Cincinnati; plant imbedded in soft clay. 12/19/05. dry, hard.

(1) Sclerophiton gracillimum. Stems slender filiform, a little more than half a millimeter thick at the base, slightly flattened or half cylindrical, transformed into hard coal polished branching dichotomous the principal ones as thick as the primary stem, anotomy, the intermediate short, the upper ones long tapering curved ~~and~~ to an extremely thin end. By their consistence or their hard substance transformed into shining coal, these plants are evidently referable to land or fresh water plant. Their dichotomous divisions refer them to Lycopodiaceæ, but their growth does not appear to be by spiral evolution; at least the terminal branches of this fragment are very slender, tapering and straight or merely curved downwards. This may represent a branch entirely unfolded whose divisions therefore do not indicate the spiral evolution. In this case, it could be referred to Psilophiton and called P. gracillimum. This would be more appropriate than to constitute a new generic division. The substance of the hard corny stem ~~has~~ is easily separated in fragment from the soft clay (blue clay) leaving but it grooves or exact impression of its forms. The specimen is tolerably large and hence the part here exactly figured. It has some broken fragments of the few species scattered upon it and exactly bearing the same characters. The specimen is from the lower part of the Cincinnati group and belongs to Prof. Herzer. Denoted as Psilophyton gracillimum

(2). The above is satisfactory but acted upon hence the discussion under. See Plants of the Silurian.

Protostigma. Lesq.

Trunks or stems of various sizes marked on the surface by transversely rhomboidal scars whose outlines only remain without any trace of vascular scars or any other inside.

1 Protostigma sigillarioides. Stem cylindrical, slightly compressed, seven centimeters in diameter, ~~two~~ and a half to three in the flattened direction marked outside by somewhat irregular rhomboidal scars placed in spiral around the stem and resembling the scars of Sigillaria Brardei or rather of the outlines of these scars. These outlines are somewhat irregular, the lines elevated and blunt but not quite sharpened more or less deformed or apparent by the compression of the stem. Another branch however, small specimen fig. 8 of the plate has a branch or rather the impression of a branch, preserved in hard coal upon the whitish clay of the Carboniferous group. The lines are quite as irregular as in the large specimen which also comes from this group, placed also in spiral order apparently more or less deformed by the contact of the clay where the surface impression or these coaly matter has become embedded and preserved. The coaly matter of these scars or the part preserved upon the clay or coal prevents the supposition that this organism might represent marine plant. It is however certain that the scars are not quite as regular as should be expected from trunks of Sigillaria or branches of plant of this family. They are to my belief original organisms if they should be still imperfect in their characters.

sippi and Ohio, where fossilized wood is found generally associated with a ferruginous argillaceous sandstone, is there any trace of volcanic agency. There is merely an evident relation of this kind of fossilization with the deposition of iron. In Ohio and Virginia, that part of the Mahoning sandstone containing silicified trunks, borders, and perhaps overlays in part, the area where the richest and most numerous beds of iron ore have been deposited. In the recent formations, the fossilized wood is generally associated with the red or ferruginous clay. Even in the small area occupied by our Post Tertiary formation at Barlow, Ohio, disks of silicified fossil wood of dicotyledonous species are found in a bed of red ferruginous clay, associated with species of shells of the genus *Anodonta*, entirely transformed into a compact mass of oxyd of iron.

§ 5. THE FLORA OF THE CARBONIFEROUS MEASURES OF ILLINOIS, CONSIDERED IN SOME OF ITS AFFINITIES.

As a whole, the coal flora of Illinois has, like that of our American Coal Measures, the general character of the Carboniferous flora of the whole world. It is well known that the representatives of this flora mostly pertain to a single class of vegetables: that of the acrogenous or vascular cryptogamous plants, containing the three families of *Equisetaceæ*, *Filices* and *Lycopodiaceæ*. The nodules of Mazon creek, where fragments of plants, even of the softest texture, have been preserved in their integrity, offered a good opportunity for examining the often proposed question: whether plants of a lower or of a higher order than those could not have entered into the compound of the coal, and, from a peculiar consistance of tissue, have been destroyed by maceration, without leaving any traces of their primitive forms. This has been affirmed, for example, of the *Algæ* or marine plants, which have left their remains in abundance in the Lower Carboniferous and Devonian strata, and also of the small cellular vegetables, *Fungi* and *Lichens*, which, at the present time, live on the bark of the trunks and branches of our trees, and are also observable, in the same circumstances, in the Tertiary and Cretaceous formations. I have already remarked, that no remains of any kind of marine plants have as yet been observed in the concretions of Mazon creek.* This is the more noticeable, as some of them have for nuclei bones of fishes of moderate size. As the so-called *Fucoides* have also never been seen in any bed of shale overlying coal strata, it is reasonable to conclude that the remains of these plants have not contributed

*Since this report was written, two or three nodules have been obtained from Mazon creek, inclosing marine shells, one of which is an *Aviculopecten*, and the others probably referable to the genera *Nucula* and *Polyphemopsis* or *Macrocheilus*, and indicate that these Mazon creek shales were probably an estuary deposit, in which the remains of marine animals were sparingly intermingled with the fauna and flora of the adjacent land. A. H. W.

in any way to the formation of the coal. But this is not a sufficient reason for asserting their non-existence at the Carboniferous epoch. *Chondrites Colletti*, Lesqx., collected from Lodi, Ind., and found in connection with a bed of limestone overlying a thin coal at the base of the true Coal Measures, or just above the mill-stone grit, like *Caulerpites marginatus*, Lesqx., from an analogous station in Pennsylvania, are sufficient proof of the existence there of marine vegetables already of a high order. But marine *Algæ* could not live in the low swamps where the coal was in process of formation, no more than they could live now on the surface of the peat bogs, even of those which extend along the sea shores. These plants had then, as they have now, a domain of their own; they have casually been brought to live upon a limestone formed under deep water, as the roof of a coal bed, but no remains of them could enter into its compound.

Of *Epiphyllæ*, small *Fungi* or *Lichens*, as parasites of stems and leaves, the concretions of Mazon creek have also no trace. They have, however, in great quantity that peculiar small organized body, *Gyromices Ammonis*, Gopp., which some European naturalists still persist in considering as a *Fungus**. In the nodules the white, shining, bony substance of this small *Serpulidæ* is better preserved still than in the shale, and the tissue of fragments of thick leaves, wherein it burrowed, is often perforated like a sieve, by the removal of this shell after the destruction of the epidermis.

The reason generally given for the non-appearance of remains of small, cellular, vegetables, like *Fungi* or *Lichens*, upon the bark of branches and trunks of the Coal Measures, is, that the maceration of the woody tissue and its softening has necessarily detached these small bodies from their place of origin. But if this was the real cause of their disappearance, small vegetables of this kind should have been preserved in the nodules of Mazon creek, as well as the small vegetable organs, scales, hairs, fruit dots, and even seeds of *Lycopodiaceæ*, which are as much exposed to separation and destruction by the process of maceration. We find, moreover, a large number of these small plants in the fossil remains of the Cretaceous and Tertiary formations, upon fragments of wood, which have been exposed, before their petrification, to maceration, just as much as the plants of the Carboniferous period. As these parasitic *Fungi* and *Lichens* are at our time of rare occurrence on ferns, as also on *Lycopodiaceæ* and *Equisetaceæ*, I would rather admit that their appearance is cotemporaneous with that of the exogenous plants, on which they especially thrive, and that species of this class, and also of mosses and *Hepaticæ* had scarcely any representatives in the vegetable world before the end of the palæozoic period.

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*Prof. W. P. Schimper places it in species of doubtful affinity in his Pal. Veg., p. 144 In his Permain Flora, Goppert has it still as a Fungus.

[illegible] the formation of the coal. But this is not a sufficient reason for their non-existence at the Carboniferous epoch. *Chondrites Colletti*, [illegible] from Lyell, Int. and found in connection with a bed of lime[illegible] this not at the base of the true Coal Measures, or just above [illegible] *Chondrites magnificus*, Lesq., from an analogous sta[illegible] of the existence there of marine vege[illegible] [illegible] could not live in the low [illegible] than they could [illegible] extend along the [illegible] of their seas; [illegible] to live upon a [illegible] under deep [illegible] as the roof of a coal bed, but no remains of them [illegible] under fair circum[illegible]

[illegible] parasites of stems and leaves, the [illegible] They have, however, in great [illegible] peculiar small organized body, *Caporces Arnoldi*, Gopp., which some European naturalists still persist in considering as a fungus. [illegible] the white shining, bony substance of this shell (*Sepultina*) better preserved still than in the shale, and the tissue of fragments of dried leaves, which is often preserved [illegible] the removal of this [illegible]

[illegible] appearance of remains of small, cellular like *Algæ* or *Lichens*, upon the bark of branches and trunks of [illegible] the maceration of the woody tissue and its softening [illegible] all bodies from their place of origin. But if [illegible] appearance, small vegetables of this kind have been preserved in the nodules of Mazon Creek, as well as the small [illegible] fruit-dots, and even seeds of *Trigonocarpaceæ*, which [illegible] of preservation. [illegible] find, moreover, a large number of [illegible] fossil remains of [illegible] and Fertacy Formation. Upon fragments of wood, which have been exposed, before their petrification, to maceration, just as much as the plants of the Carboniferous period. [illegible] *Lichens* are as com[illegible] are [illegible] on fronds, [illegible] could [illegible] that their [illegible] aquatic plants, on which they especial[illegible] species of [illegible] and *Hepatica* [illegible] representatives in [illegible] and of the palæozoic period.

[illegible] Schimper places it in species of Cladophora, [illegible] Pal. Veg., p. 134

4910.

1. Tæniopteris Pennsylvanica. Sp. nov. Pa. 38, specimen found by myself at Shaw (1876). Leaflets linear, comparatively small one and a half cent. broad in the largest part of the largest leaflet which are numerous upon the same specimen slightly decreasing upwards and obtusely pointed as seen fig. 1, borders entire, irregularly distant; midrib (1 millimetre broad) comparatively narrow, deeply marked in the upper surface of the leaflet; lateral veins joining it either nearly perpendicular or by a slightly declining bar, then running nearly horizontally to the borders which they join either straight to it or in slightly curving upwards. The veins are thin but more distinct and distant than in the other species. At one millimeter distance more generally simple sometimes forking either from near the base or from the middle or from near the margin. The frond was apparently pinnate and the fragment figured more leaflets for the specimen is covered with fragments of them, one of them fig. 8 rounded at the base and unequilateral evidently representing the lower part of a separate leaflet. This species is related to T. fallax Gopp. Perm. fl. p. 130. Pl. 8 fig. 5 & 6, Atl. 9 fig. 3 which has longer leaflet but judging from their last figs. a nervation of the same type. Goppert says nervis secundariis e nervo medio tenui angulo recto egredientibus simplicibus vel bari dichotomis which agree with Goppert's figures and also with ours for the nervation. Schimper changes this and says: nervo medio mediocri, nervulis ex eo angulo acuto egredientibus, deinde subhorizontalibus which is wrong. In Goppert fig. 5 of Pl. 8 the borders are lacerated but not laciniate as in our species. See also for the nervation T. Bertrandi Mat. Pl. 5 XXXIII fig. 5.

2. Tæniopteris vimthii Ly. Lec Notes on Cod plant p. 41. N. 153. This species differs from the former by the large size of its leaflets, the fragment figured and the only one seen being 4½ centimeters broad, indicating a length of at least 14 to 15 centimeters. The midrib is comparatively much larger, three and an half to four millimeters broad, channeled in the middle and bordered both sides by a flat shoulder to which the veins are joined nearly in right angle and nearly running downward. The veins are still closer, thinner than in the above species and mostly simple or forked, joining the borders without any trace of upper flection. The borders are lacerated irregularly as from disruption by maceration but not laciniate as in the former species.

That these two subcarboniferous species belong to the same genus or to Tæniopteris it is not possible to decide. No trace of fructification are remarked upon any of the specimens. Schimper has subdivided the genus Tæniopteris in four new divisions: Genus Tæniopteris for species of the upper Carboniferous and Permian viz. Anziopteris in from the Triassic upwards. Macrotæniopteris for Tæniopteris dentata Heer is species merely described with borders angulo dentatis. a Jurassic species, which from the description recall what I have described as Pleuro erosa in Dig. fl. – Oleandrinum and Macrotæniopteris which like the former represents especially Oolitic species. As their generic divisions are based especially to the geological distribution and to the fructification and as we have here the two first species even found in the lower or subcarboniferous and without traces of fructification, we defer them to the Tæniopteris which may be considered as a uncertain generic division. See for study Tæniopteris Munsteri, Gopp. in Genera Div. 32 & 44 pl. 4.

The shale of the coal at Morris and the concretions of Mazon creek have furnished also a number of specimens of three species, or rather forms, of *Palæoxyris*, a kind of organism which is considered by Brongniart, Schimper, and other naturalists, as a plant belonging to a higher class of the vegetable kingdom, that of the *monocotyledonous phœnogomous* plants. In describing these bodies, I have expressed my views on their nature. If the opinions of the European authors are right, we have already, from the lower part of the Coal Measures of Illinois, vegetable organisms of a class of plants, whose first appearance has been marked in the Triassic period. Though it may only effect their generic affinity, the presence of these bodies in the concretions of Mazon creek is the more remarkable that they are there associated, as in the Permian of Europe, with a quantity of animal remains, especially insects of large size, which have, as yet, not been discovered elsewhere in the Carboniferous formations.

There has been found in the Coal Measures of England and Nova Scotia, specimens of fossil wood, referable by their tissue, a compound of large woody cells or fibres, marked by vertical circular spots, to the Conifers or Pine family. It is remarkable that most of the fossil wood of our Devonian strata indicates the same characteristic form of cells, and that as yet, neither in Illinois nor in other parts of our true Coal Measures, no kind of branches, leaves, or petrified wood distinctly related to this order of vegetables, have ever been observed. The fragments described from a nodule of Mazon creek in vol. 2, p. 447, pl. xxxvii, fig. 3, of this Report, under the name of *Lycopodites asterophyllitæfolius*, resembles, indeed, a branch of some kind of Conifer, but it is as well comparable to some species of *Lycopodiaceæ*. We have also obtained from the lower strata of the Coal Measures of Illinois and of Pennsylvania, specimens of *Artisia transversa*, Sternb., a species whose affinity is still uncertain, it being considered by Dawson a Conifer, while most of the European palæontologists describe it with the *Lycopodiaceæ*. Our specimens are all transformed into sandstone, with no other part preserved but the mold, do not afford any light on this question. From this uncertainty as to the true affinity of these vegetable remains, and what is said above concerning other orders of fossil plants found in the Carboniferous strata, it would seem proper to conclude that the flora which has furnished the materials for the formation of our coal, and which covered the bogs of our continent at the Carboniferous epoch, was limited to a single group of vegetables, that of the acrogenous cryptogams. (1) The same

(1) Prof. Goppert considers the genus *Sigillaria* as rather related to a gymnosperm family. Its relation with the genus *Lepidodendron* is too evident to permit this conclusion; the cones and seeds of *Sigillaria* have moreover been found in our Coal Measures, of the same character as those described by Goldenberg.

remarks would seem also to authorize an affirmative answer to the often proposed questions:

1st. Does what we already know of the Coal Measures give us a just idea of the boggy vegetation of which the coal is a compound?

2d. Is the vegetation of the bogs of the coal a true representation of the whole flora of the epoch?

For though it is argued, with an appearance of right, that the whole flora of the Carboniferous time could not have been limited to that of the swamps, that a part of the land was high and dry, and as we have now, on our peat bogs, a peculiar group of plants appropriate to that kind of soil, and without analogy to the vegetation of our dry land, the same differences should have existed at the time of the formation of the coal. The contrary proposition, considered hypothetically, could be equally well sustained. From all appearances, the land, especially on our western coal fields, was, at the Carboniferous period, represented merely by a series of flat swamps, separated by lagoons, and therefore the whole vegetation of the land was essentially of the boggy kind. But, even if at this epoch there was any elevated land, the extreme atmospheric humidity should have forced upon it the same vegetation as that of the bogs, as it happens at our time in some parts of Ireland and Germany, where, under the influence of atmospheric humidity, peat bogs ascend on inclined slopes to the top of high mountains. Prof. Schimper says, in speaking of the ferns which constitute the essential vegetation of the coal formations: there is no other natural order of plants whose intensity of vegetation so much depends upon atmospheric humidity. Ferns are true natural hygrometers, whose individual as well as numerical development is always in direct proportion to the humidity of the climate wherein they live. Therefore, the land vegetation of the Carboniferous period must everywhere bear the same general character. A confirmation of this assertion seems also to be found in the fact, that even in the formations of great thickness of Nova Scotia, where trees are seen standing and imbedded at different altitudes, and where no coal is seen in connection with them, these trees are recognized as belonging to species, or at least to genera of the coal: *Sigillaria*, *Lepidodendron* and *Calamites*. But on the other hand, we have to account for the presence in the slate and sandstone overlying our coal strata, of various kinds of fruits or hard nuts, whose relation, for some of them at least, can not be traced to any species of the coal flora known by other kinds of remains: leaves, stems, etc. It is true that as fast as our acquaintance with this ancient vegetation becomes more intimate, some of these so-called fruits are recognized as peculiar vegetables of the coal, for example, some species of *Trigonocarpum* or *Carpolithes*, as tubercles of *Equisetaceæ*, or as vesicular appendages grown at the end of leaves of *Stigmaria*. But an explanation of this kind can not be admitted for nutlets, representing

Dictyophyton. Hall. See descriptions of the genus and species in sixteenth Annual Report of the University of the State of Newyork. appendix D. p. 84 etc.

Dictiophyton filitexile ?? Hall. Two specimens sent to me by Dr Gute of Buffalo from the Chemung of Newyork have characters which agree with most of the species described by Hall. They are the internal moulds of cylinders, one 21 centimeters long, two centimeters broad at its broken base, cylindrical but more or less flattened, more flattened in the middle where it is four centimeters broad and one and an half centimeters thick, still narrowing toward the broken upper end where it is 2½ cent broad and three to four mill. thick. Therefore spindle shaped. The other specimen is broader and shorter. Its base, three centimeters broad is flattened to one centimeter thickness. It is gradually enlarging upwards to its upper end, 13 centimeters from the base where it is broken and measures 5½ cent broad. and two and an half centimeters thick. It has also the spindle shaped form but is broken flat at the middle. The surface of both specimens is equally marked by a series of cross lines or narrow filiform striæ, irregular in thickness, the joint of each horizontal row being twice as broad and thick as the intermediate one and the same fourth in the vertical row presenting the same difference. Generally even in both horizontal and vertical lines the second or great row is more marked than the intermediate one and in that way we have a kind of checkboard like the following sketch. [redacted] The regularity is very great but not perfect, for there is sometimes in the horizontal rows more or less distance between the largest lines but it is however remarkable enough. This is the character of D. filitexile for Dr Hall remarks in its description: "that the striæ are sharp, linear, and in three "degrees of strength every fourth one being more deeply impressed or stronger "than the others, which the central intermediate one is stronger than the adjacent "two. – In the longitudinal direction, there is also a slight angularity or "greater prominence at regular interval of every eight striæ." For this and the cylindrical or spindle shaped form these specimens represent D. filitexile. But the broadest and shortest specimens is on one side evidently is marked by slightly prominent ribs or costæ at regular distances with the intervals flat or slightly concave just as Hall describes. I. Conradi While on the other side no trace of these ribs is marked. The form of the body is as in D. Conradi reversed pyramidal; for the half which is left for its broken in the middle and apparently spindle shaped like the other specimen. Hence we have in this one from the Chemung of Newyork, the characters of both D. filitexile & D. Conradi; I do not know then I have read that all these species of D. of Hall should be referred to the same. That may be the case. The one from specimens of Penn. reports however very different.

1. Dictyopteris Scheuchzeri, Hoffm. Two specimens. Ma 504 & 505 of Mansfield represent evidently this species. The first represents a single separate leaflet with a cordate-truncate unequilateral base, lanceolat gradually acuminat 3½ cent. long, nearly one cent. broad at the base with loose areolation in all similar to the enlarged figure C. of Pl. XXXII fig. 16 of Ruemer. Except that this leaflet is unequilateral at the base and somewhat less the shaped, it is like the fig. b. of Ruemer. The second is exactly similar fig. 1. only much smaller. It is the upper or terminal part of a pinna with three leaflets connected by decurrence of the upper part of the pedicel, ~~the leaflet being~~ or short pedicelled in their point of attachment to a common rachis, they are scarcely two and a half cent. long and five to six millimeters broad. Except the size, the identity of the species is perfectly distinct in all the characters. The areolation is still looser than in D. rubella.

an internal ovule or seed, covered with three different envelopes like those of *Trigonocarpum Nœggerathii*, of which a fine specimen from Mazon creek has been figured in this Report. They resemble fruit of palms, and have been referred by authors to species of *Cordaites* or *Nœggerathia*. Still less can it be proposed for winged seeds or fruits generally described under the generic name of *Cardiocarpus* and *Rhabdocarpus*. These fruits, whose place in the vegetable kingdom is still problematical to palæontologists, are far better known from American than from European specimens, and their analysis can, therefore, be pursued with chances of more satisfactory results. One of them is described and figured in its whole, in the Arks. Geol. Rept., vol. i, p. 311, pl. 4, fig. 4, as *Cardiocarpus ingens*, Lesqx. Another, still more remarkable, has been published by Dr. Newberry, in the Annals of Science, of Cleveland, May 1853, p. 152, N. 2, as *Cardiocarpus samaræformis*. A third has been obtained in good and numerous specimens from the shale overlaying the coal of Coshocton, Ohio, by Rev. H. Herzer. This peculiar fruit, *Ptilocarpus bicornutus*, Lesqx., (1) is composed of a small oval seed, pointed downwards, rounded or obtuse at the top, obscurely ribbed in the length, attached to the inside of an oval scale, elongated upwards, diverging at its base into two short horns and overlapping the seeds by its border. The seeds, though generally found connected to the winged scales, are easily detached from it, and indeed all the specimens which I have examined, show the seeds already half detached from the top downwards, and to prevent them becoming lost, I had to take them out of the specimens and preserve them separately. This connection of a small oval seed to one side of a winged scale, point out evidently the relation of this fruit and of others related to it, and mark their places as belonging, if not to true Conifers, at least to the Gymnosperm family. However peculiar they may be in their form, though different from seeds of the species of our time, it is scarcely possible to compare them to any other family of vegetables. As the seeds are generally found separate from their scale, a number of fruits of our Coal Measures are probably referable to the new genus, *Carpolithes multistriatus*, for example. For some of the numerous specimens from Colchester, Ill., bear evident remains of scales overlapping the seeds like a broad rim, more or less lacerated and partially destroyed, especially towards the point. And in the nodules of Mazon creek, where these seeds are preserved in their original form, they appear merely tumid in the middle, as compressed under a scale, and not cylindrical. *Rhabdocarpus clavatus* is, perhaps, also a seed of the same kind, as are evidently the species of *Cardiocarpus* published by Dr. Newberry, loc. cit., and many European species like *Rhabdocarpus mammillatus*, *Artis*, etc.

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(1) As the name indicates, this new genus *Ptilocarpus* is established for the special description of winged fruits having an affinity to those of the Conifers. Compare the fruit of Taxodium distichum in Heer Tert. flora Brit. pl. III fig. 19. Seed [illegible]

I have said above that the relation of these fruits can not be traced to any other kind of vegetable remains, leaves, branches or trunks of the Coal Measures, but there is, I think, a remarkable exception worth mentioning here. The shale overlying the coal of Cuyahoga Falls, Ohio, where *Ptilocarpus samaræformis* has been found with many others of the same genus, is, in some places, covered with a quantity of leaves of the peculiar *Whittleseya elegans*, Newb. These leaves, by their flabellate form, seem related to the genus *Salisburia*, while the nervation resembles that of a *Pterophyllum* or *Zamites*. I consider it very probable that some of the above mentioned winged fruits are related to these leaves, and that we have, therefore, two remarkable organs of species of the Conifer family.

It appears, therefore, that if the Acrogenous plants did constitute the essential part of the vegetation of the Carboniferous epoch, this vegetation had already representatives of the three essential classes of plants of our actual flora: the Phenogamous dicotyledonous, represented by Gymnosperms; the Phenogamous monocotyledonous, to which are referable species of *Cordaites*, *Nœggerathia* and *Trigonocarpum*, and the Cryptogamous, represented by the three families of *Equisetaceæ*, *Filices* and *Lycopodiaceæ*. And from all appearances, we have to admit the similarity of characters and uniformity of the entire flora of the Carboniferous period. For it does not appear that any of the species known from our Coal Measures have been transported from a distance, either by water or by the winds, and casually deposited in sands or clays of the coal swamps. The leaves and fruits are generally found in groups, a number of their remains being together, and covering a limited area, as if originating from trees or plants grown at the place around which these remains are spread, and, as it has been remarked above, all the species of fossil trees as yet examined from the sandstone, are referable to genera known from shale overlying the coal strata.

In pursuing the same mode of investigation, I have still to make some remarks on the affinity of our new species and genera of fossil plants from Illinois, in addition to what has already been said in the detailed description of each. As our table shows, by far the greatest number of our new species have been found in the concretions of Mazon creek, from which it is reasonable to infer that the preservation of many of these species is due to their mode of fossilization, and that the same kind of plants may have been constituents of the vegetation of the coal in other countries, though their remains have not as yet been found elsewhere. Of species of *Neuropteris*, for example, described and figured in the second volume of this Report: *Neuropteris Evenii*, *N. pachyderma* and *N. verbenæfolia*, all from Mazon creek, have been omitted by Schimper in his enumeration; and yet, though the two first have not been elsewhere discovered, their preservation is so remarkable, and their distinctive characters so

Oligocarpia gutbieri Lesq. pg. 4 Plates fig. 1. The general description of the species Fab. Veg. is right and sufficient also for the species. It varies however for the form of the pinnules or lobes and for the nervation. The pinnules are generally like those of fig. 1. more deeply cut however. Sometimes as in specimen S. 56 the pinnules are longer, cut to near the base or even disjointed and separated at the base, longer and comparatively narrower, oblong obtuse. The midrib vein of the pinnule is undulate, the lowest lateral veins forks once sometimes twice as marked in my enlarged figure; those above only once, none being simple. Sometimes the two lowest veins forks twice, but it is very rare. I have not as yet seen specimens of fructification of this species in American specimens. Geinitz' fig. 4 Pl XXXIII. figs. 6 - 8 are good.

Oligocarpia querifolia. Stur. I refer to this species with some doubt however a large specimen of ~~the~~ P.T. Coy No 17 from the Wet Stone of Indiana. The pinna is a very large one, its rachis is not seen upon the specimen which has however 5 parallel secondary pinnae from 20 to 27 cent. long. The rachis of the pinnae is rigid, 2 mill thick canaliculate, with short irregular striae, no trace of punctuation. Tertiary pinnae parallel equidistant (1 to 2 cent), turned or inclined upwards (60°) rigid with a broad rachis (channeled like the secondary) rigid, terminal, ~~pinnately~~ alternate the basilar ones 4 cent long gradually decreasing to the top where they pass to pinnules, hence these secondary pinnae are exactly lancedat. Pinnules in an open angle of divergence close, 9 pairs in 2 inches 2 cent long, the lower ones 8 mill in long gradually decreasing so that the tertiary pinnae have the same form as the secondary ones, decurrent (that is at the base which pass under the ~~and~~ ~~lob~~ upper lobe of the inferior pinnule) the lower ~~decurrent~~ pinnately divided in 4 rarely 5 pairs of lobes cut to near the thick midrib obscurely three toothed, obtuse or half round as see with the naked eyes with strong ~~ner~~ very distinct veins forking twice ~~generally~~ at the base & generally once. The species is allied to Sphenopteris Hoenninghausii greatly differing by the rigid pinnae, short tertiary pinnae, pinnules cut merely at the top ~~the~~ but joined to near the midrib along the line of division ~~by~~ the nervation and the scarcely dentate lobes. The rachis is perfectly smooth the surface of the lobes nearly flat and the veins perfectly distinct.

Macrostachys.

1 Macrostachya infundibuliformis Schp. I have copied the remains part of a trunk from Mo. 202 The figure is exact somewhat obscure and corresponds to the description of Schp. Pal. végét. 1. p. 333 especially to his figure in atlas. Pl. XXIII f. 15. 16. 17. The ears are very abundant in the carnel shale of Cannelton. This fragment of stem is the only one which I have not seen. Though the description may be exact, it does not account for the two rows of large round scars. One very large the other smaller all circular which seem to be the base of two kind of ears in rows. There are indeed two size of ears in the specimens of Cannelton. They should be copied. Some of these ears are somewhat curved, others quite right -- Schimpers speaks of leaves attached around the stem, joined together and forming sheathes. whose base or remnants of the base are attached. upon the borders of the articulation. In one specimen the borders do not bear any trace of remnants of leaves a sheath and an inch, covered like the whole of the specimen by a thin coaly or layer of coaly matter on the side where this surface coaly is destroyed the stria are slightly more distinct but not as much as marked upon the figure. Indeed the stria do not alternat at the joint but rather seem continuous. Schimper considers the broad scars as scars of branches. They bear at the bottom a round mamilla and from the bottom to the borders rays diverging star like the, mostly obsolete or indistinct. They are exactly figured. Branches of Calamites ramous or nodous, see my figure have their branch scars with rows of diverging rays which have some relation to those of the figure. The small scars might represent the point of attachment of the ears - but they seem too close for the size of the ears. ~~See~~ See a fine small branch. Ma-465.

2. Macrostachis species? mention here this species from this Rep. p 427 & 5. (not figured) See also 419 b 1.

well marked, that their specific value is beyond question. The case is still more evident with *Neuropteris verbenæfolia*, with which we now have a more intimate acquaintance, from the discovery of a number of specimens, all found at Mazon creek. I mention only these species, not merely as a kind of vindication in favor of our American discoveries, but in order to secure points of comparison in considering the geographical distribution of the plants of the Carboniferous epoch.

No more evident proof of the truth of what is said above could be afforded, than the discovery in the nodules of Mazon creek of numerous specimens of organs, which have as yet scarcely been found elsewhere. The fructification of ferns and their rhizomas, are of this kind. Besides two of the species described in the genus *Staphylopteris*, we have, in nodules from this locality, seven fruiting species of *Alethopteris*, six of *Pecopteris*, with one *Asterocarpus*, most of which were as before unknown in fructifications. And if the fossil fruit-dots of ferns were not generally obscured, and their form and position indistinct, discernible only, as they are, through the substance of the leaves, we should have had for description a far larger number of fruiting specimens of ferns. When Prof. Brongniart published his justly celebrated Fossil Flora (1848), only three species of ferns, *Pecopteris cyathea*, *P. hemiteloides* and *P. Miltoni*, were known and described, with fruiting branches. No fruiting racemes, like those of a *Staphylopteris*, had then, nor have been found even now, after forty years of further researches in the Coal Measures of Europe.

Considering this peculiar scarcity of fruiting ferns, Schimper comes to the conclusion that, as arborescent ferns of our time are rarely fertile, the species of this genus, in the Carboniferous epoch, were mostly fern trees. I should be inclined to admit the same conclusion, especially in considering the number of trunks of ferns, *Caulopteris*, found in the Coal Measures of Illinois, if the coal flora represented in the concretions did not indicate a proportion of fruiting branches nearly as marked as it would be in collecting ferns of our time in a given area.

It is peculiar that, though evidently belonging to herbaceous species of fern, there has not as yet been found any fructification of the genus *Neuropteris*. Leaves of *Neuropteris hirsuta* are the most abundant and the best preserved of all the remains of fossil plants in the nodules of Mazon creek, and yet neither here, nor anywhere else in our Coal Measures, has anything been discovered which might be considered, beyond a doubt, as its fructification. For the intumescence of veins or veinlets, often remarked on the surface of the leaflets of this and other species of *Neuropteris*, and doubtfully considered as produced by groups of fructification placed underneath, seems rather to be the result of some casualty of maceration of the leaves. A mode of fructification of this kind does not agree with that of ferns, ~~and is~~ rather comparable to the *Osmundaceæ*

of our time, which bear their fructifications either as separate racemes or on peculiar divisions of their fronds. The fructifications of species of the genus *Odontopteris*, so closely related to *Neuropteris*, are known for *Odontopteris Schlotheimii* and *O. Reichiana*, Gutb. The fertile pinnæ, not yet found in connection with sterile fronds, bear inflated, round leaflets resembling small bladders, which have no relation whatever to the intumescence of veins considered as the fructification of *Neuropteris*.

Still more than their fructification, the rhizomas of ferns have hitherto been unknown to palæontologists, at least from the Coal Measures. Prof. Goppert has given, in his Foss. Farnkreuter, p. 91, tab. 33, fig. 1, the only fragment which as yet has been published by European authors, as evidently belonging to true rhizomas of the coal. In his Pal. Veg., Prof. Schimper has published, under the name of *Rhizomopteris*, two fragments of plants, *Selaginites Erdmanni*, Gein., and *Selaginites uncinnatus*, Lesqx., which, from the spiral development of their branches, their ramifications and their scales, he considers as representing small rhizoma of ferns rather than *Lycopodiaceæ*. I cannot agree, on this subject, with my celebrated friend. The plant published as *Selaginites uncinnatus*, Lesqx., vol. ii, p. 446, pl. 41, of this Report, is too slender, and has too slender divisions to represent a rhizoma, even of a climbing fern. Its slender branches, rather pinnately placed, are not more curved in spiral than they may be in some of our species of *Lycopodium*, and the divisions are evidently pinnate, like leaflets, and not scattered like hairs. The plant named *Lycopodites Erdmanni*, by Geinitz, and which, as Prof. Schimper remarks, is different from *L. Erdmanni* of Germ., has, like our *Selaginites crassus*, the ramification and appearance of a *Lycopodium*, but from the examination of peculiar specimens of the same species, seen by the author, it seems to belong to a rhizoma. Even admitting that these two species represent climbing or ærial rhizomas, this small proportion of organs of this kind, compared with the numerous species of ferns known from the Coal Measures of Europe, would be unexplainable, but for our American species. For the concretions of Mazon creek, and only these from the whole extent of our Coal Measures, have furnished us numerous specimens of eight species of these organs, some of them referable to subterraneous rhizomas. It is, therefore, apparent that the organs of the ferns of the Carboniferous epoch were the same, and in the same proportion, as those of our time, but, that some of these, like rhizomas and fruit-bearing fronds, have been more generally destroyed in the shale on account of their soft texture.

The inflated subcylindrical base of a species of *Annularia* and of a *Lepidodendron* are also two remarkable characters, not recognized as yet in the same kind of plants of the Coal Measures, and which we owe still to the peculiar preservation of vegetable remains in the concretions of Illinois. Species of the genus *Annularia* may have been represented in the swamps of the Carboniferous period by two kinds of leaves, according to their growth, either in water

Calamodendron ! (Calamites approximates ??). I have a very fine small specimen from Mansfeld, No. 361. which represents a species of the genus as described by Dawson (mem on Calamodendron and Calamites and by Grand Eury. It is a branch 9 cents long with an internal cylinder of 16 millim. thick, a broad enlarged at the base 15 millim. with 15 articulations at unequal distances, four to nine millim. distant. The stem slightly contracted above the base is enlarged at the 6th articulation, then again contracted to the 10th art. and then again enlarged. It is thus more or less distinctly strangled at divers points. The articulations are deeply and distinctly marked. With some small scars of branches, the surface between the articulations is distinctly but somewhat irregularly striate, the striæ being either very thin intermixed with some stronger ones or more equal but not continuous across the articulations where they are modified in size and distance; they do not bear any trace of appendages or verticillaster at their base. The principal striæ about one millim. distance are intermixed in the intervals by very thin lines two or three between each, irregular, disconnected sometimes distinct, sometimes absent. — The internal cylinder which has the facies and appearance of a small branch of Calamites approximates is bordered or surrounded, for the borders appear flattened to a by a cross section by an amorphous, apparently woody band varied in thickness from three and a half to 6 millimeters; the surface is flat, smooth or amorphe only marked across by irregular heights perceptible. wrinkles the more distinct corresponding to the articulations and in the same direction. This fine specimen should be figured. See Grand Eury on Calamodendron. There is not any coincidence in the conclusions of authors on their nature. Grand Eury does not mention any where Calamites approximates. I believe however from what I have seen from specimens that this is a species of Calamites which the part described here is Calamodendron. No Calamites approximates shows any such irregularity on their stem.

or out of it, like some of our actual water plants which have for their sustenance in water peculiar organs, sometimes a mere swelling of their petioles, as in *Trapa natans* for example, which disappear on the emerged parts. A like lubulose, bladdery form characterizes the leaves of the species of *Stigmaria*, whose long stems were sustained by these floating organs, and we could therefore easily admit a dimorphism of the leaves of plants which, like *Annularia*, evidently lived partially in water. But the cylindrical form of the leaves of a *Lepidodendron*, like those of *L. rigens*, cannot be explained in the same manner. These leaves are evidently aerial organs, and by their form expose a new characteristic not yet surmised in species of this genus, though it was already obscurely marked by the position of the vascular lines seen in a different relation, according to the plane in which their leaves have been flattened in shale.

The shales of Morris and Colchester have remains of small branches of a *Lepidodendron*, referable to *L. elegans* or *L. gracile*, Brgt? one to two inches thick, mostly dividing perpendicularly to their axis, bearing short flat leaves, and so abundant that they fill the shale to the thickness of one foot or more, extending and covering a large space. These remains, scarcely varying in thickness, do not look as though pertaining to erect stems, but rather appear like creeping branches, extending all around, like those of some of our species of *Lycopodiaceæ*. The roots of *Lepidodendra* are unknown as yet, and I believe that some species of this genus, heretofore considered as branches of trees, are mere creeping stems, which, in some circumstances, only bear flowering stems, or true *Lepidodendra*. It is the same with the genus *Sigillaria*, the species of which I consider as fruiting stems of *Stigmaria*. It is easily conceivable that large trees, like those of *Lepidodendron* and *Sigillaria*, could not be sustained upon the soft surface of the swamps of the Coal period, without a peculiar kind of support; and this solidifying process of the surface could only be afforded by a vegetation like that of floating or creeping stems of the same kind of plants. Some *Lycopodes* of our time, when growing in swamps, *Lycopodium inundatum* and *L. clavatum* for example, cover the soft ground with their interlaced creeping branches, bearing their rare flowering stems here and there, out of the reach and influence of water. Many aquatic plants of our time also multiply their stems, extending them in every direction by constant division, and fill large basins, even small lakes, never bearing any flowering stem until they have formed, by compact netting, a kind of support strong enough to sustain them out of water for fertilization. This is the case especially with some species of our mosses, *Hypnum Lycopodioides*, *H. fluitans*, *Sphagna*, etc. Some of our species of *Utricularia* have two very distinct modes of vegetation. *U. intermedia*, for example, has, in water, its stems infinitely expanded and divided, sustained as they are by their utricles, while in sand the same species has a simple stem dividing at the base into three

branches, true roots which still lower bear a few thread-like filaments, without trace of leaves or utricles. I have compared this kind of vegetation to that of *Sigillaria* of the Coal Measures, merely, of course, for the mode of development.* Remains of *Stigmaria* fill whole banks of fire clay of our Coal Measures, to a thickness of from six to fifty feet, and no remains of *Sigillaria* have never been found in this clay in connection with them. Prof. Schimper mentions an analogous circumstance from his observation on the Vosges sandstone (*Grauwacke Vosgienne*), whose entire strata are also filled with remains of *Stigmaria*, and where no *Sigillaria* is ever found.† Roots cannot live by themselves, independent of any other kind of organs, and it is certainly impossible to explain the mode of vegetation, the form, the nature of the Stigmaria and its action, in considering it as a root. But admitting these plants to be the floating stems of species of Sigillaria to which they have been sometimes seen attached, their peculiar nature and mode of vegetation becomes explainable, and in circumstances where they are found in the Coal Measures, they are in perfect harmony with the general vegetation of that epoch, as well as with the end which they were called to achieve. As is the case especially with our floating mosses, these floating stems of the Carboniferous epoch have the characters blended in a kind of uniformity which renders them scarcely recognizable. All the *Stigmaria* bear the same kind of cylindrical, bladdery leaves, and therefore have all, though belonging to different species, the same kind of cicatrices upon their stems, viz., a circular, double ring, with a single vascular scar in the center. This peculiarity has been heretofore a problem to palæontologists. Binney has seen *Stigmaria ficoides* as the roots of *Sigillaria reniformis*, Rich. Brown has seen the same *Stigmaria* as the roots of *Sigillaria alternans*. Prof. Goeppert has obtained a splendid specimen of *Sigillaria elongata*, with *Stigmaria* as its roots, and Prof. Schimper has the same *Stigmaria* at the base of a fourth species of *Sigillaria*, and the fossil trees procured by Dr. D. D. Owen, should be quoted still as a fifth species, *S. Owenii*, Lesqx., bearing *Stigmaria* as its basilar appendages. This *Sigillaria* to which I have already alluded, has its mould preserved in perfect integrity with the scars of the stems, those of its base and those of the divisions called roots, fully discernible. The cicatrices of the stem have no affinity with those of any other species of *Sigillaria* hitherto known. They are double, horizontally distant from each other one and one-fourth inches, vertically three-fourths of an inch, formed of two transversly oval scars, close to each other, joined at the corners by a deep line, thus resembling in miniature a pair of spectacles. The small oval scars are about one-eighth of an inch across in their broadest diameter, deeply marked into the

*W. P. Schimper, Terrain de transition des Vosges, p. 324.

†Prof. Goppert, in his Permain, compares it to that of the Prothalliun of the mosses. There is a mere analogy of division of the branches; nothing more.

from 479 a.
Dicranophyllum ? Cordaites ? Ma. 321. A small branch. 1½ cent. broad, flattened and by compression, apparently marked by articulation where it branches in the middle and at the top. The branch is half as thick as the main one 5 cent long bearing at its top one half whorl of branches or branch seems attached to the point. The main branch also about 5 cent long from the point where it divides and one cent thick bears at this a fascicle of leaves, or fascicled branches which seems to be in a whorl. That may be a subdivision or fostering of the stem together with leaves coming out of the same place. The leaves 12 millim broad or very distinctly veined. Primary veins very distinct, three in one millimeter with 2 to 4 secondary veins between them. The stem and branches are obscurely strict certain in the length. also obscurely marked across by circular lands with thin of cortex and covered with a thin bark of coaly matter opaque not strict or lined. See rectification p. 536 (14)

2 Cordaites N. 2 A naked branch or without leaves Ma. 2. bearing flowers, has been described already p. 420 c 1.

3. Cordaites mansfeldi ? Ma. 148 fig. 3 Stem or branch about 23 cent long three cent. broad at the base, flattened. base bent gradually thinning to the top which is conical and covered with a fascicle of leaves; bases attached all around the stem, small by a slightly narrowed rhombic base as figured (see p. 428 b. 3; the fifteen millim broad exactly linear, very long, 30 centimeters, obtuse or truncate at the top as far as can be seen from the two only leaves preserved in their whole length. perfect or very acute apex of divergence from the branch point of attachment on the stem marked by oblong inflated scars, newly 16–18 in one centimeter; secondary veins three to five intermediate to the primary veins surface more or less evidently wrinkled across. See below 3a. see note p. 535 (6) with C. Conley.

4. ~~Dicranophyllum~~ ~~Cordaites~~ Spec. Ma. 370 seem referable to this form described p. 479 a 3 from Me 258. It represents a ribbed branch 1 3/4 cent thick, but flattened, 17 cent long articulated in the middle and then curved to one side with apparently bundles of leaves coming out of from the articulations or from below it. The points of union of the leaves to the stems are not clear. These leaves are very long and narrow, a little broader than two millimeters marked by a prominent midrib. The stems bear the appearance and character of a stem, a surface ribbed in the length, ribs or striae flat, 3 millim broad, undistinct and under the covering bark of coaly matter. Transverse ribs are marked, about of the same breadth.

3a. Cordaites Mansfeldi. as above 3. Specimen Me 300 a represents this species in a branch 22 cent. long, with surface marked like that of the former by a cross wise wrinkle coaly bark and under it somewhat smooth or absolutely strict surface, this distantly wrinkled cross wise and with distant and distinct scars of leaves. Like those of Poa Cordaites linearis Grand'Eury to which this species seems closely related if not allied. It bears also short branches of imbricated leaves, lanceolate acute as Cordaites communis p. 499 c 3, which come out from the branches, not from the axils of the leaves and leave a round depressed scar. 300 D has a fine branch of this kind with the leaves closely imbricated at the base from 1½ to 3 cent long 4 millim broad at the base exactly lanceolate and sharply pointed (specimen should be figured) (see p. 537 (15)

4986.

Distribution der Cordaites

§1. Leaves enlarged or expanded at the base, semi amplexicaules, surface very narrowly and obscurely striate. Represented by ~~[illegible]~~ N. 1 & N. 2 in 499 c. see plate & map bar
See Leaves enlarged of leaves in Spa. p. 205. My figure 90 b of pl. 27 bis. shows the base of this leaf slightly narrowed. that of this amplexicaule Fig 2 shows it large and amplexicaules. There is comparatively to the size of the leaves very little difference between this 90 b and that of the following section. p. 499 c. 2.

§2 Broad leaves narrowed to the base distinctly nerved lengthwise with 3 genus of the Oranifolia
Cordianthus gemmifer. Cordaites communis, ~~Cordaites pachyderm~~ Oranifolia.

§3 Narrower leaves distantly placed upon the branches with more or less distinct scars of bases. Leaves longer distinctly nerved. flowers in racemes.
Cordianthus gemmifer etc. In the Lecho (N. 498 a 478 c. 537 (4)) there are distinct species
Cordaites angustifolia, 420 a C. Mansfeldi, C. glacialis or brunsvicensis p. 360 (4)

§4 Leaves not pedicelled, pedicel inflected at the point of union narrowed downward forming irregular short wedges upon the stem. Leaves of the same character in the former division. — Cordaites Costatus.

§5 Cordaites? leaves crowded narrow, very long, without distinct nervation, decurrent at the base, more or less diverging from the stem. Stem thick covered with the coal, bark formed by the imbricated bases of the decurrent leaves.
Cordaites deflexus? p. 534 (4). C. decurrens p. 534 (5) Cordaites contentus. p. 535 (6).

§6 Dicranophyllum Grand Eury. Leaves very narrow striated by the veins or nerved dividing in filaments at the top. p. 535. 7. – p. 536, 14.
Justa sedis.

§7 Leaves either distant and simply attached to a narrow stem, or united in fascicles, three or more on one side of an articulation of the stem.
Cordaites fasciculatus p. 479 c (3) p. 538 (8)

§8 Leaves ~~diverging~~ branching in anomalous ~~bases~~ divisions. – Cordaites anomali p. 5.

§9. Leaves widely enlarging upwards like Nuggerathia.
Cordaites grandifolia p. 478 a. 538 (9).

§10. Cordianthus species p. 536 (11 & 12)

Remarks on Cordaites with Cylindrical leaves p. 586 (13).

1 Cordaites boramifolius Mss. Sates factorily described. p. 360. 6. from Cambridge specimen 461-1 from Ma 90. – p. 478 b. from Ma 90 and another with racem. of flower figured. Ma 90 not figured represent being leaf same as fig. 5. of another p. 90. face 17 millim. wood not 13 as marked p. 478 b. 1. the basilar curve descending a little more on one side or on the other with an inflated or intumescent bride around. The characters are the same as those given in Grand Eury p. 216 for Cordaites boramifolius. The veins which are a little more distant in the middle seem formed by two one of which thicker are toward the borders closer and equal. Fig 4 of my plate does not seem to be referable to this species on account of its large base. is on the same slab as fig 1 with flowers — This poorly described p. 420 a. 2420 b. On the 2. stem bearing flowers? fig 1 of my plat remark that the scale figured exactly are thick, forming a button like mamelle. The branchlets are comparatively thick 1½ to 2 millim. thick as seen in the figure. Some are half decomposed by maceration and flattening at the end or from the middle upward divided in their filaments or pleiform lacinia like the dissection of Dicranophyllum in Grand Eury. The scars are too distinctly and regularly marked in the figure. The point of attachement of the branchlets as seen in round depressions more or less irregular a single one left upon the bark in a which about 1 millim. thick represented enlarged in a. the outside part being a deep indentation and the inside marked black a mamelle projecting a little above the surface of the wood. The leaf aside fig 4 which seems the base attached to a branch and seems embracing it is far different from Cordaites Boramifolius. I have large specimens of it. It is the following.

2 Cordaites ~~[illegible]~~ Lee Grand Eury p. 216. – Spec. Ma reverse of 305. – 2. Nogg. The fragment figured and 208. This species has very large leaves. Part of one transp. on Ma 305 is 40 cent. long 5 cent broad, perfectly linear with the base embracing rather enlarged than narrowed. Another leaf on the same specimen 305 shows the base cut flat or in right angle to the leaf with the point of attachement marked by inflation of the base. viz. alternate inflations and depressions showing point of attachement. This part of leaf should be figured also though fig 4 shows well enough the mode of attachement semi amplexicaule of the leaves. They are thick quite one millim as seen in a fragment detached. the upper part very minutely obscurely striate, the veins being immersed into the epidermis 7-8 per millim; the lower part more distinct veins obtuse ~~but [illegible]~~ 4-5 per millimeters. The stem part of which is on Ma 208 is more coarsely and irregularly striate 6 to 7 cent broad, the stria irregular in size and here and there inflating or thinning so that with the eyes the veins or stria do not appear continuous. They are sometimes two sometimes three in one millimeter even one millimeter apart. The bark is a thick layer of coal 1 millimeter or more with the surface marked like that of the cylinder of wood under it, for the stem is flat or flattened and appears little perfaceous. This branch shows the point of attach of a leaf seven cent broad somewhat cordate. The other branch figured the above part of leaves Ma. 208. & reverse of 305. The other branch that which is already figured is somewhat smaller, size of the plat, the branch apparently hard, the coaly surface also thick very much shining without trace of stria.

3 Cordaites tomnuinus (? change name if needed). Spec. from Britt No 143. 221. Leaves long not as large as in (1) of this page. the part preserved is 143 22 cent long 37 millim. broad at the broken top. gradually narrowed to the base where it

15 millimeters just above the rounded point of attachement ⌣ recurved on the
borders flat somewhat thick, distinctly veined. The upper surface has the veins
less distinct with a thick epidermis distinctly cross wrinkled. The primary nerve
16–18 per cent in the middle of the leaves, rounded and less distinct at the upper surface
sharply keeled on the reverse ~~[illegible]~~ with ~~three~~ two to four intermediate
secondary veins. N. 221. ~~[illegible]~~ has the leaves attached by a branch showing
distinct scars of leaves ⬭ and bearing apparently in the axils of the leaves
unfolding buds of short small lanceolate imbricated leaves. two to two and
an half centimeters long about half a centimeter at the base with ~~[illegible]~~
small cones (one only is distinct) with imbricated scales, Cordianthus gemmifer
baccifer, Grand Eury same as the one described and figured here as Schutzia
bracteata Ow but without bracteas. The species may be one of the common
of the coal as represented by fragments of leaves, any how it is not the same
as Mayo described above which has the primary nerve twice as close. The
cicatrix base of the stem is somewhat thick about twice as thick as in the stems
described here.

4. Cordaites mansfieldii. Ma 148. See description p. 493 c. 3. It is correct. The nervation
is about as in the former species from which it differs by narrower leaves equally and by more
numerous thinner intermediate veinlets. This represents the Poa Cordaites of Grand Eury.

5. Cordaites ~~[illegible]~~ divergens, sp. nov. Specimen Di. 4 see description p. 420 c. 1. Differs
from the former by the reflexed leaves, the primary veins ~~much~~ closer, the intermediate
one less distinct. The leaves as far as can be seen from the fragment
are shorter. The relation is however very close. Remark that in my figure
the base of the leaves is too small. The scars however are very proteberant upon the
branch, taking about the whole diameter ⬭ obliquely in that way. But the
base of one leaf very distinct is exactly ⬭ like this. It is about the same in
N. 64 but the scars are much less distinctly marked.

6. Cordaites pachydermus sp. nov. Specimen from Boitts, Clinton N. 64, two of
them on 64 a representing a stem or branch a little more than 3 cent broad covered
with a thick irregularly distinctly striate bark (in coal) and also distinctly wrinkled and
marked by distant, large oval scars of leaves ⬭ nearly as broad as in
Cordaites communis and under the bark or decorticated a surface equally
distinctly irregularly striat in the length and deeply wrinkled across with
scars of the same form as upon the bark. The other specimen 64 bears
some narrow leaves, not quite 1 cent broad, scarcely narrowed at the point of attach-
ment with primary veins distinct and close 4 in one millim. or even 5 with one or two
obscure intermediate veinlets and a rough bark like the other specimen. This
stem has only one leaf but a number of branch bearing Cordianthus or flowers
like those of C. baccifer of Grand Eury. The outlets appear oval and some of
them at least are underlaid by a bracte. The racemes are simple the flowers or
outlets distant. Should be figured in parts. This species is evidently
distinct from the former. C. conspicuus in 2 C. Mansfieldii by the narrower
leaves, the close veins very irregular in size and distance, the intermediate
veinlets obsolete. The cross wrinkles are also obsolete though visible. The bark
is totally different being thick and striat like the stem under it. A detached
fragment of the specimen 64 (see it at the corner) shows a scar of those
fruits. They are true C. gemmifer like the one with C. communis
with larger scal than any of those described and figured by Grand Eury.
The lower part of the specimen should be figured as attached to the
stem a detached branch is figured Pl. ~~XVIII~~ 81. fig. 2.

Sup. 534.

stone, formed of an outer ring with crenulate borders, and a comparatively large oval or elongated vascular scar in the middle. The double scars evidently represent the point of attachment of single leaves, which, if they had any analogy of form to that of their base, should have been one-third of an inch broad, with round sub-cylindrical borders, and a broad, flat, medial line. The surface of the trunks is regularly and finely wrinkled in the length: the scars transversely and still more finely so. The cicatrices, in descending towards the base of the tree, gradually change their form. They first become united into one, forming a deep triangular depression, with a single oval scar at the bottom, and further down in reaching the divisions representing their roots, they become round, with a central vascular point, exactly like those of *Stigmaria ficoides*, though a little smaller. The divisions of the stem, at first inclined downwards, become nearly horizontal at the broken extremities, distant twelve inches from the base of the stem. The largest and best preserved of these trunks is, near its base, four to five ~~inches~~ in circumference, dividing there in feet nine cylindrical branches, the largest ones seven to nine inches in diameter, merely forked near the broken end, which is two to three inches in diameter. The smallest ones, five inches across, are simple. These divisions, though marked with stigmaroid scars, appear indeed like roots, but it is evident that species of *Sigillaria* have sometimes grown in sand, and I believe that, under such circumstances, their subterranean divisions have somewhat modified their form, and hence they become similar to roots, as do the stems of *Utricularia* when they grow in sand. It is to this kind of organs or roots of *Sigillaria*, that the fragments described in this report are referable, under the generic name of *Sigillarioides*.*

From what is said of the relation of *Stigmaria* with *Sigillaria*, it is evident that though the forms of *Stigmaria* are much alike, and generally as yet referred to one species, viz., *S. ficoides*, Brgt., we have indeed as many species of *Stigmaria* as of *Sigillaria*. In his Permian, Prof. Goppert still describes *Stigmaria ficoides* with eleven varieties. I cannot see why differences, though difficult to appreciate, should be considered as specific for one genus and as a mere variation for the other. But botanical palæontology is a peculiar science. It offers to its adepts mere fragments of organs, whose relation to a whole is mostly unknown, forcing him either to generalize, and to consider in one species a number of organs which evidently pertain to plants of various kinds, or to specify and to divide under divers genera and species, fragments which, if not evidently, at least often apparently, belong to the same vegetable. It is not surprising that opinions concerning these remains are often at variance and often modified, or that the student of these fossil remains becomes discouraged

*I have never had an opportunity of publishing descriptions with plates of these remarkable trees. It may be done hereafter in the report of the Indiana Geological Survey.

by the sterility of his researches. And yet it is to vegetable palæontology mainly that we owe our acquaintance with the surface of our earth at the various epochs. From it we learn the character of the various changes which have modified this surface, and the admirable harmony of all the phenomena produced in its successive modifications. This branch of science has therefore a fascinating attraction, as it opens to our view the treasures of a vegetation that no human eye has ever seen or can expect to see, except in their fossilized fragments, and it shows us that all the divers epochs have been constantly working to the same end: the preparation of a home for the human race; and this work has been constantly pursued in admirable harmony under the direction of a Supreme Intelligence.

§ 6. ON THE STRATIGRAPHICAL AND GEOGRAPHICAL DISTRIBUTION OF THE FOSSIL PLANTS OF THE COAL MEASURES.

European palæontologists, who have especially studied the fossil plants of the Carboniferous strata, Brongniart, Goppert, Schimper, Geinitz, etc., have admitted that the distribution of these plants is modified according to the age of each bed of coal, and that, therefore, the horizontal position of the coal strata may be recognized by species peculiar to each. These views, as it now appears, (1) have been advanced on theoretical ground, or are based on local observations which cannot be considered as furnishing conclusive proofs; for local modifications in the succession of species of plants may be the result of mere local atmospherical, or geographical changes, which do not affect the characters of the whole flora, and therefore the comparative distribution of the fossil species of plants of an epoch can not be ascertained, but from the examination of this flora over the whole extent of its domain. A question of this kind can certainly be examined in our country with better chances of a definitive solution, than in any other part of the world, for our coal fields are of vast extent, the disturbances of stratification are rare or uniform, easily recognized by geologists, and the identification of the coal strata is ascertained at different localities from stratigraphical evidence.

From the beginning of my researches, in 1850, on the fossil flora of our Coal Measures, they have been pursued especially in view of obtaining positive data, marking changes in the vegetable constituents of each coal bed, according to its age, and therefore of recognizing species of plants peculiar to each (leading species), which would serve for their identification. As my views on the sub-

(1) From the authority of Prof. Brongniart, in letters, 1869.

ject have been published at different times, with the modifications induced by the progress of the researches, a summary of what is positively ascertained as yet on the stratigraphical distribution of the vegetation of the Coal Measures is not out of place in this Report. (1)

When researches are restricted to a limited area, or to basins of small extent, marked differences are recognizable in the species of vegetable remains in the shales, as well as in the essential vegetable components of each bed of coal. It is, then, an easy task to ascertain the relative position of the coal strata from the comparison of these remains. But when researches are extended over a wider area, changes of vegetation, evidently caused by geographical distribution, become more and more appreciable, some of the predominant species of a recognized horizon disappearing at some localities, and giving place to others of different characters. A glance at our table of distribution puts this in full evidence. The coal beds of Morris, Colchester and Murphysborough, the two first on the northeastern and northwestern, the last on the southwestern borders of the coal field of Illinois, are recognized, from all evidence, as representing coal No. 2, of the Illinois section, (in vol. 3, p. 6, of this Report) the equivalent of coal 1 B, of the Kentucky Report. (2)

Though the general character of the flora may be considered as the same, we find, by comparison of the species at Murphysborough, eight peculiar species; five only in common with Colchester and Morris, and twelve in common with Morris only, or altogether, eight species proper, and seventeen in common with strata of the same horizon examined elsewhere in Illinois. Colchester and Morris have been more carefully searched for specimens and are nearer to each other. They have seventeen species in common, while Colchester has nine species not yet found at Morris, and Morris has forty-four species, without counting those of Mazon creek, which, as yet, have not been seen at Colchester. The coal of Duquoin, considered as No. 5, of the Illinois section, and the only one from which as yet we have in Illinois and from a higher horizon a number of fossil plants which can be used for comparison, has eleven species proper, and seventeen in common with some or all of the other named localities. Points of difference and identity are therefore as well marked for this bed of coal as if it belonged to the same horizon as the others, and the same differences are observable in the distribution of common or more predominant species. For example, *Neuropteris flexuosa* is most abundant at Murphysborough, and has not as yet been found at Colchester and Morris, where *Pecopteris villosa* and *Callipteris Sullivantii* are the predominant species; and these are but rarely found, or not at all, at Murphysborough. On the

(1) See, on this subject especially, Penna. Geol. Rept., p. 837; Amer. Jour. of Sci. and Art, Nov. 1860.

(2) All these strata are here marked according to the Illinois section.

contrary, *Pecopteris unita* and *Pecopteris plumosa* are common at Duquoin and Morris, especially in the nodules of Mazon creek, and rare, or not recognized as yet at Colchester and Murphysborough.

From the examination of the table, one may easily see other points of difference between the species found at the same station, or of analogy between those of different horizons. Nevertheless, I am not, on this account, prepared to abandon, as an unsustainable hypothesis, the question of the stratigraphical distribution of the fossil plants of the coal, for the following reasons:

1st. In a theoretical point of view, it is scarcely admissible that at an epoch where the land surface has been universally, and at repeated times, modified by deposits, either of sand or of limestone, sometimes of great thickness, indicating a prolonged submersion, the flora, re-appearing after these terms of subsidence, has always been represented by the same species distributed in the same proportion. Atmospherical circumstances, indeed, are the essential agents in modifying the characters of a flora, and these circumstances have been apparently the same during the whole duration of the Carboniferous epoch. But the elements or components of the soil, or of the water where the plants have lived, have been evidently modified at different times, and even if the medium affording life to the vegetation had been repeatedly the same, some species of plants should have been lost or have somewhat changed their forms in these repeated and prolonged submersions of the whole surface of the coal fields. The destruction, or the first appearance of a species, either animal or vegetable, is the most difficult phenomenon to ascertain. Animal species, for example, seem to appear at once, and of far different kinds, in successive geological strata. But these strata are either composed of different materials, or have been formed in water of various depths, and under other varied circumstances. The changes of life, therefore, are local or casual phenomena, which generally represent a mere displacement of groups, and are of no account whatever in considering the first appearance, or the destruction of a single species.

2d. The fossil plants hitherto obtained from the Coal Measures of Illinois are mainly the result of local researches, too limited to serve as a basis for general conclusions, and it is only after more extended examinations, and more complete collections from other portions of the great area now occupied by Carboniferous strata in this and the adjacent States, that we may expect to obtain the data for determining, in a satisfactory manner, the distribution of the Caboniferous flora over the whole extent of our American coal fields.

3d. When this is done, we shall have sufficient proofs of a gradual change in the characters of the vegetation of the Coal Measures from the first appearance of land vegetation. The *Lycopodiaceous* plants, represented by the genera *Lepidodendron, Knorria, Ulodendron, Sigillaria*, etc., are already represented by

Plates with N: (

Pl. LVII

Figs. 1–3. ~~Alethopteris~~ Dactyotheca Emersoni sp. nov. from a large number of specimens.
2a fructiferous part with coaly spores destroyed. 2b same fructiferous with coaly
28. of seed and spores. Ill. Rep. IV p. 396 a. (2)

4, 4a. Alethopteris trichilica Brgt. old plate from Cambridge specimen

5–2a. A. Gibsoni sp. nov. N. 6 of Gibson spec. Ill. Rep. IV p. 396 b (2)

Pl. LVIII

1, 1a. Goniopteris, ~~sp. nov.~~ neuropteroides Gibson? sp. N. 49. Ill. Rep. IV p. 353 (3).

2, 2a, 3, 3a. G. argutus Brgt. 2. specimen fertile from Mazon Creek Ill. 96. 3, 3a from the specimen in Cambridge Coll. from Salem rein.

4, 4a. Pecopteris Cistii from Brgt. in part. But we have a number of specimens

5, 5a. P. platyrachis Brgt. " " "

6, 7, ~~7b~~, P. arborescens with fructiferous fragments, we have the species in large number then two specimens are from Ill. Lace.

8, 8a. P. oreopteridius Brgt. partly from Brgt. very common

9, 9a. P. Miltoni – polymorpha Brgt. " " "

10, 10a. P. Clathii Lesq. Ill. Rep. p. 404 b. Ill. Rep. IV p. 404 b (2).

Pl. ~~LVIII~~ LIX.

1, 1a. Sphenopteris Newberryi, Lesq. from specimens in Cambridge & Cassville.
this last has been left out. though figured.

2–2b. Sphenopteris muricata Brgt. Ill. Rep. IV p. 395 b (2)

3. Pecopteris Illinoiensis Brgt. refer this specimen by comparison to ~~Pl. XX~~ p. 13.

4, 5. P. Lorchii Brgt. Ill. Rep. p. 395 b (4) with the former. – Compare to P. Cistii 2

6. Sphenopteris acuta, Brgt. apparently. Gibson specimen from Gray Creek N. 29.

7, 8. Pecopteris crenulata Brgt. from Mazon Creek specimens. Ill. Rep. IV p. 352 (3) 353 (2), 392.

Pl. LX.

Figs. 1–3. Oligocarpia Gutbieri with enlarged fruit copied from Geinitz or Göppert see Ill. Rep. IV p. 494 b. Cred. note p. 38. N. 144.

3–4. Dictyopteris (or acrogenus) polypodioides? not described. ~~Figured from specimen nodules of Mazon Creek~~

3–4. Sphenopteris lycopodioides Gutb. see 55. 188 of Cambridge Herb. In 1664 both nodules from Mazon Creek. Ill. Rep. IV p. 407 b 3.

Continuing Pl LX.

60 Figs. 5-5b. Alethopteris solida, Lesq. Ill. Rep. IV. p. 397. Pl. XI fig 5-7.
6-6b. Alethopteris stellata, Lesq. " II. p. 440 Pl. XXXVII fig 4-4b
7-7b. Staphylopteris stellata, Lesq. Ark. Rep II. p. 309. Pl II fig 2-2b.
8-8b. " cesteroides, Lesq. Ill. Rep. IV p. 406. Pl. XIV, fig. 6-7b.
9-9b. " sagittata, Lesq. " " p. 407 Pl XIV fig. 3-5
10. " ? a different species not described - fr specimen of Brutts No 200 Differs by long stem and lanceolate pinnaes.

Pl LXI.

Fig. 1, 1a. Sphenopteris pseudo-sub-alata (or another name) same as S. alata described in 2d Vol of Ill. Rep. p. 437. as described in mss. This species from Mazon Creek. Ill Rep IV p 407a.
2-2b. Sphenopteris Brittsii, Sp nov Ill. Rep IV p. 412b. (2) & 412c. (2) Brutts No 99.
3-4a Sphenopteris sp. nov. Ill. Rep. as Alethopteris p. 493b. 1. Ma 101.
5, 5a. " Hoeninghausii Brgt. not described. Large splendid spec. from Alabama
55 6. " elegans, Brgt. Ill. Rep. IV p. 407 b. (1). The specimen figured is from Alabama.
7. " sp. nov? Al. 33. I do not find the species described. May be a var. of Sphenopteris trichomanoides Brgt. see Cat Bot. Sing. Ill Rep IV p 411(
8-9a. Sphenopteris bidactylites Brgt & Fred. Spec. 6.3 of Brutts. Ill. Rep IV, 408b.
C.B. p. 29 - No 126. Sing. 25 No 104.

Pl LXII.

1 Fig. 1. Calamites cannaeformis, Brgt. Fragm. of a large specimen
2-3 C. ramosus, Brgt. SM. 46b. C.B. p. 16 No 46
3, 4 C. Jacksonii Brgt. fragments.
6 C. Cistii. Brgt. from specimen of Ho.
5 C. approximatus Lesq. Jm. 2.3.
7 C. radiatus, Brgt. Copied from Brongniart.

Pl. LXIII.

Figs 1-1b. Sphenodendron Porteri Lesq. Ill. Rep. IV p 448 Pl XXVII, fig 4-b
2, 2a. " " pachyderma, Brgt. Ill plate see expl. of plate Si 25
70 3-3b. " " pes Caprioli Gein. Trevorton Si 13 see expl.
4-4a. " " cyclostigma Brgt. No ~~2191 Amherst College~~ Si 11 see expl
5-9 " " remiformis Brgt. Which Schimper matches S alternans in parts fig 9 is from Lawe p. 452. see expl. of plate

Pl. LXIV

Figs. 1. 2, 3. Sigillaria lævigata Brgt. Ill. Rep. IV p. 481. c. 3. Lawe. No 481. c.
decorticata 482, 486
4 " Pittsburgiana (a another name) Ill Rep. p 480a b. 1 Lawe 48
71. 5 " marginata, sp. nov. Lawe 460 seven. Ill Rep 4 p. 481 c.
6 " Illinoiana Brgt. Lawe 460, 466. Ill Rep IV p. 480b. 2-
7, 8 " triplicata sp. nov. " 466. Ill Rep IV p 481 c 1.

Pl. LXV. 2 Ser. 553, 3 = 477.

Fig. 1. 4. Sigillaria tessellata Brgt? Ill. Rep. IV p. 448 (2, 3), compare
5. 6? S. " manullaris Brgt. " " 480 (1) 5 = 461
72. 7, 8. S. " attenuata Lx. Penn. Pott. cat. p. 17. figured the same.
9 S. " Lecuriei Schp. see Schp. 2 p. 25.
10 S. " leptoderma, sp. nov. Ill. Rep. IV p. 480 (5) Acc. N. 497.
11 S. " Wolgii, Brgt. " " IV p. 480 (2) " N. 494
12 S. " Lacuei. sp. nov. " " IV p. 480 (4) " N. 464

Pl. LXVI.

Fig. 1. Sigillaria polita, Lx. 1st Penn. Rep. p. 872. Pl. XIV fig. 3. copied.
2 S. " Gardleyi Lx. Cat. of Pott. p. 17. Pl. II fig. 4. copied.
73. 3–6. S. " monostigma, Lx. 3 M. 116. 4. 67. 5. 201. 6 Ill. Rep. IV & XXVI fig. 5.
7. S. " menardi Brgt. Gibson N. 17. Compare Ulodendron fig. 2 a
8–16 a. S. " Brardei Brgt. from a same specimen in Lesley Collection.
8. 9. 10 decort. 11 & 13 decort. 12 cort. 14 Stigmaria of the same 15 leaf of Stigmaria. 16. 16 a. leaf of the species.
Fig. 17. S. " Sulcata Lx. 1st Penn. Rep. p. 871. Pl. XIII, fig. 4.
18 S. " Sculpt. " " p. 871. Pl. XIII fig. 3. = ? S. oblique Brgt. see original specimen
19. S. " reticulata Lx. Ast. Rep. p. 310 Pl. III fig. 2, see Schemper
20 S. " S. stellata Lx. 1st Penn. Rep. p. 871. Pl. XIII fig. 2.
21 S. " S. Schemperi, Lx. " " 871 Pl. XIII fig. 1 } copied

Pl. LXVII. (Should be Pl. III.)

Fig. 1–4. Dalcopteris (Neuropteris Boschiana) 1st Pa. Rep. p. 854 Pl. III fig. 1 & 1 d (copied.
49. 5 D. " (minor) Lx. " " p. 854. Pl. 1. fig. 10.
6 7. D. " (obtusa.) Lx. " " 854 Pl. 1 fig. 11. Fig. 7 is copied from a sketch from Rev. L.
8, 8 a. D. " pecta, Andrew. Geol. R. of Ohio. 2 vol. p. 418 pl XLIX fig. 9. 2 a. Fig. copied in part.
9. 9 a. D. " Alleghaniensis, Meek, Descriptions of Invert. Bull. Phil. Soc. of Washington Dec. 1875. P. XVIII. Pl. 1 fig. 2. (copied)

Pl. LXVIII

Fig. 1. Ulodendron elongatum, Lx. Ill. Rep. IV. p. 437 fig. 4. copied.
2–2 c. U. " ellipticum Hend. Ill. Rep. p. 436. fig. 2 = Pl. XXII fig. 3 fig. 2 a – 2 c = Pl. XXIII fig. 1. 2. 3. copied both.
65 3. 3 a. U. " punctatum H. from specimen in Hildreth collection Marietta College. Fig. 3 reduced. 3 a. nat. size.

Pl. LXIX

Fig. 1. Ulodendron minus Al. & H. Ala. Spe. N. 19. Coal B. pg. N. 19.
2, 2 a. U. commutatum Schp. Ill. Rep. IV p. 435 (2). Aldrich. N. 9.
66. 3, 3 a. U. magus. Al. & H. upper surface 3 lower surface 3 a. copied from Ill. Rep. pl XXII fig. 4.

Pl. LXX

Figs. 1 & 1b, 2 Lepidodendron Brittsii Lqu, Britt N 54 C B p 29 N 129
3, 3a & 4 L " spec. nov. ? Britts N. 55 Cab. B. p 20 N 82 & 32
5, 5a L " Sternbergii ? Prgt. L. 23. Ill Rep IV p 428 b. C B p 25
63. 6, 7, 7a L " spec. nov. ? L. 20 b. Ill Rep. p 428 d 21.
8, 8a, 9, 9a L " fruitaten Lqu Ill Rep IV

Pl LXXI L

Fig 1. Lycopodites Mackii Lqu Ill Rep. Pl XXVI fgs 6, 6a. p 426 b. 1.
" 2, 2a. L " " ? " " p 426 c. 1.

62. 3, 3a Lepidodendron squamiferum L. nov. C.M. 18. C.B. p. 9 N 18
4 Lepidodendron species not described see specimens. Britts N 201.
5 L " marginatum ? N. a quadratum. C-B N 70.
6 - 8 L " Wetherinnanum St. C. B. p 17 N 70 for fig. 6 & 8. for fig 7. 7a = species for Ill Rep IV pl XXVIII fgs 7, 8.

Pl LXXII.

Fig 1, 1a Caulopteris Gifford, Lqu. specimen in Col. No Ill Rep. IV. p 458 c. 3.
60 2. C. Mansfieldi ? Ma 92. Ill Rep IV p 459 b. 1
Pl LXXIII.

Fig 1. C Caulopteris turnite Lq. so named in Cat. Mus p. 17. S. 60.
2. C. " squamosa, Lq. is another name not described Ma 39 b.
59 3 C. " punctata Lqu Gem Rep. p 869. Pl XIII, fg 8. 1.
4 C " ~~marginata~~ ~~Lqu~~ ~~p nov~~ Ma 375.
5 C " angustata L. nov (Ma 388 } not described
6 C " modesta or megapteris ? not described Ma 113.
7 C. magni Lqu. Ill Rep IV p 459. Pl. 49. fg. 1.
8 C. obtusata Ill Rep IV p 457 Pl XXIII fg 1

Pl LXXIV

1-2. Halonia tortuosa ? conjuncta Lq Hpt. C. B. p 21 N 84 p 38 N 143
61 3 Megaphitum Goldenbergi C. B. p 29 N 130.
Pl LXXV (not yet cut.)

56 1 Alethopteris (sphenopteris) spinulosa Lqu Ill Rep IV Pl 11 fg 1, 1a p 394
2. 3. A " " hymenophylloides St. " " p 393 Pl 10 fgs 1-4
4 4a Hymenophyllites splendens St. Ill Rep. Pl XIX fg 1. p 413.
5-5b Sphenophyllum Cornutum St. " " " 2. p 421

large tree in the Devonian of Ohio; in the Upper Silurian and Lower Devonian of Pennsylvania, (1) and occur in abundance in the Chester group (Lower Carboniferous) of Illinois. Representatives of this family of plants become more and more predominant in ascending, and by the number of species, and the size of the trees, the group attains its full development near the base of the true Coal Measures, at the horizon of coal No. 2. The bed of shale overlaying the Sub-Conglomerate coal of Kentucky and Arkansas, appears generally as a compound of mere debris, especially the leaves of *Lepidodendra*. This coal, like that of No. 2, shows also, upon its horizontal layers, distinct remains of plants of the same kind. In Pennsylvania, the shale of the mammoth bed, which I consider as the equivalent of coal 2, is, in places, a compound of large pieces of the bark of *Sigillaria* and *Lepidodendra*, superposed in a thickness of one to two feet, like the leaves of a book. (2) At Cuyahoga Falls, Ohio, the shale of the same coal is, in places, a mere compound also of pieces of bark of *Sigillaria*, and in Illinois, as seen by our table, the remains of *Sigillaria* and *Lepidodendra* predominate in the shale of coal No. 2, and the place of this coal in the sandstone of Marseilles is marked by remains of large trees of the same genera.

Ascending higher in the Measures, the Lycopodiaceous plants decrease in number to coal No. 5, or to the Duquoin coal, which, from its vegetable remains, appears to be the equivalent of coal No. 3. of the Kentucky Reports. This family is here represented still by some species of *Lepidodendron*, *Lepidophloios*, by cones or *Lepidostrobi* of large size, and by a few *Sigillaria* of the *Lepidodendroid* type, viz.: *Sigillaria sculpta* and *S. Brardei*, which appear to be universal species of the Carboniferous epoch. In higher strata of the Coal Measures of the United States, species of *Lepidodendra* have not as yet been found.

In connection with the Pittsburgh coal, as with coal No. 9 and No· 11, of Kentucky, I have seen specimens of the two last named species of *Sigillaria*, but no remains of *Lepidodendra*. From horizons above the Pittsburgh coal, we know nothing as yet of the flora of our Coal Measures. But in Europe, Goppert, in his flora of the Permian, enumerates *Sigillaria Brardei*, and describes two new species, *S. denudata* and *S. Danziana*, which are nearly related to *Sigillaria sculpta*, Lesqx., if not identical with it. The same work mentions also, as found in the lowest strata of the Permian Measures, *Lepidodendron Veltheimianum*, already present in the Devonian of Europe, and with us in the Lower Carboniferous limestones of Illinois, and with it he describes a

(1) Penn. Geol. Rep., p. 829, fig. 675, 677.

(2) A shale of this kind is, by an abrupt flexure of the coal strata, thrown up near Trevorton, and exposed as a perpendicular wall.

few species of cones (*Lepidostrobi*) of diminutive size, indicating there the disappearance of the large Lycopodiaceous plants which afterwards were not represented in any of the formations of our earth.

The fruits described under the generic names of *Trigonocarpus*, *Rhabdocarpus*, and *Ptilocarpus*, have as yet been found only from the Sub-Conglomerate coal strata upwards to coal No. 2. They abound in the Millstone grit and the hearth sandstone, as in the shale of coal No. 2. A few fruits of uncertain affinity, and considered under the name of *Carpolithes*, have been observed higher in the Measures; for example, *Carpolithes fasciculatus*, at Grayville, Ills. As yet these cases are very rare.

As to the ferns, the distribution at different horizons is more striking in considering certain groups or races, rather than peculiar genera or species. The genus *Neuropteris*, for example, is equally well represented, from the Sub-Conglomerate coal of Arkansas to the highest strata of Pennsylvania and Kentucky, by *Neuropteris hirsuta*, *Neuropteris flexuosa*, and *Neuropteris Loschii*, all species closely related by their peculiar nervation. These are, moreover, universally distributed over the whole extent of our coal fields, and in Europe two, at least, ascend to the Permian. From this group, *Neuropteris tenuifolia* is the only one which, appearing with the Sub-Conglomerate coal, has not as yet been found higher than coal No. 2. Another section of this genus, especially comprising species of a coarse or thick nervation or texture, like *Neuropteris Clarksonii*, *N. rarinervis*, *N. vermicularis*, *N. coriacea*, *N. pachyderma*, etc., is as yet truly characteristic of coal No. 2, none of them having as yet been found above or below it. All the species of the genus *Odontopteris* appear distributed from the coal strata under the Millstone grit up to coal No. 1 and No. 2. In Illinois, as in Pennsylvania, most of the species are found in connection with the last bed. It is the same with the species of large, thick leaved *Alethopteris*, *A. lonchitica*, *A. Serlii*, *A. Mazoniana*, *A. Massillonis*, *A. Owenii*, etc. They form, with *Callipteris Sullivantii*, a distinct and peculiar group, which may be considered truly characteristic of coal No. 2. *Alethopteris lonchitica*, has always been for me an essential leading species, and never, as yet, has misled me as marking the horizon of the mammoth vein of Penna. In the east, it is a most common species; it abounds also at Cuyahoga Falls, Ohio; but it seems to disappear in some basins, as for example in Illinois, where its place is taken by *Alethopteris Serlii* and *Callipteris Sullivantii*.

Of *Pecopteris*, the section which Brongniart separates under the name of *Sphenopteroides*, and which Schimper rightly places in the genus *Sphenopteris*, is the only one which may be considered as yet as peculiar to the lower Coal Measures. Its species, *Pecopteris Murrayana*, *P. chœrophylloides*, *P. Newberryi*, with *Sphenopteris latifolia*, *S. obtusiloba*, and *S. acuta*, are found in connection

Pl. LXXXVI

Figs. 1–5 Asterophyllites fasciculatus Lx. Hl. Rep. p. 426 c. 2. Brutt. spec. 110.
6. 7. " " ovalis Lx. Rep. p. 426 c. 7.
3. 8–11. " ? copied figures from Grand Eury
— 12. " compare author. specimen in notebook Mazo creek.
13 Annularia minuta? compare specimen from St Clairville. Ennesa.
14 Macrostachya infundibuliformis Ung. Rep. 495 a. 1. Mo 208.
17. 18 " " " "
19. 19a " " " "
20. 20 Asterophyllites equisetiformis Lx see Pen. Rep. The fig is copied from spec. of Mansfield?
21–23a. Rotularia? not described. Spec. from Carrer of Penn.
24–25 " ? " " from Newcastle Waverly.

Pl. LXXXVII

Fig. 1, 2 Lepidocarpus imbricatus Hl. Rep. 463 c. (18).
3. L. " pectinatus " " 365 (3). Lacx spe. 423.
4 L. " spec. cited see spec. where from.
5 L. " — 7. quadrangulare Hl. Rep. b. p. 365. (2). Sketch of spec.
6, 7 L. " ? see A described in Penn. Rep.
8. Lepidostrobus foliaceus? Hl. Rep. IV p. 440 d. (21) 441, 444 a. (1) Lx 199 on 171
9, 10 Lepidophyllum " ? Hl. Rep. p. 444 a. 1. Lx. 1613. fig 10 is Mo 398.
11. 12. 13. 14. 15 – 17 agglomeration of spores which should be described under generic name. macrosporites? fig. 11 is Mo 152a Fig 12 is mashes 147. fig 13 is copied from Hl. Rep. pl 31 fig. 25 La. fig 14 is 302 of Lacx Sporocarpus rugosus, see further this Rep p. 367. fig 16 is 307 Lacx. fig 17 is 301.
18. Lepidostrobus see L. bractifolius this Rep p 440 d (20). Pl. 60. compare Lesq. Atlas. 59, 1
18 – 24. Carpolithes vesicularis referable to sporophores. see 18 = Lac. 306. 19, 20 & 23 as C. vesicularis from Lacx specimen under conglomerat 21–23 may be separated as C. parisiformis. 24 & 24a are copied from this Rep. pl 31 fig 22, 24
25. Lepidophyllum & Lepidostrobus see this Rep. 440 a. 20.
26. Lepidostrobus variabilis Hl & Ht. Mo 305.
27, 28. Lepidostrobus bractatus Lx. Lacx. p. 216. Hl. Rep. IV p 442 c. (2.)
29. L. " oblongifolius Hl. Rep. IV pl. 30 fig 3.
30 L. " lanceifolius " " 31 fig 7, 7b.
31 L. " cassifolius (not Lindley or another name.) Lacx spe. Hl. Rep. p. 443 b. (9.)
32 L. " ovalifolius for this Rep. Pl 80 fig 2b.
33 L. " brevifolius copied and amended Pen. Rep. Pl XXVIII f. 6.
34 L. lepidophyllum Mansfieldi? dont find it described in mashes
L. undulatum Hl. Rep. IV p. 440 b. (5). spe. Mo. 120.
35 L. verticillatum Lx this rep. pl 31 fig 8.
36 L. striatulum or striatum Hl. Rep. IV p. 403 b (6).
37 L. acuminatum Lx Hl. Rep. IV p. 403 b. (7
38 L. [illegible] Rep. mean spe. in Lacx
39 L. lineaefolium for my spec. named by Schimper
40. 41 L. Morierianum Lx. Hl. Rep. p 443 b (2) Lx 1611.

Pl LXXXIII

Fig 1. Trigonocarpum Woeggerathi Ad & Hall. This Report Pl 31 fig 16.
2,3 T. " Davieni Ad & Hall. This Rep. p. 460 b. 7.
85 5,6. T. " Gifferdi, Ly. not described see specimen.
7,8. T. " olivæformis. H? Ill. Rep. p 460 b (4)
9,10 T. " subcylindricum Ly. " 460 b (5)
11. T. " Mengelianum. Gopp & Berg. 460 b (6).
12, 13 Hexapterospermum ornatum Newb. (Bradley) Ill. Rep. pl. 42 fig. 7 & 7 a.
14. Rhabdocarpus clavatus. Hunt. This Rep. pl 31. fig. 11 & Ill. Rep.
15 R. " cornutus Ly. not described. Two figures on pl 29 not described
16 Carpolithes? bifidus? Ly. Ill. Rep. p. 462 c (6) fig. 5 p. 530 fig 8, 9.
17 – 19. C. " Lachnomanus Ly. 17 is var? comparable to C. Sulcifer Newb. Third p 4
20. Rhabdocarpus clavatus? Mab. Rep. Sni. 74.
21. R. " Mansfieldi Ly. This Rep. p. 461 b. (5)
22, 23 R. " Multistriatus H. see Newb. R. carinatus O. Rep. pl 4 & 4 fig c
24 " " Howardi Ly. This Rep. p. 462 b. 4.
25 R. " Bochicanus? Gopp. see also Trigon. ventricosum Trie pl XXV fig. 21 b. or Trig. Davieni in Ma. 130.
26. Carpolithes? insignis Ly. Lacu. spec. 373 not described
27 Rhabdocarpus amygdalaformis. N. 310 Lacu. spec. not described see C.B. p. 23. N. 98.
28. R. " Bochicanus? p. 301. 75.
29. R. " platimarginatus Ly. Art. Rep. pl. IV fig. 6.
30. 30a R. " fasciculatus Ly. Ill. Rep. p 463 c. (20)
31, 31a Carpolithes regularis H. Ill. Rep. p 462 c. (10)
32, 33a Cardiocarpus mamillatus? Fig. 32 may differ Ill. Rep. IV p. 463 c
34, 35 C. " ingens Ly. Art. Rep. Pl IV fig. 4, 4a.
36, 37 C. " annulatus? Newb. " p. 461 c (9)
38 C. " affine. Ly. Art. Rep. Pl IV fig 5.
39, 40 C. " bicuspidatus H. O. Geol Rep. pl XLIII figs 9, 9a.
38. C. " ~~elongatus~~ unicus Newb. " " 4
40 C. " orbiculare " " 10.
41 C. " elongatum " " 5
44, 45 C. " triplicatus? change name. Ill Rep IV p. 461 b. 3.
46, 47 C. " simplex. " " 461 c. 10
48 – 50 C. " clypeiformis? not described. these are from Lacu. spec.
51 Trilobocarpus bicornutus Ly.
52 Carpolithes rostellatus? see Ill. Rep. not figured.

Pl. LXXIX

Fig 2. Fruit of Lepidophloios laricinum St. copied from Roemer pl XIII fig. 1a. see also on in Goldenberg.
1. Lepidophloios macrolepidotum Gold. see from Geinitz.
8, 3 Cone of Lepidophloios (L. acuticulatum, &c. this report Pl XXX fig. 1.
4 Scale of the same " " Pl XXIV fig 1 in part.
5 Lepidophyllum acuticulatum of the same " " " "
6 Lepidophloios with scales covering seeds. Pl a. 318?
7, a b Same " seeds in group " " 318
8. 8a Lepidophloios? from Britt. N. 208 see what it may be
9, 9. L. " protuberans Lq. this rpt. Pl. XXVI figs 1-2.
10 L. " ? may be a Lepidophloios Lq. 1611. des. Pl. Rep. IV p. 449 611 at Sieller Schimper?

Pl LXXX

1. Lepidodendron aculeatum St.? see for specimen in bags. I do not know where it is from
2. L. " diplotegioides Lq. Pl. Rep. p. 311. (corned)
3. L. " obovatum? see specimen & compare.
64 4. L. " costatum. Lq. Pl. Rep. II. p. 453. Pl. XLIV fig. 7.
5 L. " turbinatum Lq. " " " 8.
6. L. " ? see specimen from Alnwick.
7. L. " " " " Lacu 717 des. 718 cont.
8, 9. L. " Wortheni. Pl. Rep. II p. 205 2 Pl. 411 fig. 4.5.
10. L. " distans Lq. Pl. Rep. I pl XVI fig. 5.
11. L. " minorum St. see about specimen.
12. L. " Mielichi. Goep. Compare Goep. Syst. pl. XLIV fig 2 and see for specimen whence from.
13. 14. L. " modulatum. Lq. Pl. Rep 2 p. 310 Pl. Rep. 6. 874
15 L. " rectatum Lq. Pl. Rep. p. 474. Pl. Rep. p. 428. specimen whence from?
16. L. " clypeatum? specimen unknown to me? see 16a & 16d. belongs to 1 or 2 as I remember
17 12 compare fequer 7 & Number may be referable to 16.

Pl LXXXI

Fig. 1. 2. 3. Galeopteris minor Lq. 3a & 3a. fruit q. Bronciart specimen
4. G. " Lacu 695 Saporta refait par de Marquer
5a. " see cette forme. LXXX
5 G. " hybernica L. 697. Saporta dit qu'elle se rapproche plus des G. hybernica rouillée
6 " " Lucciana Meell figure cut for Meell
7 G. Hymenophyllites Gr. nov. Spe. Lacu 699. Saporta. La comparer communément forqueur L. Bronni une ressemblance avec Schizopteris pachyrachis de Goepp. Silesia. Voir la note lettre de M. Guillet. Il est with the Cordaites

Pl. LXXXII

Fig. 1. Alethopteris Gibsoni Ld. Ill. Rep. IV p. 396 b 1, 397 c 2. Drawn & taken from a very large specimen of the Agricultural College of Ohio but by Prof. Orton
33. I am specie figured pl. XXVII.
2-5. A. " obtusa (?) or as the name, marked subtruncata in the vol. p. 397 b (1), all the specimens, and I have some more now on from Mansfield, Canada.
6-8. Alethopteris Owenii Ldy. Fig. 6, 6a copied from the Ill. Report, fig. 7, is what I prepared for Hy Report on A. Coriana which I think the same. Fig. 8 8a is A. Sheaffer from another specimen from the North Coal Anthracite of Pa. 8 is the enlarged part of the pinna in Footville Catalogue, made from the specimen at Cambridge. Mass.
9, 9a. A. inflata copied from the Report. pl X fig 5 & 6.

Pl. LXXXIII

Fig. 1. 2. 3. Pecopteris pseudo-neuropt. sp. nov. Ill. Rep. IV p. 398 c 3.
4 5, 4a P. " elliptica Bunb. " " " 400 c 2
39. 6, 6a " " " fructiferous part
12, 13. ~~7, 8~~ P. " squamosa Ldy copied from this vol. pl XIV fig 10, 11 (part) XIV
14, 15 ~~9, 10~~ P. " Stronzii Ld. " " " Pl. XIII. fig 7-9.
7, 8, 11, 12 Goniopteris latifolia sp. nov. Ill. Rep. VI p. 354 (1), 685 a dec
9, 10 ~~3-6~~ Goniopteris lanceolata Ldy. Ill. Rep. this vol. pl XIII fig 1-3
11. ~~5~~ " emarginata, Goepp. " " " " 4.

Pl. LXXXIV

Fig. 1. Stigmaria ficoides reduced see Göppert. Lr. 1-2 Pl. IX fig. 6 also Ldy Report IX & X
2, 3, 4, 6, 8 " " " "
5 " " I do not recollect. find out!
74 7 Stigmarioides stellaris Ldy. this vol. Pl XXX fig 3
9. Halonia tuberculata Byst? " " " fig 1.
10. Sigillaria Brardii copied from Owen specimen. 10a & 10b. Mature
11 Stigmaria in place " from Schimper Ves Pal. Pl LXIX fig 2 Sup.
12, 13 Rootlets or laces of Stigmaria with tubercles 12 from Smith specimen. 13 Midgley's specimen.
14. Halonia imbricata. which copied in part for Goepp Gatt. Lr. 3, 4. f
15 " " from Ill's Report. see

Pl. LXXXV

1 Stigmaria Evenii Ldy Ill. Rep. II p. l. XXXIX fig. 9.
75 2. Stigmarioides truncatus Ld. " IV pl XXIX fig 4
3. " " tilloides " " " XXXI fig. 1.
4 " " tuberosus " " " XXIX fig. 5
5 " " linearis " " " XXXI fig 2.
6. Sigillarioides radicans " " " " 4
7. Stigmarioides affinis Ld. " " " XXVII " 9
8. " " delage Ld. " " " XXXI " 3.

Ure

with coal No. 2. *Hymenophyllites furcatus* has more generally been found below the Millstone grit, but it ascends, though rarely, to coal No. 2, where also *Hymenophyllites splendens*, *H. Schlotheimii* and some other species of the section *Aphlebia* are generally found.

As representative of the higher coal strata of Illinois, or of coal No. 5, there is no particular species to quote. *Alethopteris aquilina*, with *Pecopteris unita*, *P. plumosa*, *Cordaites angustifolia*, and species of *Lepidophloios*, are there represented by more abundant specimens than anywhere else, but remains of these plants have been also observed in the lower Coal Measures. In the anthracite basin of Pennsylvania, the highest strata are recognized by the presence of *Pecopteris arborescens*, which has not been as yet positively discovered in Illinois, the small specimens referred to it from a nodule of Mazon creek being too obscure for certain identification. This species, the most abundant of all in some localities of Pennsylvania, is found also in profusion in the red clay beds of Ohio, especially in the *grotto of flowers*, near Marietta, where it is represented by a slightly different form, perhaps a mere variety of *P. rubra*, Lesqx. In Europe, it ascends to the Permian, where its characters, though somewhat modified, have been considered as specific by Goppert, who has named it *P.* (*Cyatheites*) *Schlotheimii*. It is there, as with us, associated with its large form *P. Cyathea*, Brgt. The section *Cyatheites* of the genus *Pecopteris*, is, indeed, of all the fossil ferns of the coal, the one which is, in some of its species, characteristic of the higher coal strata. But as yet these species are indifferently known, and therefore it is hardly possible to indicate them as peculiar to a certain horizon. For example, *Pecopteris polymorpha*, Brgt., abounds in the highest coal strata of Illinois at Grayville, and near New Harmony, Ind. It is generally like *P. arborescens*, a marked species of our upper Coal Measures, while *Pecopteris abbreviata*, which Prof. Geinitz takes as a mere variety of it, is common at Morris, Mazon creek and other places, always in connection with coal No. 2, and has not yet been observed in higher strata. The differences in these horizons, as well as in the form of the pinnæ, indicate these remains as representing two different species, though the nervation is of the same kind. It is certain that, as the Lycopodiaceous plants of the coal decrease in the number of their representatives, as in their size, in ascending in the Coal Measures, they are proportionally replaced by ferns, either herbaceous or arborescent. This change is everywhere evident in the shale overlaying the coal beds, as in the coal itself. At Grayville, and especially at Springfield, Ill., where the upper coal is nearly 200 feet above coal No. 5, the lamellæ of the coal bear a quantity of recognizable leaflets and branches of ferns, especially of the genus *Pecopteris*. The roof shales of the Pomroy coal in Ohio are thickly covered with remains of ferns, especially large pinnæ, still bearing leaves of *Neuropteris flexuosa* and *N. hirsuta*. A bed of shale,

which in places underlies the Pittsburg coal, is also a mere compound of stems and leaves of this last species, and I have received from the highest coal bed of Kansas, which is considered by some geologists as belonging to the Permian strata, a large lot of specimens of the roof shale, which, like those from under the Pittsburg coal, contain leaves of the same *Neuropteris hirsuta* heaped in profusion, without any other species but *N. Loschii.*

From the horizon of the Pittsburg coal, we have from Pennsylvania two remarkable species, whose discovery is due to the sagacious investigation of Rev. D. C. Moore, and which, by their characters, appear related rather to species of the Permian, or even of the Oolite, than to those of the Carboniferous epoch. One is the peculiar *Neuropteris Moorii*, Lesqx., Penn. Geol. Rept., p. 860, Pl. xix, fix. 1,* related by the pointed form of its leaflets and their size to *Pecopteris Whitbiensis*, Ll. and Hutt., of the Oolite of England. The second is apparently a species of *Schizoneura*, a new genus of Schimper, represented as yet by only four species in the Trias and the Oolite of Europe. Our species is known only by small branches, one-fourth of an inch broad, striated lengthwise, like those of a *Sphenophyllum*, articulated at short distances, bearing at the articulations whorls of ten to twelve oblanceolate obtuse flat leaflets, about one inch long, marked lengthwise by parallel thin veinlets. These leaflets appear distinct or unconnected to their base, which is marked by small, circular, distinct scars. No trace of a vagina has been observed as yet.

The presence of these peculiar plants in the higher Coal Measures of Pennsylvania may not be more conclusive, as indicating a distinct geological horizon, than are the numerous remains of insects, crustaceans, etc., discovered in the nodules of Mazon creek, and which have as yet their relatives only represented in the Permian. But I desire to make here only a record of facts, according to our actual knowledge, in regard to the flora of the Coal Measures, and leave to future discoverers the task of obtaining more reliable data for a definitive conclusion on the subject.

The examination of the geographical distribution of the flora of our Carboniferous strata, according to the suggestions of Prof. H. D. Rogers, in the preparation of the Pennsylvania Geological Report, proposes the solution of these three questions: 1st. What is the geological relation of our Coal Measures with those of Europe, in considering the vegetable constituents of the strata in both continents? 2d. From the same kind of researches, is the anthracite basin of Pennsylvania identical in its age and in the distribution of its measures with the great Apalachian bituminous coal basin of Ohio and Pennsylvania? And as a corollary: 3d. What is the geological relation of the sepa-

*Prof. W. P. Schimper has separated this species as the type of a new genus *Lescuropteris*, a separation already indicated by my remarks with the description of this species, loc. cit.

Pl. XXXV continued

9. Rhizolithes palmatifidus Lx. Att. Rep. Pl. V. fig 9.
10. Tachypteris gracillima Lx. Hl. Rep. IV. pl. XIX. fig 6.
11. Palæoxyris (Spiranxium) plicata. sp. nov. From specm Di 104. Hl. Rep. IV. p. 464 & 2.
12. " " appendiculata Lx. Hl. Rep. IV. pl. XXVII, fig. 11.
13-15 b. " Wendelin Lx. " " " pl. " " 10-12.
15 c. Part of the same enlarged to show surface
16. Calamodendron. ? compare & describe specimen of Mansfeld. 361.
17. Calamites gracilis Brongn. Hy. Report. p. 436. N. vol IV.

Calamites,

Calamites ramifer, Stur, Ma 481. a fine specimen both C. ramosus Brgt. but with the bar of the ribs converging distinctly to the scars of branches which are very small. This convergence is marked in C. approximatus fig. by Schimper Atlas but not in Brgt.

rate coal basins of Western Kentucky, Illinois and Michigan with our eastern coal fields? The first two of these questions have been examined and answered in the Geological Report of Pennsylvania, pp. 839–842. Though new discoveries might now furnish some interesting details to the discussion, nothing has as yet been found in the Coal Measures, which might tend to invalidate the conclusions admitted in that report. The third question has been also considered* from data obtained in the geological explorations of Kentucky, Arkansas and Indiana, and therefore I have but to add here a few remarks which are called for by the species recently found in the Coal Measures of Illinois.

We cannot expect to trace any marked differences indicating climatic divisions from the northern to the southern limits of the coal fields of Illinois. Local changes, as indicated from the table of distribution, can but be considered as casual, and not ascribed to any permanent or general thermal influence.

The relation of the Coal Measures of Illinois with the eastern coal fields of Pennsylvania, Rhode Island and Nova Scotia, is indicated not only by the common or more predominant species, but also by some rare and striking ones. The coal of Morris, for example, has, in common with that of Newport, R. I., *Pecopteris squamosa*, *Pecopteris unita*, *Odontopteris Schlotheimii* and *Asterophyllites lævis;* with the low beds of anthracite of Pennsylvania, *Callipteris Sullivantii*, *Neuropteris fimbriata*, *N. rarinervis*, *N. Clarksonii*, *N. Desorii*, etc., and with the Coal Measures of Nova Scotia: *Odontopteris subcuneata*, a species not seen as yet in any other part of the coal fields of the United States. Some species of the eastern basin, like *Neuropteris Rogersi*, Lesqx., *Odontopteris alata*, Lesqx., *Alethopteris obscura*, Lesqx., *Whittleseya elegans* ,Newb.,etc., have not yet been found in Illinois; but these are very rare species, discovered each at a single locality, as are some of the new species described from the coal fields of Illinois, and which may be found elsewhere hereafter. Illinois has likewise about 30 species known in the coal flora of Europe, and which have not been yet seen in the more eastern coal fields of America.

Of the common species of our eastern coal fields, not yet found in Illinois, none can be quoted but *Dictyopteris obliqua*, Bunb., locally abundant in the shale of the high coal near Pottsville, Penn., of Newport, R. I., and of the subconglomerate coal of Arkansas; *Sphenopteris artemisiæfolia*, Brgt., rare everywhere, sparingly found in the low beds of the anthracite basin of Pennsylvania and of the western coal fields of Kentucky; *Pecopteris arborescens*, already quoted; *Pecopteris Loschii* and the peculiar *Brachyphyllum obtusum*, Lesqx., both locally predominant in the anthracite fields. The near relation of the coal basin of Illinois with the other coal fields of this continent, is thus demonstrated by its fossil flora.

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*Journal of Science and Art, July, 1860.

The number of European species recognized in the Coal Measures of Illinois do not change in any way the relation of the American Coal Measures with those of Europe. It remains now the same as I have presented it formerly (Penn. Geol. Rep., loc. cit.). If general affinity is ascertained by a large number of plants, either identical or closely related, geographical differences in the vegetation are indicated by peculiar species or races of ours, which as yet have not been observed in the Coal Measures of Europe. It is true that European palæontologists, though at work on the coal flora for more than a century, still discover species, either identical with or allied to some of ours, which were once considered as exclusively pertaining to the American coal flora; for example, a fimbriate *Cyclopteris** from a small anthracite basin of the Swiss Alpine mountains. But these cases are very rare indeed, and besides what is known from other parts of our coal fields, Illinois has now furnished a number of these peculiar types of vegetables, which render geographical disparity more appreciable. Of this kind are especially *Neuropteris verbenæfolia*, *N. Evenii*, *N. pachyderma*, *Dictyopteris rubella*, *Alethopteris hymenophylloides*, *A. inflata*, *A. solida*, *Pecopteris Strongii*, species of *Staphylopteris*, *Sphenopteris scaberrima*, *Hymenophyllites mollis*, *Schutzia bracteata*, a number of species of *Lepidodendra* and *Sigillaria*, *Syringodendron Porteri*, *Megaphytum McLayii*, species of *Caulopteris* and of fruits of *Palæoxyris*. Indeed, no genus of our coal flora, except, perhaps, *Calamites*, can be considered as represented on both continents by species all identical or closely allied. As these points of difference, like those of affinity, have been observed from the beginning of the researches on the coal flora, and have not varied much in comparative quantity, they appear to fully corroborate the statement that, at the Carboniferous epoch, the flora which formed the constituents of the coal, was in Europe and in the United States as different, and at the same time as relatively alike, as is now the flora of the peat bogs of the two continents.

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* *Cyclopteris lacerata*, Heer., see descriptive part. The predominant species of this Alpine basin, which was for a long time considered as of a different formation from that of the Carboniferous epoch, is *Odontopteris Alpina*, Brgt., a peculiar plant, which, as yet, with us, has been found only in connection with the anthracite of Rhode Island.

General remarks.

1. On the hairs of Neuropteris hirsuta Lqx. Their position is quite irregular. They are mostly placed in the middle of the space between the medial nerve and the border. Their direction is generally upward but varies much some of the hairs being turned more or less toward the border or the medial nerve, ever but rarely perpendicular to the direction of the border. Their form is that of very small short needles about one line in length, of the same thickness in their whole length, somewhat thicker in the middle, only pointed at the top. The large leaflets are more generally covered with hairs, the basilar ones sparcely or rarely. The more remarkable appearance of these hairs is that they are marked upon the surface of the leaves by a depression or as if cut into the substance of the leaves and not as placed upon by an elevation as it should appear if they had grown upon it. This can not be explained, but in supposing that they were of a harder substance that by the maceration of the leaves they have penetrated the parenchyma and have become covered from it and attached to the clay where the counterpart of the leaves is marked. The hairs marked upon the upper part of the leaves are so deep and equal that it is not well possible to suppose that the hairs were upon the under or lower surface, for if it was the case, their presence should be indicated by elevation of the surface and not by depression. Though it may be, they appear to represent hairs. They cut across the veins traversing 6 to 7 nerves between the veinlets and originate mostly from the veins and their divisions. It can be that they were upon the under surface of the leaves and that being of a hard texture and more slowly softened than the leaves they have, by compression penetrated through the substance of the leaves cutting these forms upon the leaves and being detached by maceration have been glued to the clay covering the upper surface. They are so distinctly marked upon the clay covering that the supposition is admissible. (21.6.71). – The appearance marked upon the surface of the leaflets would be explained also in supposing that originally the hairs, being on the upper surface and of a harder texture than the leaves were first by compression imbedded into the substance of the leaves and afterwards totally destroyed by maceration leaving only their place cut into the leaflets to be filled by the ~~over~~ covering clay. The scars of these hairs appear indeed as cut into the substance of the leaves and often sharply and deeply so. The hairs are not quite filiform but slightly thicker in the middle. They are seen as well upon the basilar leaflets as upon the large ones. – Some specimens have the upper surface of the leaflet and the clay impression resting upon it separated by a thin coat of a white substance (gypsum). In this case though the upper surface bears the prints of hair, the clay covering has not the corresponding marks in relief. It then appears as from another species, the veins and veinlets being well marked without any trace of hairs. Better specimens show the hairs originating from the veinlets and rather turned backwards than towards the point. – The process of harder penetrating substances being marked by grooves and not by upraised lines upon the surface is remarked in the form of the veins of some species. For example in specimen N. 219. Neuropteris rarinervis, the veinlets are distinctly marked by grooves both in the leaflet the upper part of the specimen as well as upon the shale covering them. It is as if a vacuum had been formed by the destruction of the veinlets after maceration.

1. Brongniart remarks in (Rapport sur le memoire de Grand'Eury) p. 2 that the Carboniferous formations are not referable to a single epoch but that one has recognized in them four different geological positions which equally offer marked differences in the ensemble of the plants which have formed them. To speak merely of the carboniferous measures of France, one has to admit that those of the West including the department of Maine & Loire & Lower inferieure placed at the upper limit of the Devonian formation are the most ancient; that those of the Dep^t of the North (Dep. du Nord) which appear contemporaneous with those of Belgium, England and most of those of Germany come after and that those which surround the central massif of France are more recent and in some cases rely (touchent) to the Permian which is the upper limit of the Carboniferous. See same Mem: that these upper carboniferous measures show different epochs by their plants or different stages. See on this subject Grand'Eury remarks in Brongniart Mem. p 19.

2 I have purposely abstained of multiplied comparisons of our joint fossil ferns to Eury. over. The attempt made by divers authors and the extraordinary difference of their opinion in regard to reference of this kind, this for authors like d'Eichwald, Schimper, Brongniart etc who had in hand all the materials of value for a comparison of this kind is sufficient to prove how little we know as yet of the true characters of the ferns of the coal in comparison with those of our time. ~~Deprived~~ as I am of sufficient means of comparison an attempt of this kind could have be but an exhibition of personal view & without any useful result. Moreover those for who the Flora is prepared especially have no means of comparison and for the authors in Phytopaleontologists they will have opportunity of making numerous the work of comparison with more advantages ~~than~~ and I have only tried to represent faithfully the plants a fragment of plants of the Ill. Coal measures and then afford a supply of reliable materials for those who may continue this study or their research from a more elevated & scientific point of view.

Remark for the reproduction of certain figures for the Ill. Report especially that the figures have been very carefully drawn by myself and beautifully engraved by the Wheeler Engraving Company of Chicago that most of the specimens ~~were lost~~ for represented were the property of the Ill. Geol. Survey and preserved in the State Cabinet of Springfield & lost by M. Green especially that both the Ill. Cabinet and Green have been burn and most of the specimens lost and that also the stell plates of the Survey have be destroyed in the Great Chicago fire. (see 4 & 512)

3 In the quotation I have merely quoted in the 1st by mentioning or reference the authors original author a those which have good illustration of the described species. See No 8 same remarks.

4 It is only regrettable that the number of plates and figures could not be greatly increased. At least double the number of plates would have been necessary to satisfactorily represent all the species described. I have tried to compensate the absence of figures by ~~more~~ careful more detailed descriptions. But no description is equivalent to a figure. And even for the ferns, a simple species to be elucidated in all its characters would need many plates. I have therefore in the selection of plant figures endeavoured to give a good representation of the flora of our coal measures. The blanks to be filled may be so hereafter by figures as a supplement to this flora.

5 I have especially reproduced figures of the ~~pt~~ a number of organisms obtained from the Nodules or Concretions of Mazon Creek. From their character and from the fact that a number of the peculiar species which they represent have not been found elsewhere, it seems that big masses of soft tissue generally destroyed by maceration or compression in the shale have been preserved at Mazon Creek and from the researches pursued for years by Mr. J. J. Stevens. For ~~Ere~~ on other it is not probable that remains of the ~~very~~ rarer ~~extreme~~ forms may be found hereafter. They are of peculiar importance in demonstrating the variety and richness of the coal flora and also the fern nature of this flora. For example the Rattopteris, Rhizomopteris, Sporangites etc. have all without exception been found in these concretions, also most of the finest fragments of ferns.

6 Some fragments, little than described as they manifestly may seem of too obscure character to merit a description. These remain, however, extremely rare, representing organisms generally destroyed by maceration. They help to give us a clue to the mode of existence of the coal plant and nothing should be omitted in this work which might relate to the Carboniferous flora and expression of its characters.

7. The fossil plants, to be known merely by fragments which rarely give an idea of the true characters of the vegetable which they represent. They are riddles, hieroglyphics which phytopaleontologists are called to decipher or explain and which are generally differently explained by the student. I am not at all disposed to enter into discussion on the value of the so called species which I admit for the description of the fragments which I have studied. And I freely have to every one the privilege of contradicting my views and my opinions. For in a field like phytopaleontology

8 I have given with the specification the more important synonyms especially mentioning the authors whose descriptions are elucidated by figures. A number of species are not figured (say why) some of the more important figures are found in Schimper's Traité. Quest. a work now in the hands of every phytopaleontologist.

9 I can of branches of Neuropteris and of Macrostachya also Rhizomes of Calamites are preserved separately in coal shale

INDEX.

10 In the Cannel Coal the Sigillaria are very rare the Macrospores and Lycopodiaceous capsules very abundant.

11 Neuropteris species appear more abundant on the coal measures of this Continent than in Europe, not only for the number of species but for the development of the genitalia.

12 Perhaps the comparison made of the characters of some of the American species to those described by the authors may seem too lengthy and too detailed. As we have no European specimens for comparison these details are necessary to allow the study of the ~~species~~ characters which the have forced me to a separation or to a identification of species.

13 There are in the Neuropteris such a variety of American forms and a ~~[illegible]~~ number of peculiar characters forming their distinction in a large number of species that at first sight their multiplication may appear unreasonable and have been considered in that way by European authors in the Beginning of my research. But when after a while a number of specimens representing these species were under the eye, the doubt has entirely disappeared and with few exceptions ~~[illegible]~~ remarked by myself all these species have now acknowledged as remarkable for peculiar at least until now to the American coal measures. Should we think that their great variety is limited to the ferns. What we see of the Lycopodiaceous fruit specimens of the Cordaites species is sufficient to indicate that for an introductory work these flora a too large number of unnamed species I have been by far too conservative and that we have on hand materials enough and peculiarly characterized to form new claims generic and specific which will be established by authors hereafter.

Though the flora description and perhaps will represent hereafter all the species known untill now from the Carboniferous and may therefore supply the wants of procuring the numerous works which treat of the subject, I did not ~~think~~ prope to omit the nomenclature and the reference to the books which have been used in the preparation of the flora. The references may ~~show the~~ are necessary; they seeming also them to be indicated at least in its most important data in order to show the true meaning of the species and to afford means of comparison of what we have described to what is known in Europe etc.

to p. 315

Warm plants in the Carboniferous

See description of the species of which I have given some figures in Pl. I.

Scyphophicus & Scypholithus. I suggest this generic name for the description of the following plant of which I have received a specimen from Prof Broadhead. The plant represents a semi-spherical or cup, like a ball cut in two, rounded downward to a branch or axis upon which it is supported, the axis dividing on three branches as a support of the cup whose ~~border~~ outsides are elegantly marked by upward ridges branching and flattening up toward the borders, on fine ornament of the side of a cup. The upper part is concave, the borders somewhat thick. The diameter across the border is 8 cent. and the axis or pedicel is nearly 1 cent thick. The cup appears as half filled by inorganic matter; the thickness of the borders is nearly 1 centimeter. Of this organism Prof Broadhead writes in his letter Feby 11. 1878 "I have three kinds of plant in much smaller specimens or in diameter from 1½ to 3 inches. The one he sends is the only with a well defined stem or axis. Their position is in nests or on top of others as you could set a dish on another with cavity upwards but most of them were found singly or one or two together. I have three small ones just as they occurred in shale, most of them have 5 or 6 well defined ridges extending from axis to margin. There also have lesser ridges attached but some have not ridges at all. The interior is slightly cupshaped with no particular ornamentation only the broader place where the overlying cup was attached as it rests or axis, more properly called axis because it connects several or rather one to that above. When no cup is above, the cavity is filled over evenly but probably would be cut out. I have only found them at the locality where they abound." In shale near the base of the Coal measures in Vernon Co. Mo. about half way between Nevada and F. S. Scott.

15. See and examine somewhere that quarter: if the species of the coal which we may consider as ancestors are not generally larger more fully developed than what we may consider as descendants. Alethopteris grandifolia A. mucronata, A. Grotoldeana etc. of Newby & Andrew. pecopteris A. serrii, aequalis etc. then pecopteris the Scolopendrium see also Polypteris, Dicksonia & Neuropteris etc. Forth Sphenopteris & Calypteris. Forth Lepidodendron of Lycopodiaceae & Veltheimian. for the Sigillaria. etc etc

16 I know that the work will be looked at as deficient in many points. But I am unable to change it. I have prepared it as a book as I should have wished to find it prepared when I was a director in entering upon my research in the carboniferous flora. It is for this reason that I had to enter into somewhat too long descriptions of species or of specimens and also into the character of some the genus or the group in order to afford the American reader unacquainted with Paleontology the explanation sufficient to enable him to understand the book. The species are often described not merely on the figured specimen but upon the consideration of many fragments of one of which only perhaps is found by the paleontologists and he has to understand the various forms under which a species is appears.

17 A ~~longer discussion~~ more detailed discussion and characters of the character of the species is forced by the deficiency of means of comparison with Europe species considered identical or perhaps different for some peculiar characters. Also ~~say that for this year that I have been collecting materials pertaining to the coal flora and studying either in place where they were found or in the mines attached to the roof or in the cabinet, I have not a many fragment of a fern plant and recognized the difficulty of recognizing the general character from one or a small number of specimens that I am forced to expose the different forms remarked and then to send the results on explorer. For a full representation of the coal flora would require volumes of plates. But this I say. The largest work on Coal plant has nearly two hundred plates quarto plates and this is scarcely half. Since the many are of the coal plants

18 Lengthy descriptions forced by the deficiency of the figures and the scarcity of comparison upon these characters rather upon these fragments of a fern species which could not be represented by drawing. I by total absence of Europe material for comparison of species by authors called referred to Europe on known fern description or figures of authors. By the chemist prepare of possible representative of the American coal flora clear enough to supply the numerous partial works of authors on the coal flora. Bear what says. Lesquereux in the discouragement in the formation of the coal. Also by the fact that observers and searchers

specimen of the coal flora during a space of ten years I have constantly annoted the specification by remarks upon all the peculiar varieties recognized in specimens.

19 It will not be amiss to remark that I have here described some fragment of ferns whose attribution is not certain even acknowledged by myself as to correct. I have done it only to give an exponent of the materials which have been observed and studied in my long exploration of the coal plants of the N. Am. Perhaps these fragments may be found represented in better specimens and their relation ascertained. I do not consider any fragment of fossil plants unworthy of observation, remark and I am ~~indifferent as to the use which can be made of my de~~ (See Carnal fern Pennsylvania. Neuropteris ferrisii. memoir. #19a.

20 Except that this flora represent a number of coal plant of type specific or generic type unknown in the Euro- Gea coal flora. I do not intend to teach any thing to the learned of the plant to European Paleontologists. I would consider it an author who has not ever had the opportunity to compare American specimen with those of Europe. Who is deprived of the means of studying fossil plant for anatomical analysis to put his opinion in contradiction to those of the celebrate authors. Mostly few with have offered an give an ideal are to be research. The aim of these flora is to represent the American vegetable of the coal as it has been to be the exploration of a long series of years. Further one of the whole coal of the coal fields. To give them the means of becoming acquainted with the ~~flor~~ flora to all who are interested in ~~to produce~~ regard in all the question pertaining to the coal. to the mine, the properties of cabinets or museum the geologist. etc.

19a And also, I have described these uncertain species from specimens when reference is given by No to the different cabinet where they can be studied and compared. The flora is described as fully as possible as I have seen it and as I wish I had had a book for directing my researches when I began the study of the coal flora.

21 Now what is left to future Paleontologists friends of the coal plants is not merely to correct the errors which the book contain and which are certainly numerous but to fill the lacuna in complete the description and giving a better acquaintance of the specific characters of the species and of their relations. To essentially examine and carefully the local flora either for geographical or chronological comparison of the species (distribution etc. This knowledge is very difficult but now when can we expect to find material more appropriate or more numerous distributed / more numerous for researches of this kind.

22 I have described in the Coal flora species connected by Prof Dawson as Devonian separate of the coal flora ~~with~~ the Devonian is not positively marked species of the Catskill group. Have been lately now considered as Devonian. Now the presence of coal beds in their formation proves their separation from the Carboniferous and of coal beds in their formation proves that the carbon formation so widely extended in the that very probable the strata of Devonian here Mauch Chunk will be recognized to be the lacy of the Devonian

23 Remark a fragilar that first of their trees have been prostrate either into the coal or at their top passing now forming that. Their woody substance is generally destroyed. The bark left flattened and heaped in successive layers or rolled downwards folded as it. Valet. These heaps of bark do not represent same species a at least many species have found representing by the bark. Compare this formation to that of the Lidgge Swamps and see Bunny on Sigillaria 1865. where speaks of the often decomposed internal woody cylinder as of the bark preserved

24 Mark a distinct section of the Sub conglomerate and remark that it is very interesting. — Also a separate subsection should be made of the sums around Pittsler for reference to their species

25 A degree of attention has been given to the geological and also the geographical distribution of the species of the coal. The question of their distribution in the connection with different strata of the coal would greatly help our acquaintance with the relative ranks of the coal strata and therefore simplify the research for their discovery. This can not be done until much more is ascertained both concerning the geology & the geographical distribution. The flora of the coal must proceed by local prolonged research and the data obtained carefully recorded for each strata when the strata is ascertained. In this case Paleontology may be called later to afford some assistance to geology, rather than to receive it all from geology

26 As to the importance of the data derivative from the vegetable paleontology as the identification of the coal strata, there is indeed nothing to say. In 1850 when I began my researches on the fossil plants in the anthracite of Penna. I was persuaded that according to the notions received from European paleontologist or from both learning that it would be possible to find early in the investigations of the coal strata difference marked enough to ascertain their relative position. I then knew very little of the geographical distribution of the coal plants. At the epoch of the coal or a long time, the vegetation was locally very diversified and as it happens upon the surface of the peat bogs. The diversity was constantly locally modified by the successive changes in the nature of the plants. Now taking only a single place for some years the surface of a peat bog is covered by grass. They disappear after a while to be replaced by more or small trailing plants or by weeds in such a way that taking the whole thickness of a bed of peat a fair surface of moderate extent has been occupied at different times by a number of plants or groups of vegetables of quite different character. Supposing the upper layers of the bog to have been covered by ferns and then by muddy deposit from shallows, it is probable that a second bed of peat produced after a long period of time at the same locality may have its surface overlaid by sphagnum that then

remains of these plants may be also preserved into mud and shale
both those of the beds underneath. When of course comparing the remains
it is easy to recognize a difference in the vegetation. But transferring
then research to long distance say from Pennsylvania to Illinois
the order of surface vegetation, the succession of the plants in beds of peat
formed at the same period as those of Pennsylvania may be reversed
and therefore the points of comparison instead of being given being drawn to right
indications become fallacious and it is certainly what has happened
or may have happened often in the formation of coal strata. The indi-
cation may therefore be of some value when given for a very reduced
area but can not afford advantage for a whole coal basin. In this
case vegetable paleontology may offer general indication which can be
fully tested. It gives to the first observation the evidence that
the coal strata of the U. S. men of the same age as those of Europe
as they have a large number of the species described by Prof. especially
all the genera. It may prove that the lower sub conglomerate
coal strata are not of the same time as those of a later growth.
But for the details paleontology is subservient to stratigraphy and
has to regulate its conclusions to those of their last issue. Indeed
it may follow stratigraphy for instruction. It may derive its
conclusions on the distribution of the plants from geological data and
will only if possible slowly come to get materials enough to
confirm the data obtained by stratigraphy but nothing more.
It has take for a long time a dependent a servant before it
may become a master or grow up from infancy to manhood
under the tutelage of Geology.

So am the more disposed to say this because it has taken
a long time of hard study of erroneous conclusions before I could
put aside that ~~false idea~~ ~~theoretical error~~ which ~~was not~~
~~the less potent or accord~~ which lieth most of the theoretical
assertions are more tenaciously sustained etc. ~~errors~~ because
courage and hard work are necessary for their erasure.

The above may be put at the beginning of the chapter on the
distribution of the fossil plants in the N. A. Coal measures after
the table; the considering the characters indicated by the table
27. The descriptions are of necessity somewhat longer to obviate in some cases
the absence of figures. And as from the beginning my research on the Coal
Plants I have constantly noted every variety or every peculiarity remarkable
upon the different sometimes numerous specimens I have been at some
trouble to condensed all the observations or to select those which might
be more valuable for descriptions for acquaintance with the plants

See Plan.

Examination of the flora after the Tabl.

1st The plants or the flora in itself. – What it indicates of the existence of the vegetable of the coal. §1. of the physical circumstances or the atmosphere of their habitat. §2. their general characters as vegetable. to what class they represent. their nature as prepared for the building up of combustible materials, lignite. No chemical analysis can be made of the plants. They must be known only to the compounds of their heaped remains. – No food for animal life. great absorbers of carbonic acid and humidity. – Richness here by the number of species constantly increased by discoveries. (mod of researches, methods, etc.) (with the number of species recognised in a single bed of coal.) Mode of preservation and formation of the coal. – Name classes or families described or admitted their general characters. Remarks on the imperfection of the fragments that scarcely any species is known in all its characters. stem leaves and fructification. See the ferns when related to their stem or primary rachis is scarcely recognized. –

2d Flore compared to that of Europe. Many species described as new or different may be identical or mere varieties of the European ones. This can be ascertained only by comparison of specimens.

3. Geographical distributes.

4 Geological. distributes.

Number species which are in America of different formation, Spirangium, Scolopsyllum etc.
Ferns equally in distribution. the Phanerogams of the Sub carboniferous.
Type not yet found in Europe Megalopteris.

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28 Remark that some types are longer in diameter or represented by related species are often found together predominant in the same localities. The Phaseolus Phyllanthus at Clinton Me. The Dordatta at Cornelia; Justicia ocana the Lilaeopsis occidentalis of Pittsburg. This might offer the idea that all these form described as specific are mere varieties of a same species. This however is exactly the same now with living plant. Be as South there are many species of Vetch are grouped together quite what is seen with swamp species.

29 Count number of species described and number of them frequent see why there was necessity of descriptions not only to supply the absence of figures but to give a idea of the different forms observed by long examination of specimens and which can not be all represented in figures.

30 If I had been the proprietor of the flora which belongs to the survey of Prussia I should have decided to the two internet friends who have be the promoters of this work and have given me constant assistance and encouragement the Chamisso Agassiz and the director of the survey of Prussia. Without their assistance and constant encouragement it would never have been for that to publish

ERRATA.

Page 22, 15th line from bottom, for "old" read older.
Page 90, 15th line from bottom, for "positions" read portions.
Page 97, 16th line from top, for "southeast" read southwest.
Page 109, 15th line from bottom, for "Cophalanthus" read Cephalanthus.
Page 110, 10th line from top, for "eriocephala" read criocephala.
Page 120, 11th line from bottom, for "gasterapod" read gasteropod.
Page 136, 8th line from top, for "three" read these
Page 168, 12th line from bottom, for "Roissi" read Royssii.
Page 184, 16th line from top, for "exactneas" read exactness.
Page 195, 8th line from top, for "Crustaceon" read Crustacean.
Page 195, 18th line from bottom, for "Morgan" read Mazon.
Page 201, 16th line from top, for "fossil" read fossils.
Page 222, 18th line from top, for "oxide" read oxyd.
Page 233, 3d line from top, for "ara" read are.
Page 251, 20th line from top. for "is quite it" read it is quite.
Page 319, 19th line from top, for "Geineitzii" read Geinitzii.
Page 336, 10th line from bottom, for "Tamarach" read Tamarack.
Page 350, 10th line from top, for "enamelled" read enameled.
Page 353, 11th line from bottom, for "bitumization" read bituminization.
Page 356, 5th line from top, for "bevelled" read beveled.
Page 359, 1st line, for "are" read one.
Page 360, 15th line from top, and 361, 4th line from bottom, for "bevelled" read beveled.
Page 361, bottom line, for "enamelled" read enameled.
Page 386, 12th line from bottom, for "diversions" read divisions.
Page 389, 6th line from bottom, and bottom line, for "Brongnarti" read Brongniarti.
Page 399, 7th line from bottom, for "coreaceous" read coriaceous.
Page 403, 6th line from bottom, for "Versteinerimgen" read Versteinerungen.
Page 409, 2d line from bottom, for "Sphenotopteris" read Sphenopteris.
Page 433, 5th line from top, for "Syrigodendron" read Syringodendron.
Page 456, 2d line from bottom, for "Phizomopteris Rrdmani" read Rhizomopteris Erdmanni.

Terminologie

Foliolis a se invicem remotis: (Schp. 1346), Leaflets at a distance from each other.

Dichotome: forking twice see Schimper, p: 567 Neuwstern sera or merely forking: the rays: bis ter ve dichotomis in Odontopteris alpina or iterum dichotomis Le. repeatedly dichotomous.

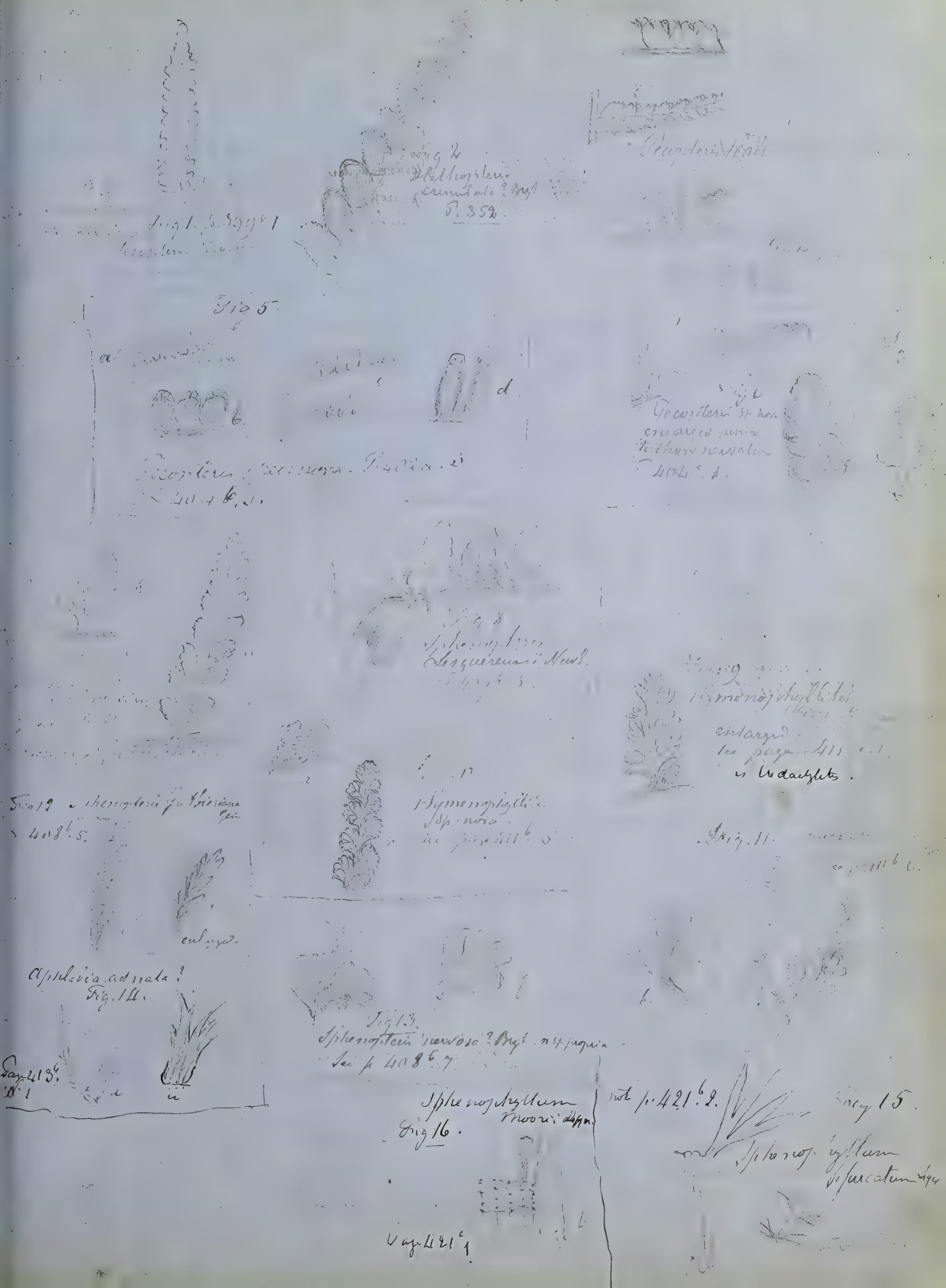
Pinnulæ singulæ in rachi primaria pinnis interpositæ, leaflets attached to the rachis between the pinna.

Espèces Américaines mentionnées par Schimper.

Sphenopteris	pauperculo Lesq	p. 380.	
S. "	mixta Schp.	382	= S. mixta Nl. Gol. Schp. 2. p. 435 L
S. "	latifolia Brgt.	399	
S. "	decipiens Lesq	401.	
S. "	flexicaulis Lesq	409	
Cyclopteris	lacerata Heer	421.	
Neuropteris	cordata Brgt.	431	Espèce Ouralienne species d'Europe
N. "	gigantea Sternb.	436	
N. "	Loschii Brgt.	437	
N. "	tenuifolia Schloth.	438	
N. "	rarinervis Bunb.	440	
N. "	microphylla Brgt.	441	
N. "	Grangeri "	441	
N. "	Cistii "	441	
N. "	auriculata "	444	
N. "	Rogersi Lesq.	445	
N. "	lepsuta Lesq.	445	
N. "	Clarksoni "	446	
N. "	gibbosa "	446	
N. "	undata & tenuifaeris Lesq.	446	merely mentioned as synonym of N. gibbosa
N. "	dentata Lesq.	447	
N. "	Desorii "	447	
Odontopteris	intermedia Lesq.	455	mentionné comme syn. de O. Brardii
O. "	alata Lesq.	456	
O. "	subcuneata Bun.	461	
O. "	squamosa Lesq.	463	
O. "	delicatula Lesq. Schp.	463	
O. "	Worthenii Lesq.	463	
O. "	heterophylla Lesq.	464	
Lescuropteris	Moori Lesq. Schp.	465	
Palaeopteris	hybernica E. & Forbes	475	= Noeggerathia obtusa Lesq.
P. "	Roemeri	476	= N. minor Lesq.
Sphenopteris	lasa Hall.	477	

527.

Sketches of plants described in notes of Insect.



529

Equisetites
not p. 425 b 3.
fig. 2.

Fig 4
Lepidodendron marginatum
not p. 428 b 2.

Fig 5
Lepidodendron sp.
See not p. 428 c 13

Fig 1.
not 425 b 1

Fig 3
Dictyopteris ciliata
sp. propria ? not
p. 458 b 7.

Fig 6
Lepidodendron carinatum
not p. 428 c 17

Fig 7
Lepidodendron
sp. nov.
Not p. 428 d 21

Equisetites occidentalis
Frent.

Fig 8
Lepidodendron
sp. propria
Not p. 428 d, 23

Fig 9.
Lepidophyllum ?
See note 19.
p. 441 d.

Fig 10
Lepidophloios sp. nov.
note p. 439 c 4.

Fig 11.
Sigillaria
mamillaris sp.
Not p. 446 b 3.

Fig 12
Sigillaria
reniformis ? Rog
not 446 c 11.

Fig 13.
Trigonocarpus
sicyonus Lyc.
note p. 460 b 1.

Fig 14
Trigonocarpus
Whitei Lyc.
p. 461 b 3.

Fig 15
Trigonocarpus obovatus
Not p. 460 b 4.

Fig 16.
Trigonocarpus subglobularis
sp. prop ?
not p. 461 b 5

Fig 17.
Trigonocarpus
Mantzelianum ? Gein.
Not p. 460 b 6.

Fig 19.

Fig 18.
Trigonocarpus Dawsoni ? ? 461 b
Note p. 461 b 7

Trigonocarpus spec. nov. ?
not p. 460 c 8.

Fig 1. Gregonocarpus cornutus? sp. nov? see note p. 460 c. 9.

Fig 2.

Fig 3. Carpolithes Howardianus sp. nov. note p. 462 b 4.

Fig 4 spec: Ca 57 Carpolithes Sachsoniensis Sch. see Not p. 462 b. 3

Fig 5. spec: Ca 65

Carpolithes species nova? see note p. 462 b 5 from fig. 4. 5, 6. 7.

Fig 7 spec: Ca 40 b

Fig 6 spec Ca 91.

Fig 8. Carpolithes Lindenbergi. note 462 b. 6.

Fig 9.

Fig 10

Fig 11.

Fig 12 Dilocarpus microstriatus. note 461 c 6.

Fig 13 Dilocarpus Crassiusculus Sch. Fl. Sag. vol 4 p. 49. note 461 c 7.

Fig 14 Carpolithes Equisetiformis note p. 462 c 10.

Fig 15 Carpolithes elongatus note p. 462 c 11.

Fig. 16 Carpolithes fasciculatus Sch. note p. 462 c. 13

Fig 17 Carpolithes Macrophyllus note p. 463 c. 17.

Fig 18. Carpolithes imbricatus sp. nov. 463 c. 18.

Fig 19. note b p. 463 c. 19

See counterpart fig 7. p. 531.

Fig 20 note p. 463 c. 20.

Fig 20. b note p. 463 b (17)

Fig 21. p. 463 c. 21.

531.

1 fig. 1. vide note p. 460 c. N 11

2. Si 1. note p. 27.

Not p. 463 b. fig. 7.

Si 2. vides les note p. 446 a 22

3

4

Fig. 8. note mss. 458 b.

6 Fig. note 446 a 5.

2a note p. 446 c. 1.

5. note p. 446 c 4

4 not p. 446 c. 3

fig. 10 note 383 c.

fig. 9. note p. 448 a

fig. 11 p. 448 a. 2.

fig. 12 p. 448 a 3.

15. Voir p. 429 a

13. p. 463 b. 7.

14 p. 463 b. 3.

146. 14 c.

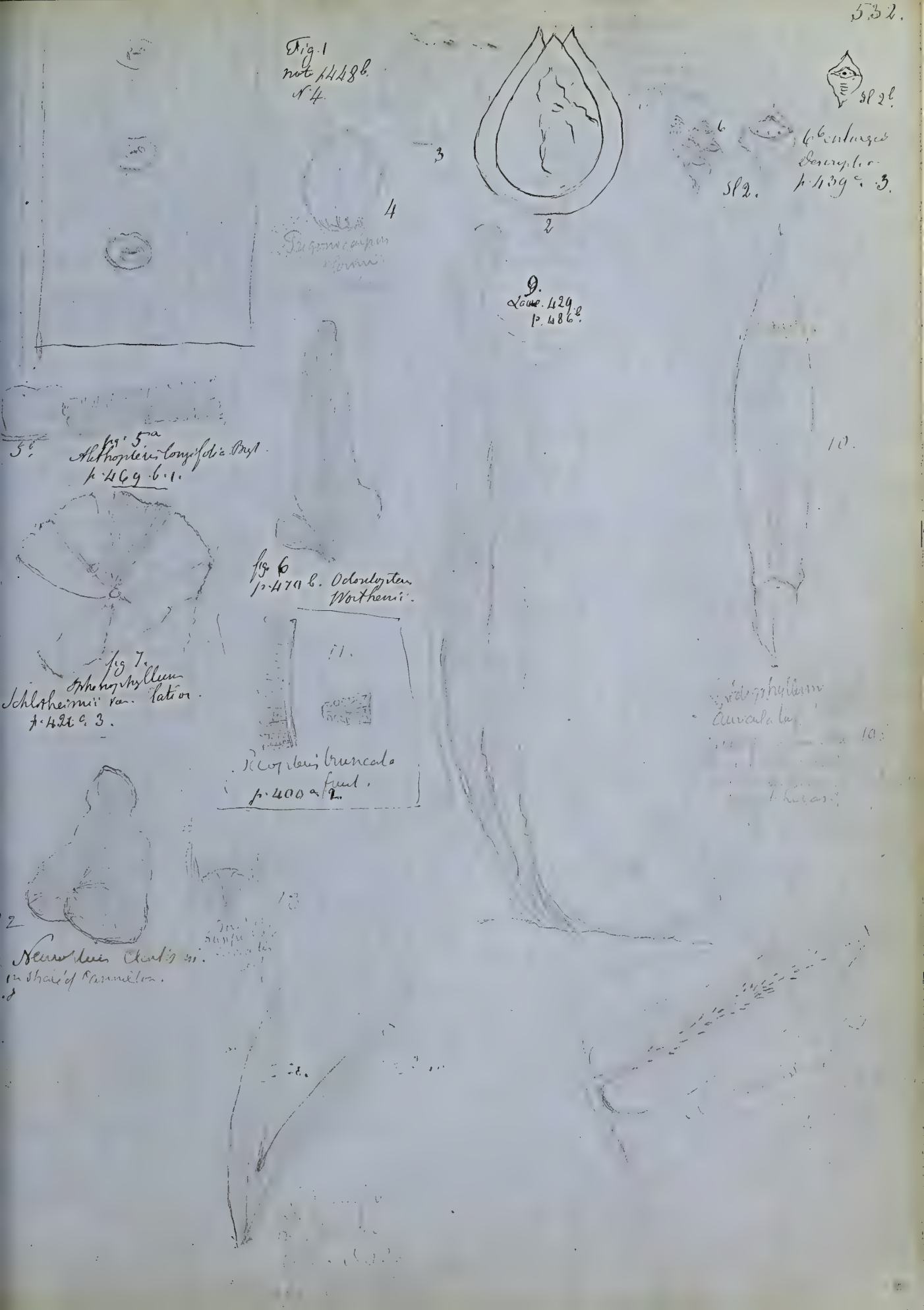
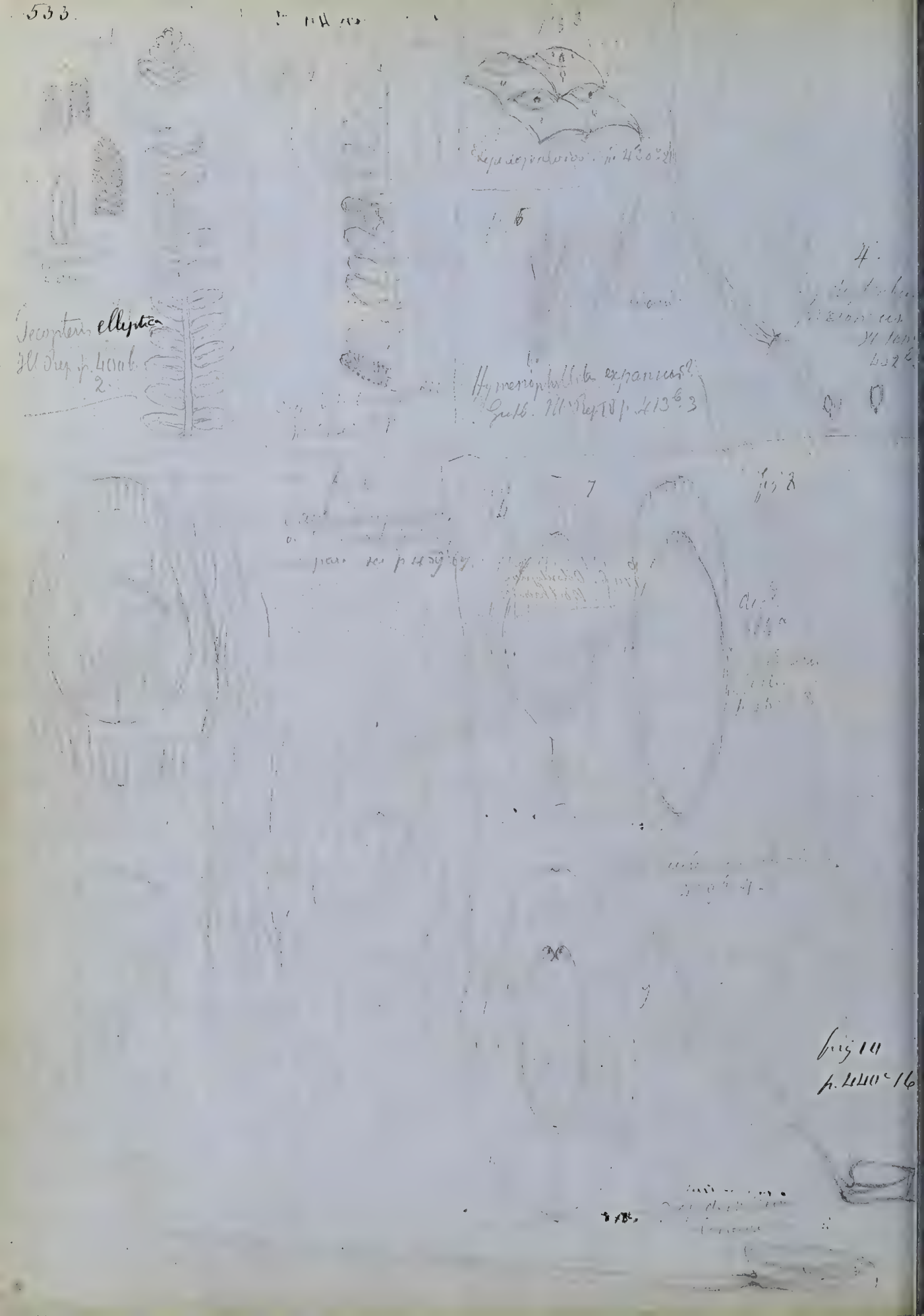


Fig. 1
not 448 b.
N. 4.
3
4
2
9.
Lowe. 429
p. 486 b.
Sl 2 b.
6 b enlarged
description
p. 439 c. 3.
Sl 2.
5 b.
fig. 5 a
Alethopteris longifolia Ost.
p. 469 b. 1.
fig. 6
p. 470 b. Odontopteris
Wortheni.
10.
fig. 7.
Sphenopteris
Schlotheimii var. latior.
p. 421 c. 3.
11.
Odontopteris
p. 400 a. 2.
Sphenopteris
Auricularia
10.
T. Lucas
12
Neuropteris Charlesii.
in shale of Pennsylvania.


Hymenophyllites expansus?
fig 14
p. 440 c 16

Cordaites gracilis Dy (corrected from p. 361 (4)). The veins, primary and secondary are not quite distinct in the upper part or rather upper surface of the leaves either covered with their thick epidermis or under it. On the lower surface and toward the upper end of the leaves the primary veins are distinct or a little stronger than the secondary ones, distant about ~~one~~ one millimeter distant separated by 3 to 6 smaller secondary veins. Toward the base of the leaves the nerves become all equal, the primary no scarcely different and there measure 5 to 6 per millimeter. This is the same distance of the veins generally speaking as in the upper end of the leaves when there are 5 or 6 intermediate veinlets between the primary ones 1 millim. distant. The upper surface has the same reticulation but far less distinct. On both surfaces the epidermis is thick minutely wrinkled across as in all the other species. The difference of this species with C. angustifolius is clearly marked in the narrower leaves, half as broad, the rugose punctulate surface of the stem when cuticulated, the far less distinct reticulation of the upper surface of the leaves, etc. Correct plate in which should be obtuse and curved inside. - The borders are also slightly reflexed backward.

2. Cordaites [illegible] (or another name) sp. nov. from p. 479 b 5). This species seems to belong to a different section. It is represented by three specimens. No 329, with leaves No 123 & 141 stems only. All these stems are small branches, 1 to 1½ cent. diameter. The leaves are not very distant nor crowded, linear, slightly enlarging upward narrowed and rounded at the point of attachement on inflated mamilla, reniform at the top as seen on 123 (figure one) decurring and narrowing downward, rarely preserved upon the stem leaving after erosion or abrasion linear, short parallel interrupted narrow ridges ~~marks~~ giving to the surface of the stems an appearance of coarsely striate. By the form and the position of the leaves, it resembles C. Manfeldi, the nerves being very distinct, especially when the epidermis is destroyed. Primary nerves 3 to 4 in two millim. with three or four more rarely five thin intermediate veinlets; surface distinctly crowwrinkled. None of the leaves is preserved entire, the longest one broken left to the others at the top is 9 cent. long. See description p. 479 b 5. No 329 a is a small specimen a branch with top leaves attached to it showing distinctly mode of attachement (figure it with 123). Cordaites ellipticus of Grand Eury pl XXVII f. 5 has some resemblance to this but is far different.

4 ~~Cordaites deflexus~~ ~~Valeur transform~~ ~~Tanopsellum deflexum~~ sp. nov. (change name?) No 307. Stem or branch small two centimeters broad, (flattened). Leaves very long linear, flat, one cent. meter broad, 34 cent. long as far as seen to the point where they are broken and where the are of the same width, crowded and imbricated, decurrent at the and abruptly folded back in right angle to the stem above their point of attachement which is not distinctly seen and appears like a somewhat narrowed decurrent base. The stem being evidently covered by imbricated decurrent part of leaves. The surface of the leaves opaque, without any distinct veins or nerves. With a strong glass only it is seen provered by very thin all equal lines 25-30 in the millimeter and across by very thin lines quite as distinct in one way as in the other and therefore forming a network similar to that of very thin tissue. The specimen is dry, 40 cent. by thirty one with the branch or one side and the whole surface covered by the leaves all flattened in the same direction, parallel to each other and in right angle to the branch or fragment of stem. See description p 479 a (2). (The leaves are not far different than those of specimen 123 and 141.)

5. Cordaites ~~Tanopsellum~~ decurrens sp. nov. See description 478 b (2) 479 a 1.) from specimen No 159, 305, 141 ~~and~~ (313?) this one is somewhat obtuse. The large specimen 305 is the best. It shows the large stem part of which is decorticated, the cuticular part showing the mode of decurring of the leaves and the decorticated part showing the point of attachement. This should be figured, at least at least.

535 to show mode of attachement of the leaves their scars et. The corner of the plate where 161 is figured could be used for this. This species especially differs from C. deflexus by narrower somewhat thicker leaves with a shining surface and the very long decurrent narrowed part of the leaves. The areolation or epidermis of the leaves is of the same nature.

6. ~~Cordaites~~ Sagenopteris Contentiensis (or another name) specimen Mc 162. see figure 2 7c 2. Described p 479 b 3 – The leaves are about half the size of those of the former species, linear and equall in all their length. I can not see any trace of veins upon any part of the surface which is covered more generally with a thick epidermis transformed into coal with a rather granulous surface. This character separates them from the leaves of Grand Eury named Dicranophyllum which for the surface is opaque and without traces of stria or veins. Specimen Mc 3710 has bundle of the same kind of leaves. It represent a branch with scars very regular wrinkles or narrow flat ribs like those of Artisia when flattened with a bark of thin coal without traces of scars of leaves. This stem 19 cent. long, 4 cent broad, flattened is strangled in the middle by an articulation and a large scar of a branch like that of Calamites ramosus but without internal stariolle scars and from this branch and ~~from~~ under it is derived from the border of the stem comes out a bunch of leaves like the one figured and of the same character. The point of connection of these bundles of leaves to the stem is not positively seen as there is another separat bundle upon the same specimen, the one seemingly attached to the border of the stem may be casually placed there and therefore the connection merely apparent. The articulation of the branch and its nodes are however positively marked and like an anomaly in a branch referable to a Cordaites? – Another specimen 2334 has a branch of the same appearance and size marked across by the same transversal narrow flat ribs with a thin bark of coal and distinct and distant scars of leaves visible only upon the bark not at all marked under it. Mc 303 is a specimen representing a bundle of leaves of the same species some of which appear attached and decurring upon a very thin flexuous branch. But this two may be a mere appearance as the bundle of leaves is continuous below the branch and appear there without connection to it.

+6a Artisia: Mc 3710

7. Dicranophyllum? The above leaves have no reference or see above to Dicranophyllum: I have however specimen Mc 162. 6 which represents three narrow linear nerved or striated leaves not more than two millimeter broad and at least 10 cent long which seems enlarged at the base and there joined to or coming out of a small oval mutlett or carpolites like C. disciformis of Grand'Eury pl XXIV fig 7. They curve in smooth form and divide in filaments at the top just like the leaves of Dicranophyllum striatum, Grand'Eury.

8 ~~Dicranophyllum~~ ~~Cordaites~~ Fasciculatus Spec.? see description of Mc 258 or 250 p 479 a 3 By the size and the texture of the leaves this species is like Cordaites decurrens or like C. deflexus but leaves half a long. The point of attachment of the separate leaves is not perfectly distinct as in. however visible for the base of the point a and also distinctly seen for the ~~connected~~ fasciculate bases of leaves above the stem is flat and marked by irregular narrow ribs but appear thin and of the same texture as the leaves being smooth and shining like them

9 ~~Cordaites~~ Sagenopteris anomalus see figures and description C. Mss. p. 19 N. 79 & p. 30 N. 796. Compare specimen which have and complet description apparently for the texture of the leaves. – I have compared the specimen figured, 231. n° 26

10 Cordaites (Noeggerathia grandifolia) see description p. 478 a 1 & 2

which is evidently the top of the large specimen pl. 27. It shows the gradually pointed top of the stem which is still 6 cent broad below the point which is sup't seven centim long. The leaves figured exactly as on side, the other side being broken. Their angle to the stem gradually enlarges in descending. The stem is covered by the points marking base of scales which are still persistant and distinctly seen on the borders. On surface of the leaves, both cortical and decorticated is smooth but seen with the glass it shows eight or nine primary veins in two millimeters separated generally by two intermediate very thin secondary veins and not crossed by other at least none can be seen with a strong glass. It appears therefore to have the characters of a Cordaites.

10 Cordaites (Noeggerathia) grandifolia see description p. 478 a 1, 2. and figure compare Noeggerathia Bestätigung Göpp. Gatt. V. VI p. 108 pl. XII fig. 3.

11 Cordianthus species — C. gemmifer as I have exactly figured it is represented in two small specimens of Butts and in a very large one all No. 64 always a single branch to the large specimens some of the scales are evidently cut at the point as I marked it in pencil upon the figure of the plate in the other specimens the scales are more or less obtuse or acute scarcely if ever marked with a top cortex hence this is no character worth remarking. The upper surface of the scales is regulose in the length as seen in 64 a while in other specimens it is smooth and polished. The buds are either with or without bracts at the base, for they appear to be early fallen and are preserved only in the young branches or young buds. The specimen fig 3 pl XXVIII old. May be a young state of the same species, the scales are short few, very obtuse and striate or regulose lengthwise with a distinct midrib the buds without bracts or with very long linear ones, eleven to 12 millim. long. Specimens Di 94 & Di 98 in collection fro Mazo Creek appear with Cordianthus bacciferus. But they are obsolete by ferruginous nitrum and some of the buds evidently stem scales which appear as half destroyed by decomposition or maceration. Hence I can not describe any Cordaites bacciferus from bacca attached to stem.

12 Cordianthus? spec. Mc. 280 This is not yet figured but should be. It represents two nutlets ovate or round, the both deeply emarginate or indented at the point of attachement to a narrow stem and nearly opposite, one and an half centimeter in diameter with the surface nearly smooth or slightly obscurely striate lengthwise covered with a coating of coal here and there detached and with a narrow border formed or covered by coaly matter. These fruits have to allusion to fig 24 pl XXII of Lyc and Lesq for the basilar indentation and for the form to fig 26 of the same plate.

13 Remarks on Cordaites. I have never seen any leaf or fragment of leaf such as figured by Geinitz pl XXI fig 1 c of the Steinkohlen formation of Sachsen but I have seen and described in the book p. 359 a 1 as C. angustifolius narrow nearly cylindrical leaves from the anthracite of Penna. May be that should be considered as a new species or rather referable to Cordaites duplinervis Gö. H. & Ett. wide

14 Dicranophyllum species? Mc. 321 This specimen is a remarkable one and should be figured. It is partly described p. 498 a 1. The stem which is flattened but which seems to have been originally cylindrical is twelve centimeters long, 15 millimeters broad in its lower half or

as far high up as the first articulation with a branch and only one centimeter broad above this to the second articulation with two branches or more. From the second articulation in the middle, a branch diverge on an angle of about 50°. It is 6 to 7 millim. thick, a little more than 5 centimeter long where it is strangled a abruptly narrowed as for an articulation, topped and continued upward in the same direction either by a prolongation of the stem only a half of the same width, a part only two and an half centimeter long whose surface though divolete seemingly decidedly different from that of the lower part as it has not any coaly epidermis or bark and is officially striated in the length by three a four flat narrow costa only. The top of the main branch which is 5½ cent. long is also articulat and from the articulation two branches or leaves just like the one on the top of the lateral branches pass upwards, diverging from their point of attachement which is contiguous or both aside on the articulation. These two divisions appear rather divisions of branches rather than leaves for they are covered by a thin coaly epidermis like the main stem under which they are obscurely lowed as is also the main stem. It therefore appears that all the divisions from articulations either from the branches or from the stem are branchlets. This appears the more evident that from the upper main articulation and from the part of the stem under it narrow deeply nerved or divided leaves quite similar to those of Dicranophyllum come out in right angle to the branch. The stem there or under the articulations and below bears small circular or oval convex scars which appear those of narrow leaves ∞. These leaves are deeply distinctly nerved or strict like those of Cordaites still more distinctly

and at a short distance from the stem divide in two and then in fifteen lacinia. Specimen should be figured. I refer it to Dicranophyllum. There is another specimen, Mat 36 which still more positively indicate its relation to Dicranophyllum. It represents a fragment of stem only seven centimeters long 1½ cent broad with the same surface appearance as marked in the specimen 321. surface irregularly and obliquely striat covered with a thin coating of coaly matter bearing nearly in right angle and as in the former specimen very narrow leaves, one ½ to 2 millim. strait or obstinately simply nerved, the nerves a three dividing near the top a few in the upper part or in the leaves figured by Grand'Eury as Dicranophyllum. These leaves are enlarged at the base and the enlarged part is smooth or not nerved. There is no doubt that these fragment are referable to plants of the same nature as the Cordaites, the divergent leaves their position, point of attachement, being the same. The relation of the leaves upon the stem is not indicated by the scars which are merely a small nearly round button like protuberance.

15 Cordaites Mansfeldi. The specimen Mat 371. represent a large stem or branch still than that figured. From the base of the branch 2 to 3 cent thick a branch diverge in the same way as in my figure, on an aut angl of divergence. But the branch is stronger more developpet already about 22 cent. long with the bases which are all gradually and sharply acuminet with the borders somewhat enrolled towards the point. One of them is already about nearly 15 cent long. The nervation very distinctly marked is preserved in the leaves of the branches is same as in the specimen figured as in the large leaves, the primary veins varying from ½ to 1 mill. distance with 2 a 3 intermedial veins.

1. Ma. 376. Represents a very peculiar cone. It is born at the top of a cylindrical segment, strial stem 6½ cent. long 6 millim. broad passing up through the cone to its top at least a stem by a depressed strial line. The cone is 6½ cent long 3 cent. broad at its base gradually tapering to a point a conical. It bears placed in spiral protuberent ◇ scars ~~form~~ about two millim. distant from each other as are seen from those of the borders, these scars are those of leaves of Cordaites, narrowed at the base with those attached to the stem, 5 mill. broad. The primary nerves more or less distant, about 3 in one mill. with three or two intermediate ones, the surface rough transversally distinctly wrinkled. The remaining cone are covered by a scaly coating about 1/4th of a millim. thick which does not obliterate the strias of the stem, 7 primary ones with 2 thinner intermediate ones. They are more marked upon the scaly cortex than upon the surface deprived of it.

2. The reverse of Ma. 376 has a fragment of leaf 7 cent long, 8 mill. broad at the base gradually enlarging upwards to 32 millim. where it is broken. The primary veins are obliquely close 3-4 in one millim. with one intermediate veinlet often invisible. It appears by the nervation and the gradual enlarging of the leaf from a narrow inflated base ⬭ to be same as C. grandifolius described p. 478 a.

3. Cordaites serpens. sp. nov. Stem ~~long~~ narrow 1½ to 2½ cent broad wavy or serpentine apparently very long, one of my specimens, Ma 306 is 50 cent long varying in size from 12 to 24 millim, narrowest in the middle, enlarged at both extremities ~~which~~ passing through the whole length of the specimen and covered with close hemicent scars of leaves nearly rhomboidal ⬡. All the leaves are destroyed. Upon the specimen figured the leaves are about in right angle to the branches somewhat distant, narrow, 8 to 10 millim broad, flat, born upon semilunar scars somewhat narrowed at the point of attachment, linear (length not seen). Distinctly marked with primary veins 4-5 in 3 millim. space with 3-5 smaller intermediate veinlets, the primary obliquely reached the secondary oblique. The top of the branches ~~are~~ end into a large leaf, as large as the stem, long; the longest measures 28 cent. to the point where it is broken, covered with a thick coating of coal

thicker than that upon the leaves nervation distinct, in relief upon the bark showing on the under part the primary veins often just decided; primary vein about a in the stem leaves, a little dozen with the same number of intermediate veins also distinct scarcely or not at all wrinkled across as also the stem leaves. One specimen show the upper part with of a cylindrical stem deprived of its bark and marked across by deep very distinct obtuse equal ribs with the bark? or partly by a terminal leaf nearly two millim. thick on both sides and passing up in slightly widening to the terminal leaf. The point of the cylindrical stem is not cut but looks like a somewhat abrupt terminus or end as the coating of coal covering the leaf is continuous upon it and marked with nerves. This show therefore that the stem stopped growth abruptly and gave raise to the leaf which terminates it. As seen in the specimen the terminal leaf is enlarging upward. Sometimes as in No 393 series. it is at its base cut or divided in irregular lacinia diverging from it like fragments and flexuous. Their nervation is the same as that of the stem but by laceration of the leaves it becomes mixed and irregular more or less inflated per places.

1. Taeniophyllum imbricatum No 161 see description (prov.) p. 459 b. 2. Might be the same species as T. decurrens. Though different indeed. This is also part of a large stem. The leaves imbricated at base are not decurrent or do not appear to be. The stem along the borders are cut square at the base, slightly diminishing; the scars however are designed of the same character as in T. decurrens. or rather longer narrower linea not inflated at the lower end. The veins of the leaves under the coaly surface or epidermis are so thin that they are scarcely discernable with a strong glass. The nervation is the same as in T. decurrens. the leaves however are broader generally covered with the thick coating of coaly epidermis less or scarcely decurring upon the stem which is however covered by their imbricated base but not narrowed and costat as in specimen 305. Any how then can not be separated into different genera.

2 Fruits of Pl LIV. (provisoire) Fig. 5 resembles Podocarpus Congnuen G d P. pl XXI Fig. 6 resembles C. Guthrieri G Hk. Fig 7. is described p. 536 (12) Figs 8–11. are somewhat like C. ventricosus G. Hk. loc. cit. No. possible like new recognized

X [illegible]

[illegible] 335

[illegible] 3–4 mm wide [illegible] narrowing [illegible] appears [illegible] or coming out [illegible] substance [illegible] 1/2 to 1/3 of a millim. [illegible] marked [illegible] [illegible] intermediate nervet. It differs for [illegible] more [illegible] water. Bract more [illegible] linear leaves and the lower part of the [illegible] [illegible] Seen. This species appears to be Podocarpus [illegible]. The surface [illegible] with the decurrent [illegible] Podocarpus [illegible] the upper side of this [illegible] with [illegible] is [illegible]

compare C. lingulatus Gp. Ht. pl. 212. fig. XX, described as lingulatus 540

[illegible]

Cordaites Lacei. sp. nov. sp. 531. 531a. of Lace. see figure in paper [illegible]
leaves small from 7 – 12 cent long, 3 to 4 cent broad. all [illegible] oblong
linguiform slightly incurved, with a comparatively broad [illegible] 13 to 20 millim. very distinctly veined, veins seen [illegible] 1.6 of a millimeter distant separated by four to five very thin reinlets. [illegible]
two leaves. In the one the epidermis is mostly stripped and the [illegible]
medial veins are not seen. In the smaller one the reinlets are [illegible]
fornical veins parallel obtuse offset equally the epidermis [illegible]
decurrent distinct. The leaves are somewhat thick. [illegible]

Cordaites Gertrudæ. Lace. n° 538. [illegible] 3a. There is a small one obovate rhombic 3 cent long
seven millim broad at the base 1 p cent broad near the obtuse top, nervation (reinlets) not distinct but
primary veins [illegible]

Cordaites Calamitoides. Lace n° 539. [illegible]
[illegible] 2 cent long, 1 cent broad where it is [illegible]
[illegible] measured [illegible]
[illegible] like those of [illegible]
[illegible] with [illegible]
[illegible] veins [illegible]
[illegible] which though [illegible]
[illegible]

compare Noeggerathia Buckeri and Goep. Tran. p. 222 pl. 42

Cordaites Mansfieldi. sp. n° 529. of Lacey has a large specimen. [illegible]
perfectly agreeing with the description all the details the leaves [illegible]
cut none seen to the end exactly linear.

Cordaites [illegible]. I refer to this species a number of leaves [illegible] 533 of Lacey, all which have a [illegible] 1 to 5 [illegible]
[illegible] mostly obtuse [illegible]
[illegible] slightly wavy the veins where they appear indistinctly being very obtuse two in every
millim. [illegible] generally distinct and 3 – 5 in one millim.
[illegible] in the normal form. [illegible] the distance [illegible]
veins in some places [illegible] appear as a distinct [illegible]
[illegible] more distinct are seen separated by 2. 4 to 5 very thin reinlets which however appear
[illegible] in the primary veins [illegible] there is not a vestige [illegible]
[illegible] the leaves.

Cordaites Lacei. Among other leaves sent by Lacey there is a small one obovate 3 cent long
seven millimeters broad at the base, 1½ cent broad near the very obtuse top: primary veins
prominent, the reinlets scarcely discernable. Compare Gp. Ht. pl. XXI f. 3 Co. foliolatus.

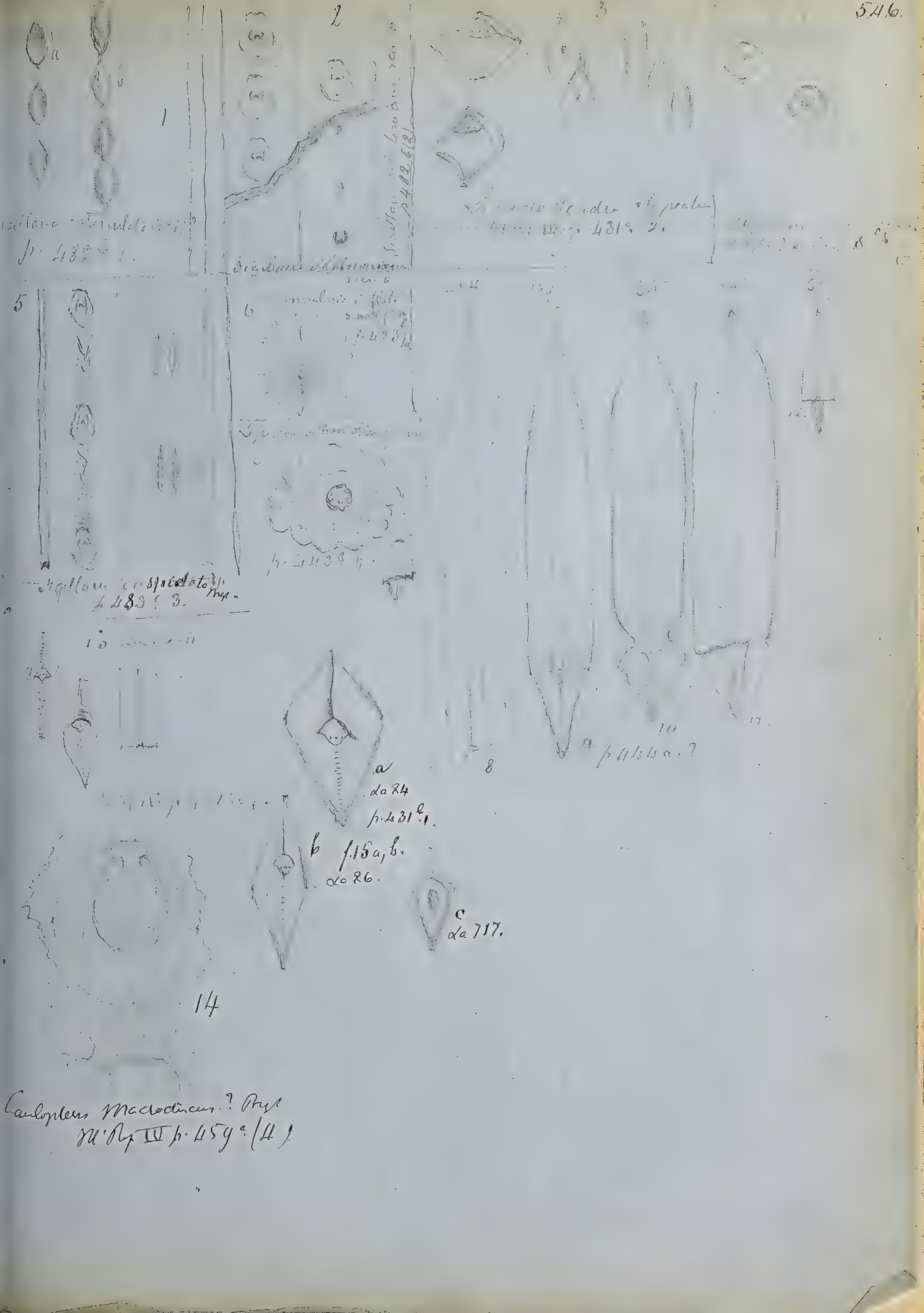
1 Cordaites? grandifolius? flowers. Saw 46a. Racem about 18 cent long curved ⌒ in the middle, axis or stem grooved in the middle, two millim. broad heavy mostly opposite ~~terminal~~ glomerules or gemmules of a few imbricated scales, which when detached show an oval nutlet. gemmules ovate or obovate the largest near the base of the racème point fine millim long three to 3½ millim broad. the nutlet when the involucres are out is about as large. The same specimen has a long narrowed base of Cordaites grandifolia and nutlets like those of Cordianthus bacifer Grand'H. pl. 26, fig. 10. but nearly round 7-8 millim across emarginate at base and surrounded by a ring. like fig 27 same plate Diploteste Grand'Eury, Bryl. These flowers therefore are gemmiferous when surrounded by the involucres but truly baciferous when ripe.

2. Dicranophyllum gallicum Grand'H. Ma p. 506. represent short leaves 3 to 4 cent long, half cent broad at the base, forking dichotomy from the main axis and the forks dividing again in five lanceolate divisions, either simple and pointed or still forking at the point. The substance is thick rugose the large divisions marked by two or three wavy or obscure veins. These leaves are like those of Grand'Eury Pl XIV f. 10. described under the above name p. 275

3 Cordaites radiatus or radiatus Sp. nov. Ma. 528 Leaves flattened flat like around a central axis 22 leaves linear narrowed to an obtuse point four to 8 centimeters long four to seven millim. broad. distinctly nerved, nerves separated by one or two very rarely three veinlets, surface somewhat wrinkled by indistinct crow wrinkles a beautiful plant

4 Cordaicarpus attached to a branch of Cordaites costatus. Ma. 531: 2b. The branch is flexuous, ten centimeters long, a little more than one centimeter broad, marked by the prominent thick wedge shaped bases or supports of bases of leaves as seen in Pl LXXX f. 2 but more inflated up to seven millim broad near the round inflated top narrowed into a flexuous lanceolate pedicel. The scars appear in spiral four to five for a spiral. The fruit is oval three centimeters long from the point of attachment, nearly three millimeters broad flattened with a border of three millimeters broad marking perhaps around the point of connection of the fruit to the stem is distinctly seen upon the back impression of the stem a counterpart of the specimen. where the half the stem of the fruit is left attached while the other half is empty the real stem. Difficult to represent without figure


6
7
Krorna
imbricata
a recollée
Epitodicus
theimonenus
8
10
11



Carlopterus Macrodiscus ? Ag.
M. Ag. III p. 459 c. (4.)

547.

[illegible] exupiq. [illegible] Dor: Cordiz. in guadalup. 21

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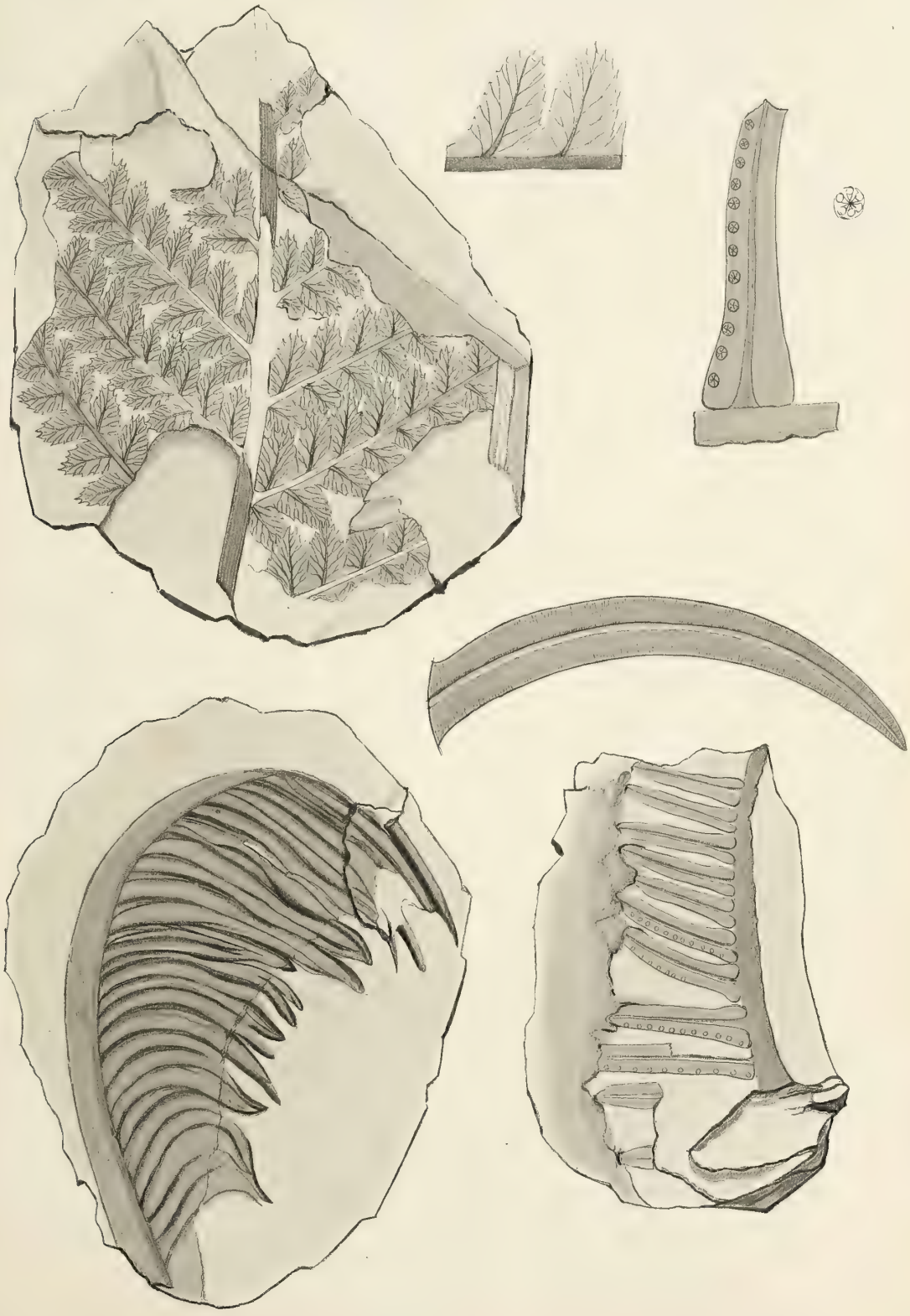
PLATE XI.



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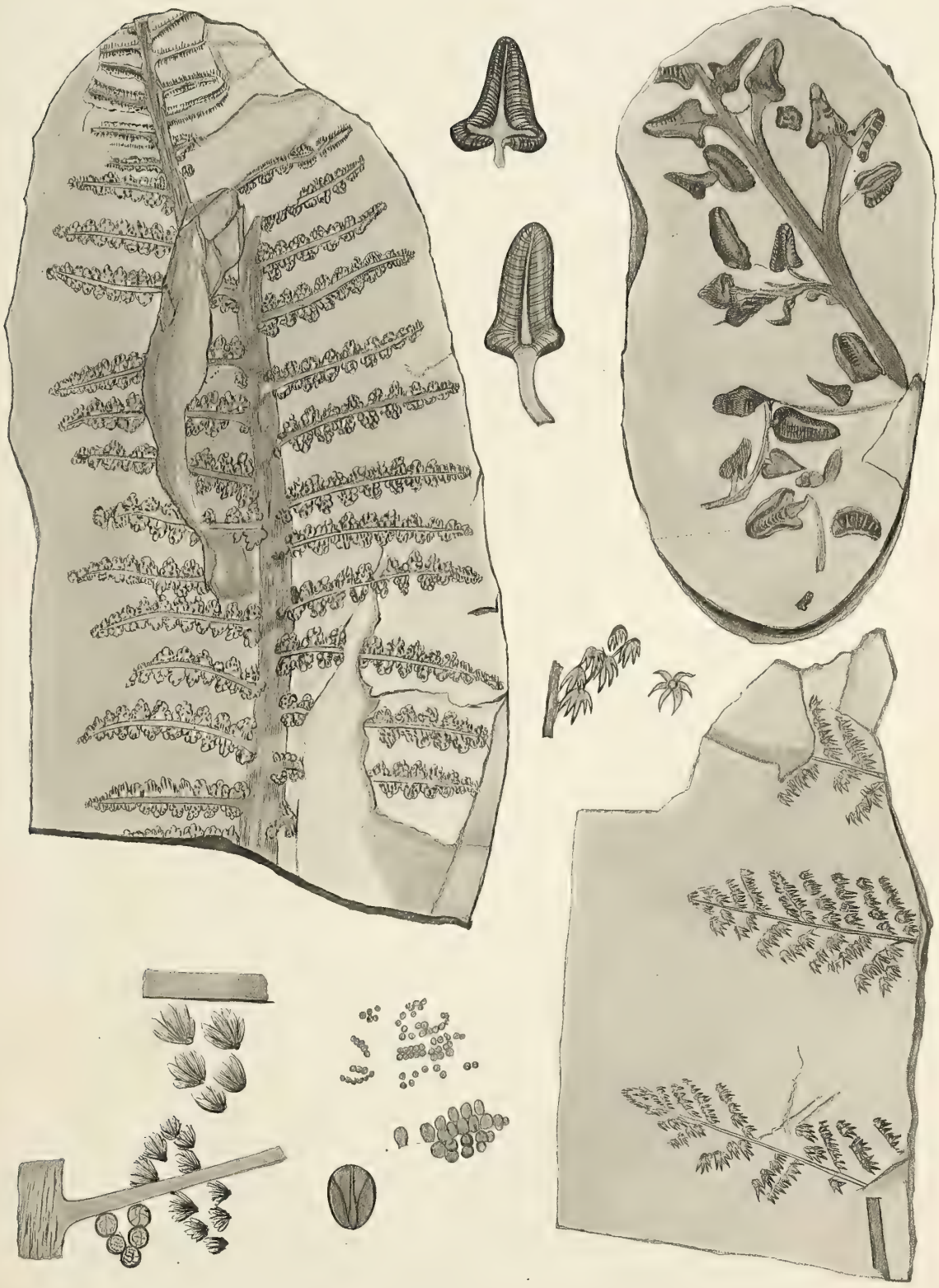

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1 & 2 Sphenopteris Scai

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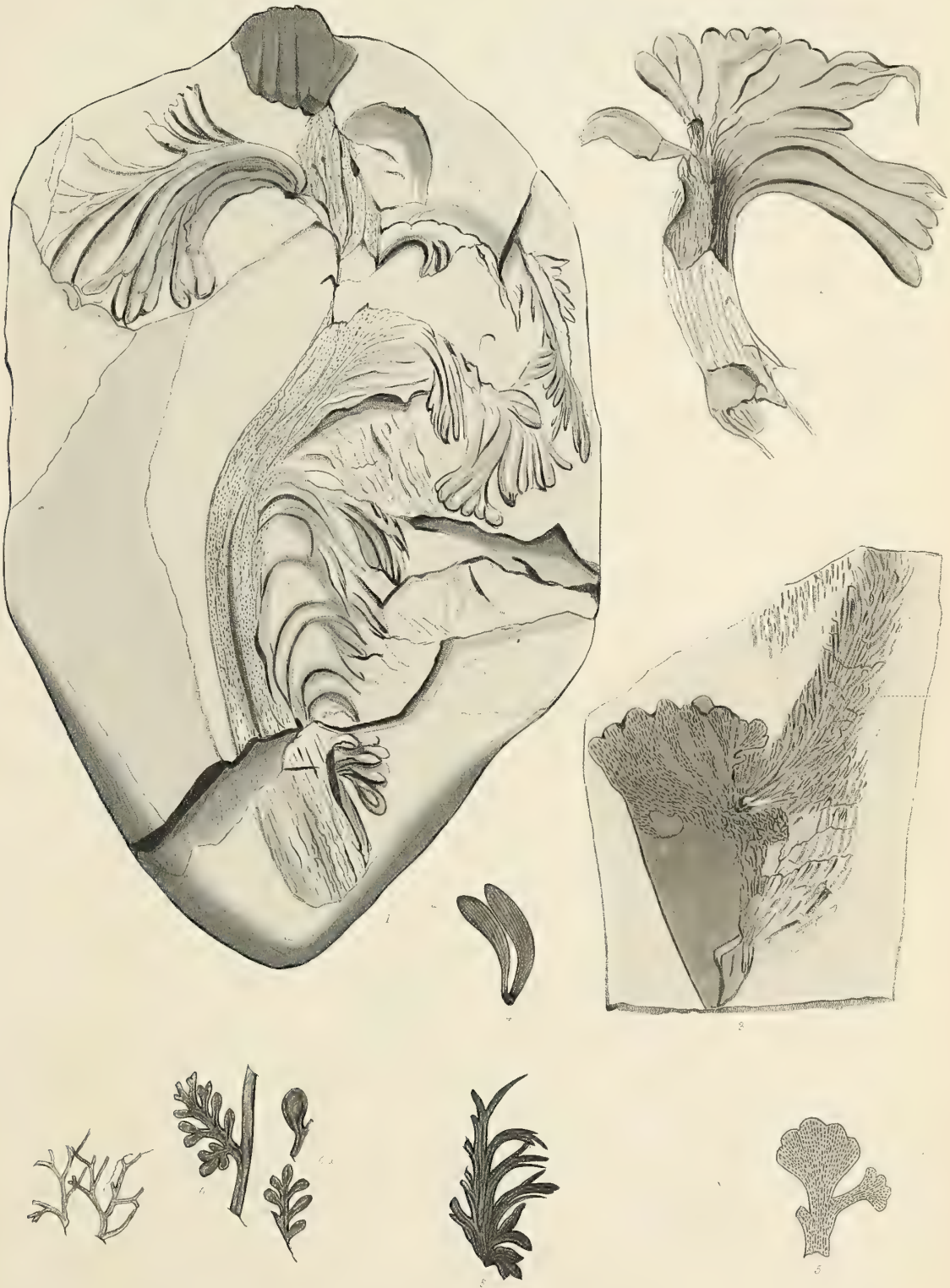

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PLATE XVII.

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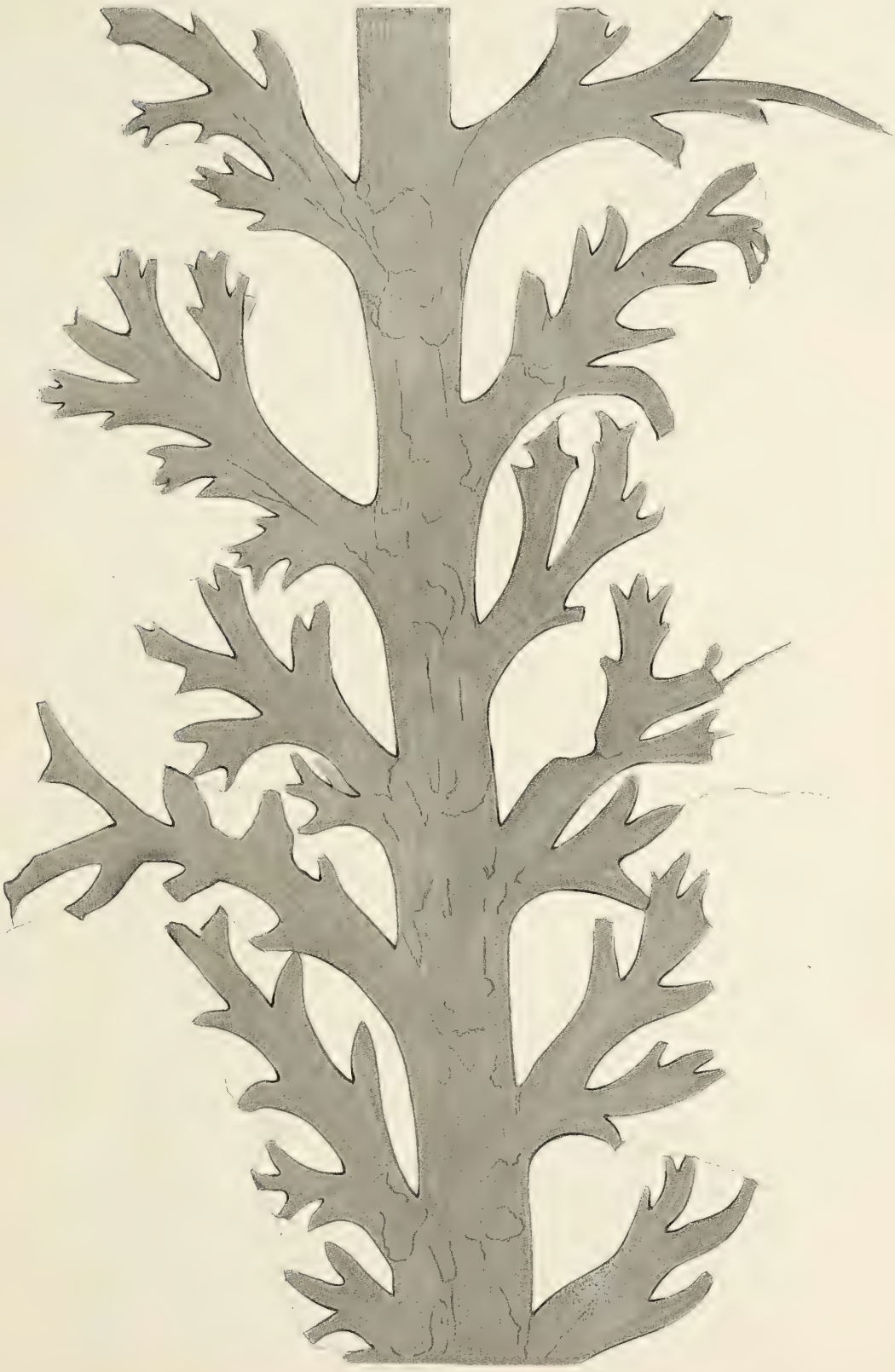

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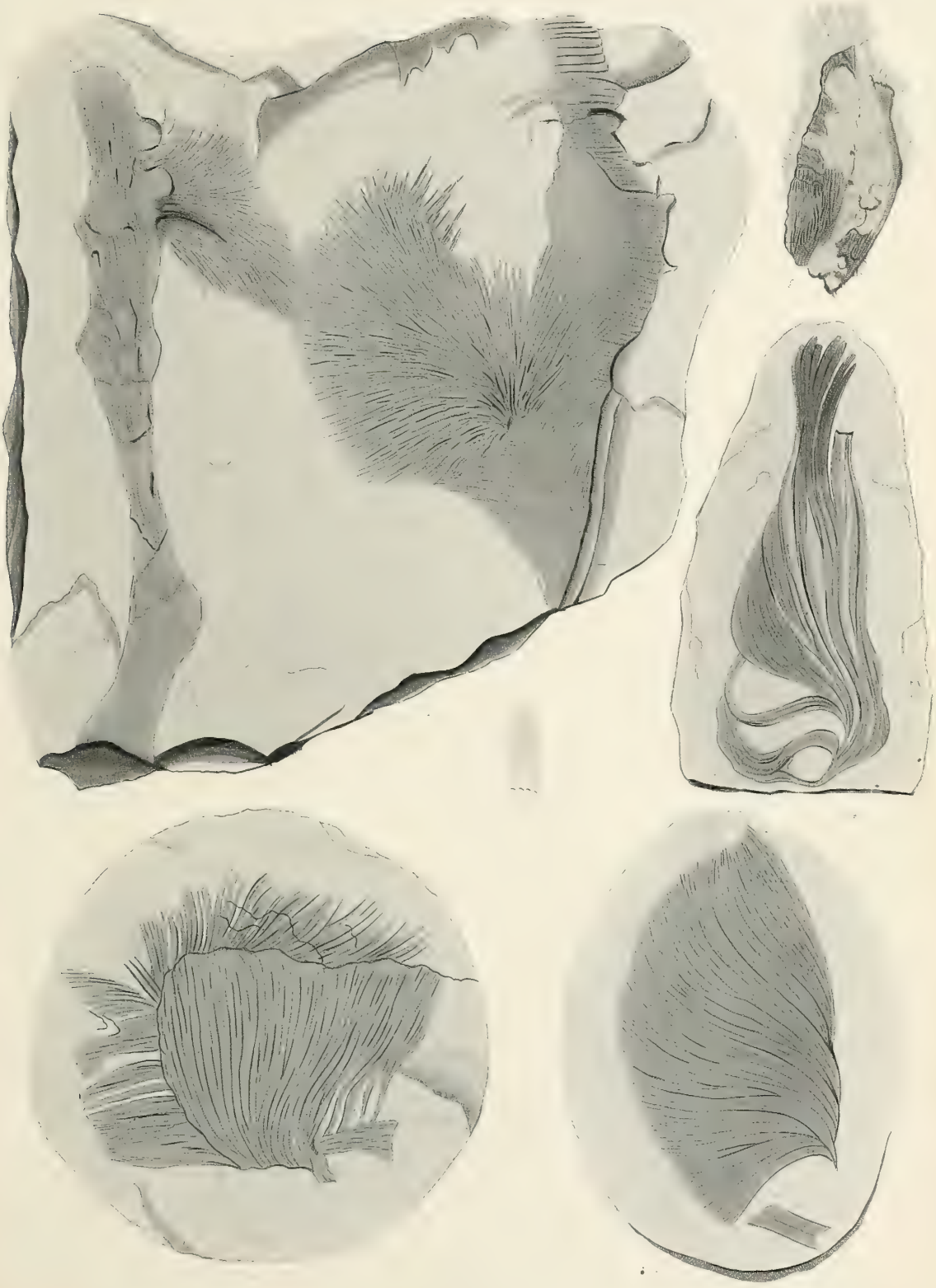

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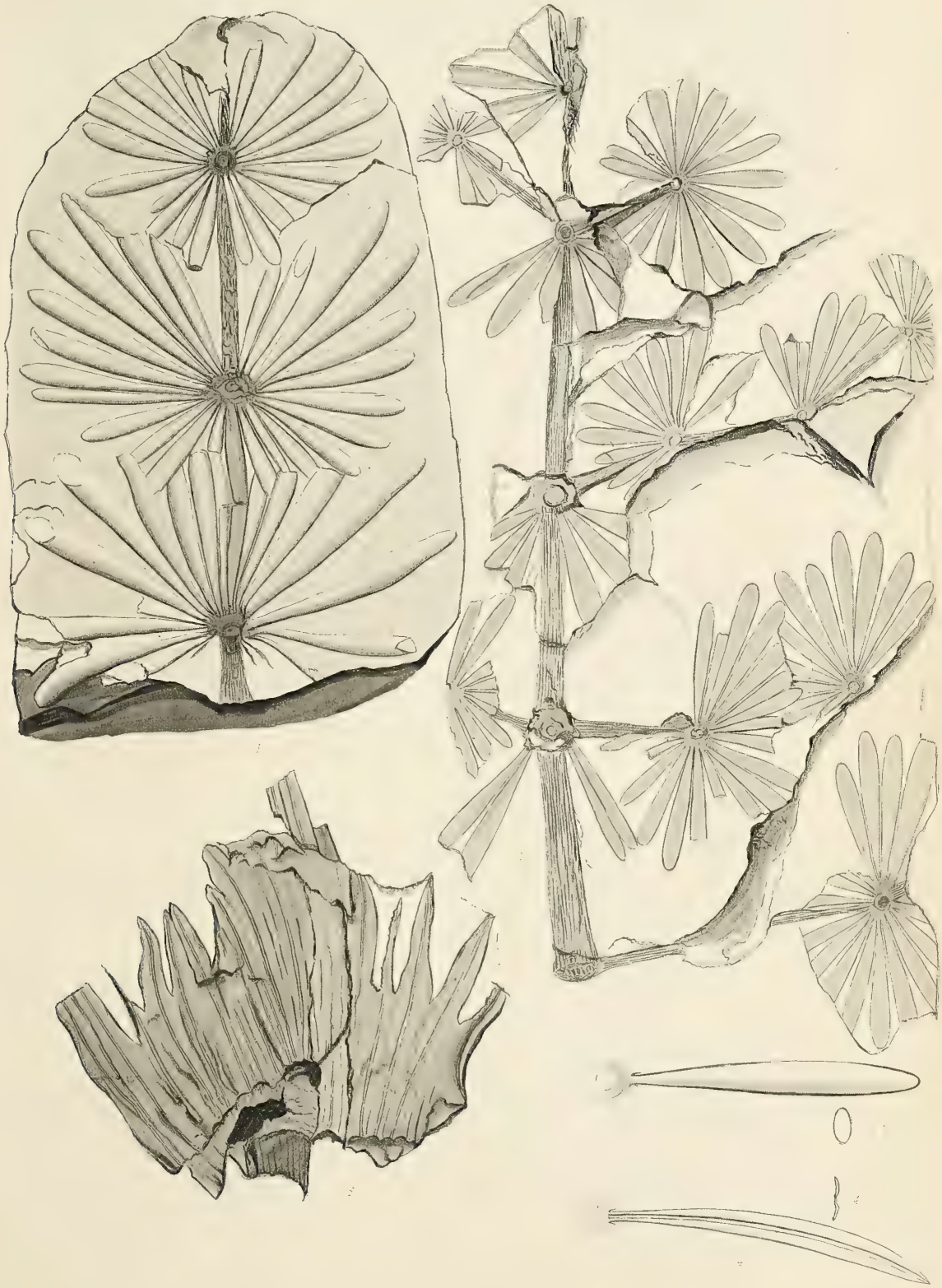

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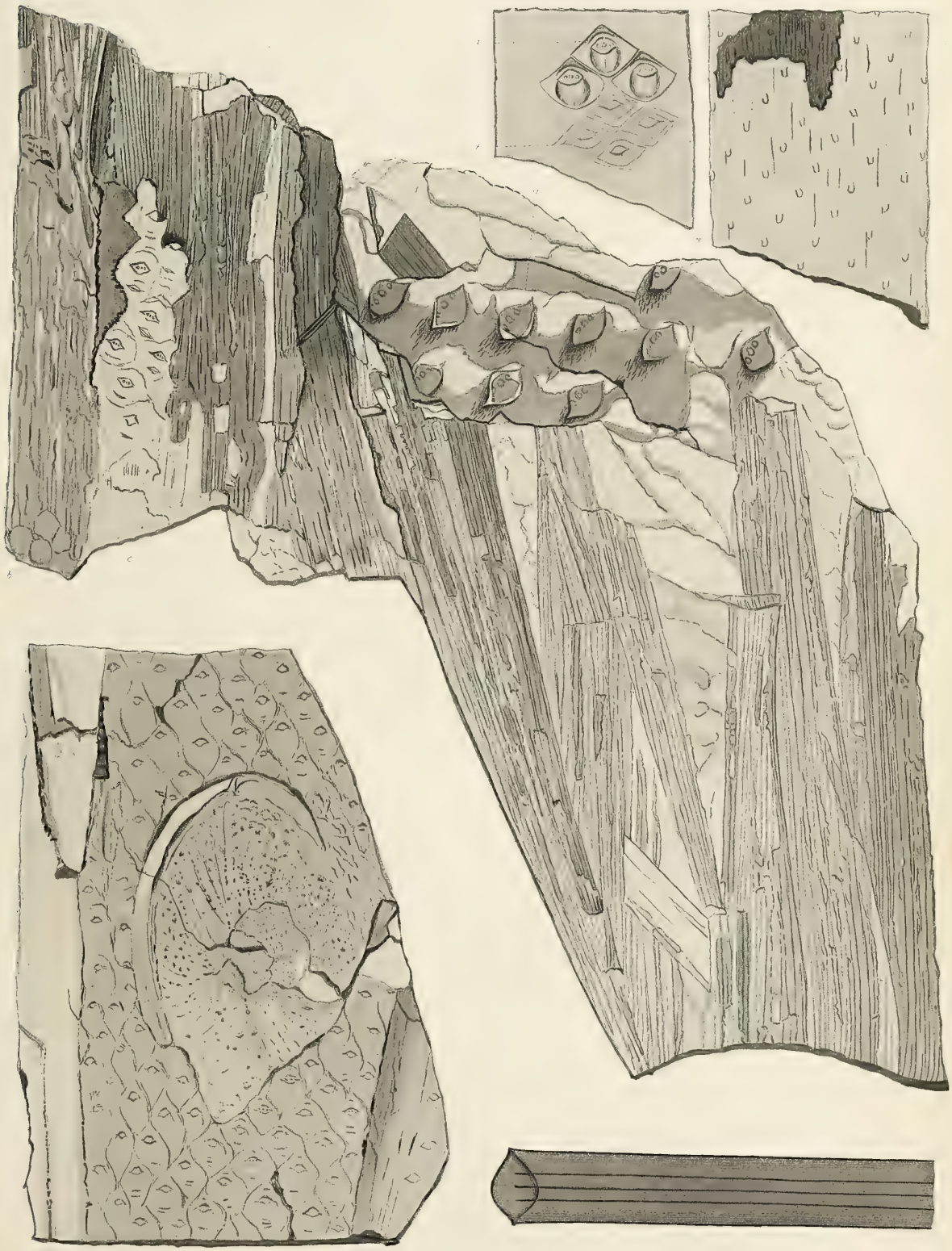

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CARBONIFEROUS (Coal Measures) FOSSIL FLORA

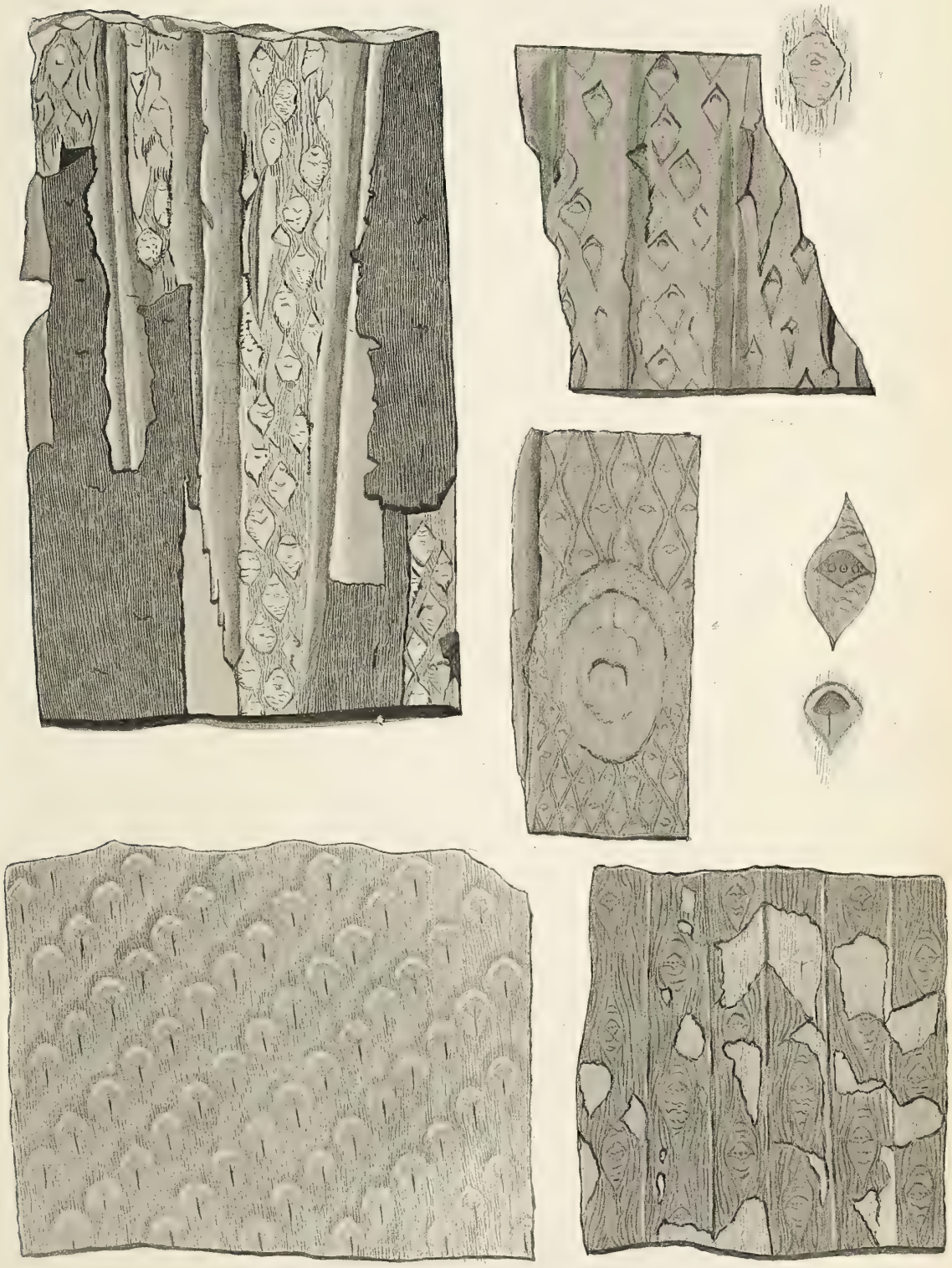

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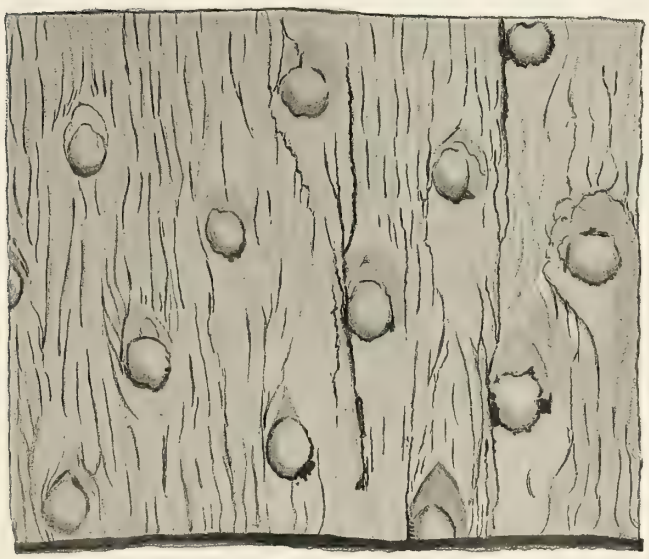
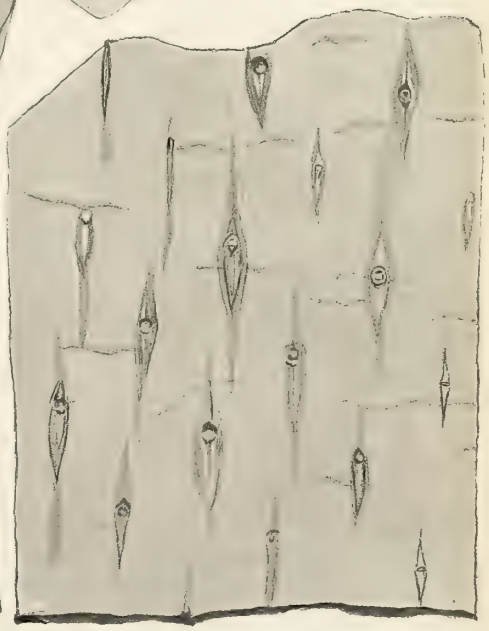
PLATE XXIV.

PLATE XXV.


1
3
3a
3b





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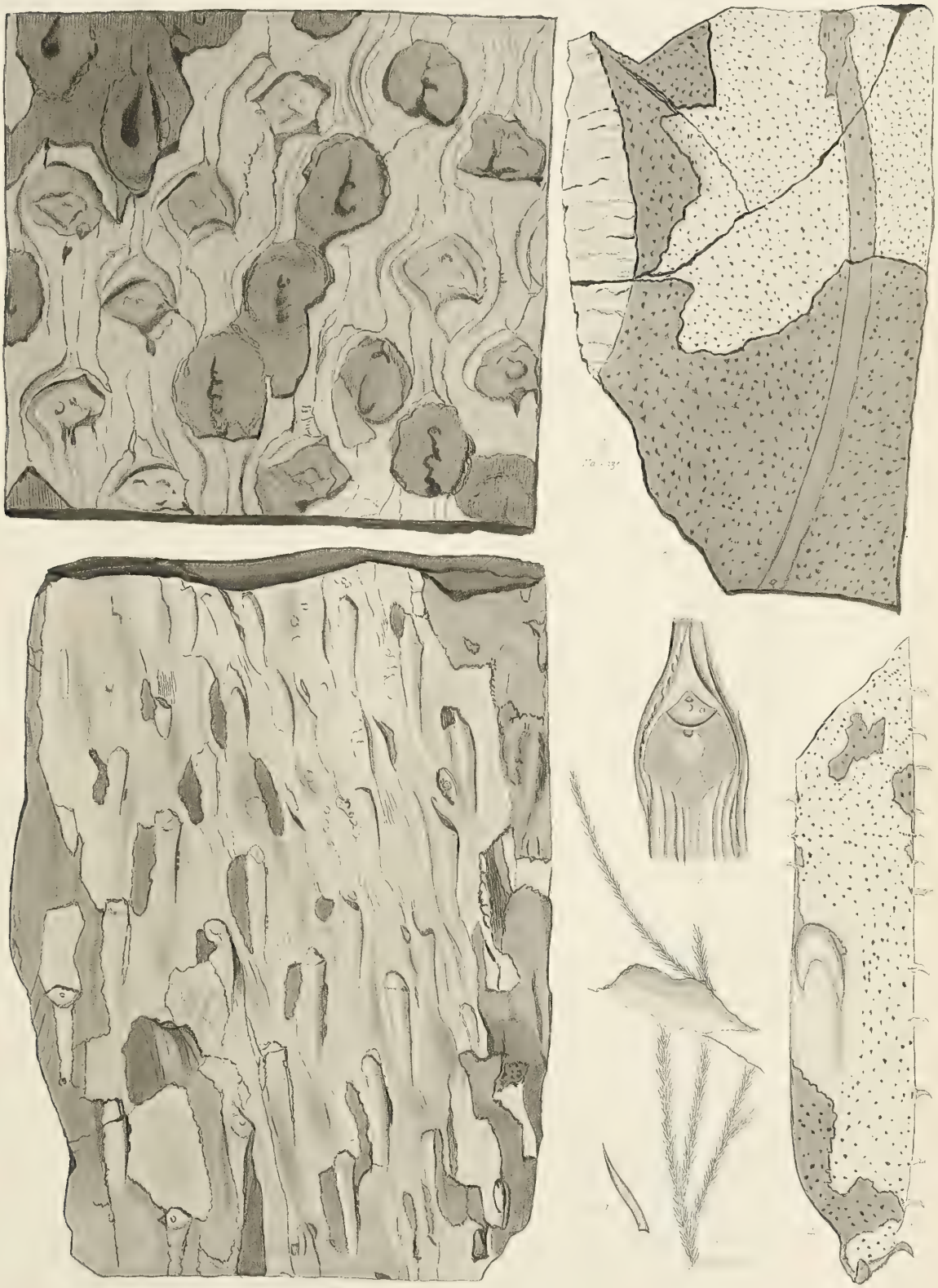

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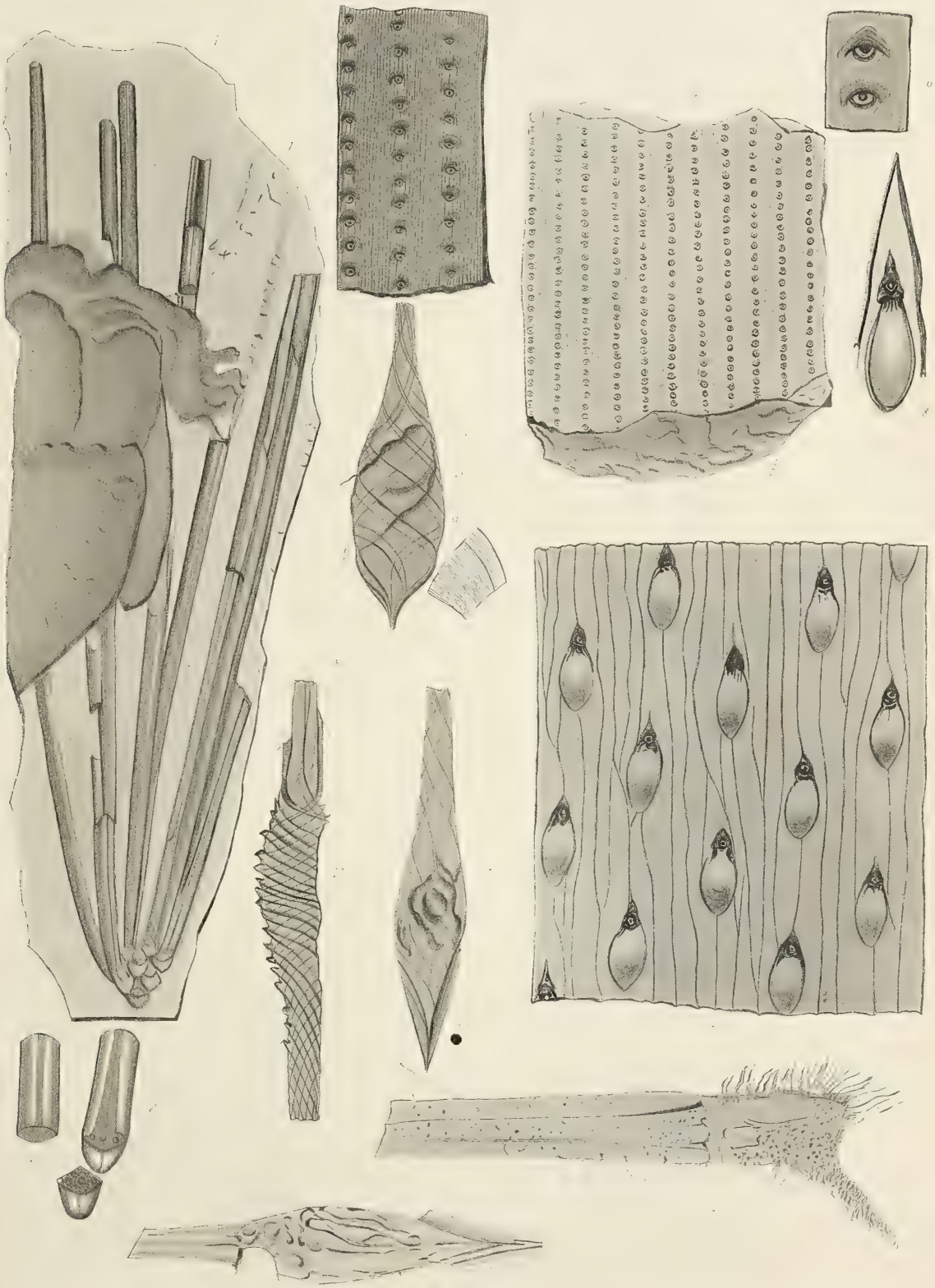

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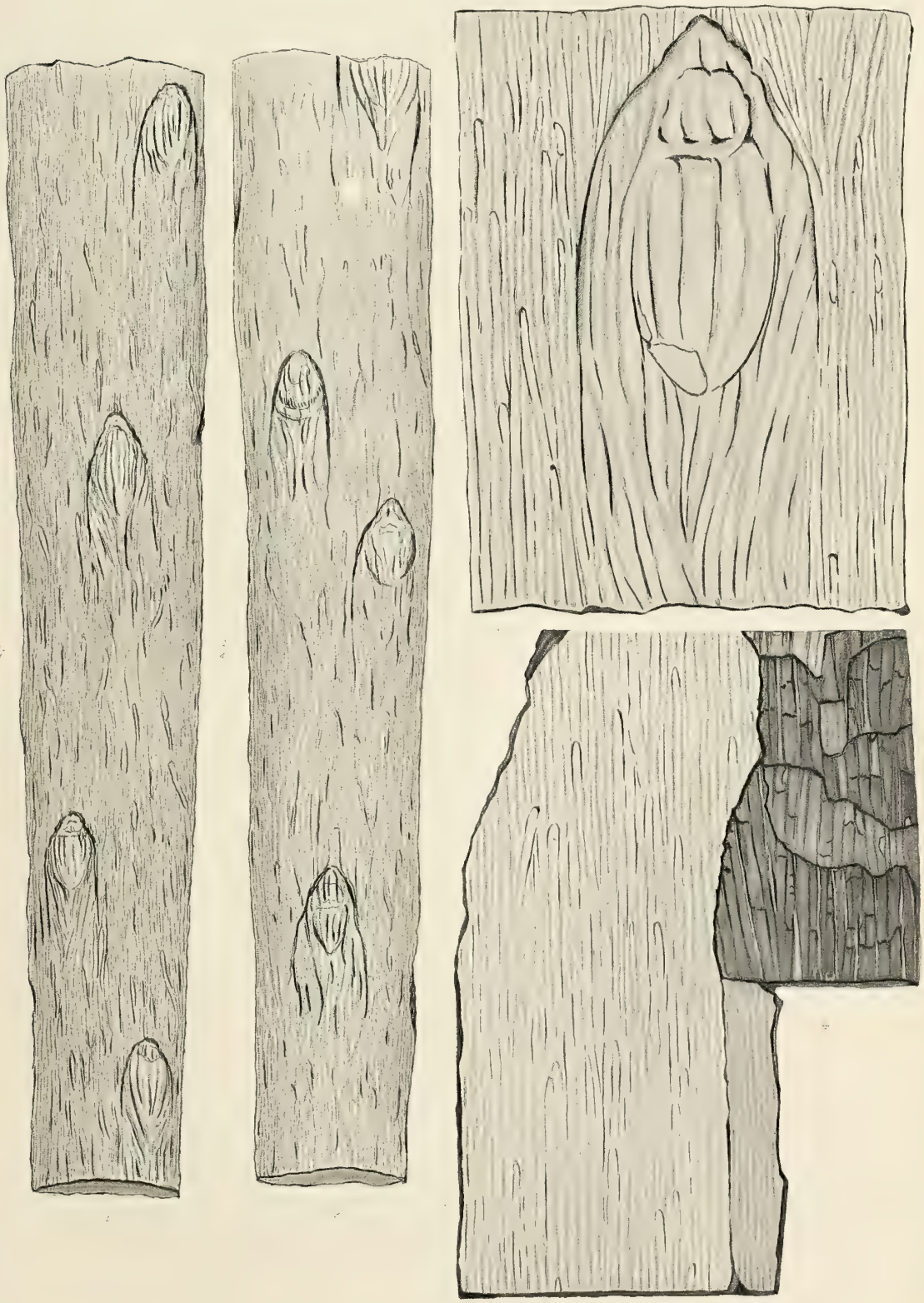

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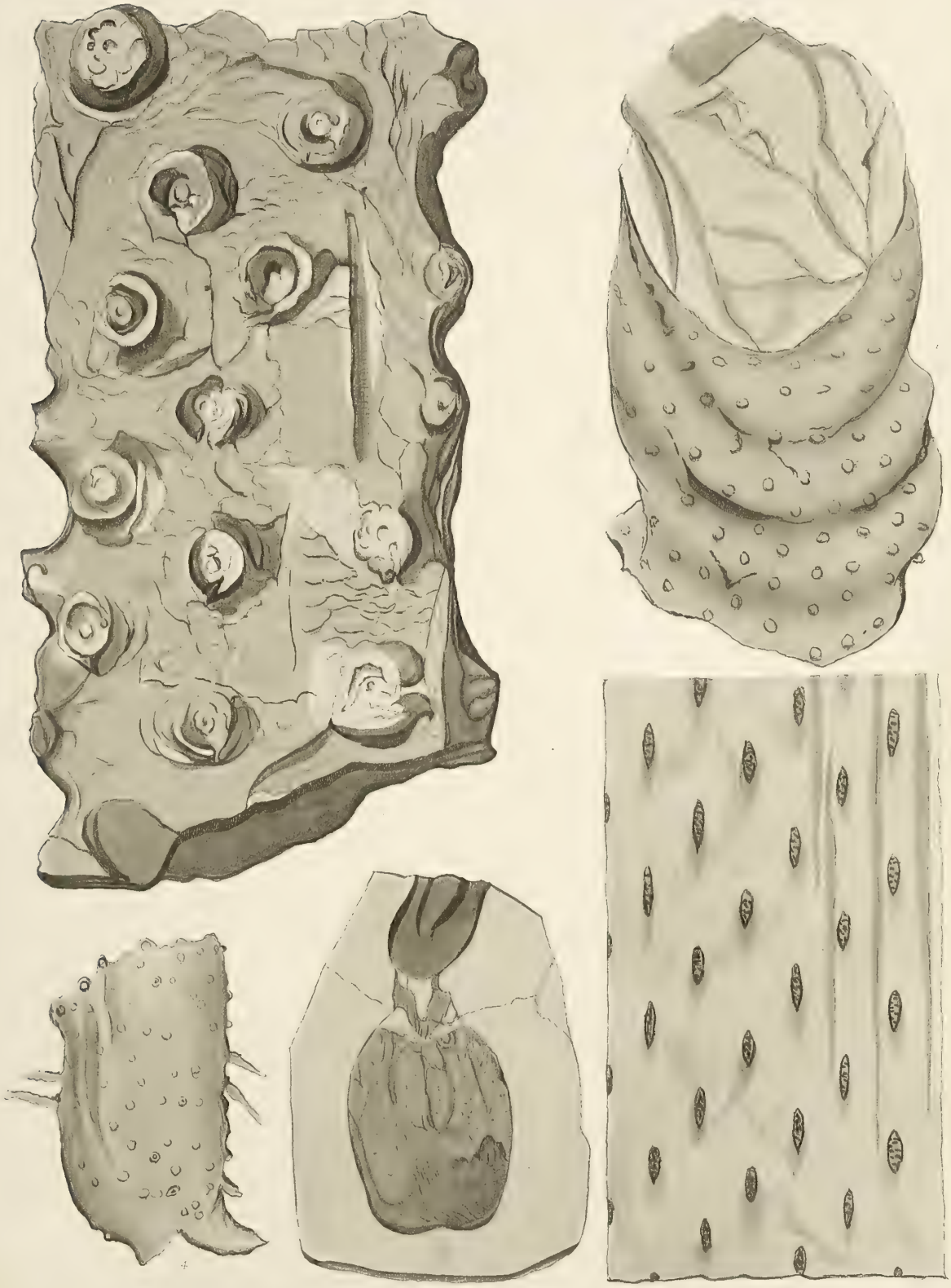
1. Compare Ancistrophyllum Göpp.



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CARBONIFEROUS [Coal Measures.] FOSSIL FLORA

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