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ON THE
FLORA OF THE DEVONIAN PERIOD
IN
NORTH-EASTERN AMERICA.

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THE existence of several species of land-plants in the Devonian rocks of New York and Pennsylvania was ascertained many years ago by the Geological Surveys of those States, and several of those plants have been described and figured in their Reports*. In Canada Sir W. E. Logan had ascertained, as early as 1843, the presence of an abundant, though apparently monotonous and simple, flora in the

* Hall and Vanuxem, Reports on the Geology of New York; Rogers, Report on Pennsylvania.

ERRATA ET CORRIGENDA.

Pages 296-329 inclusive. A delay in the transmission to Dr. Dawson of a proof of his paper having occurred, the Author's corrections were not received until after its publication, and the following list of *Errata* has consequently become necessary:—

- Page 299, line 30, for M'Clakeney's read M'Closkeney's.
" " line 30, for Cones read Coves.
" " line 39, for Fort House read Fort Howe.
" 305, line 8, second column, for *decurrens* read *discrepans*.
" " line 11, first column, for *Goepfert* read *Lesquereux*.
" 309, line 26, for *Skaneatales* read *Shenectales*.
" 310, line 4 from bottom, for specimen read specimens.
" 313, line 14, for Houghton read Houghton.
" 314, line 9 from bottom, for *pinnaeformis* read *pennaeformis*.
" " line 7 from bottom, for were read was.
" 321, line 25, for *Davallioides* read *Davallie*.
" 323, line 27, for *Rimeriana* read *Ræmeriana*.
" 324, line 5, for Mr. Lann read Mr. Lunn.
" " last line, for *lineata* read *hirsuta*.
" 325, line 12, for *invested* read *inverted*.
" 327, Table, No. 57, for *decurrens* read *discrepans*.
" 329, Description of Plate XIII. fig. 25, for *C. acutum* read *C. obliquum*.
" " " " XV. fig. 39, for *obtusilobus* read *curtilobus*.
" " " " " fig. 40, for *decurrens* read *discrepans*.
(See also the Appendix.)

Devonian strata of Gaspé; but it was not until 1859 that these plants were described by the author in the 'Proceedings' of this Society*. More recently Messrs. Matthew and Hartt, two young geologists of St. John, New Brunswick, have found a rich and interesting flora in the semi-metamorphic beds in the vicinity of that city, in which a few fossil plants had previously been observed by Dr. Gesner, Dr. Robb, and Mr. Bennett of St. John; but they had not been figured or described. These plants, however, I described in the 'Canadian Naturalist' †, together with some additional species, of the same age, found at Perry, in the State of Maine, and preserved in the collection of the Natural History Society of Portland. The whole of the plants thus described I summed up in the paper last mentioned as consisting of 21 species, belonging to 16 genera, exclusive of genera like *Sternbergia* and *Lepidostrobus*, which represent parts of plants only.

In the past summer I visited St. John; and, in company with Messrs. Matthew and Hartt, explored the localities of the plants previously discovered, and examined the large collections which had been formed by those gentlemen since the publication of my previous paper. The material thus obtained proving unexpectedly copious and interesting, I was desirous of having opportunities of fuller comparison with the Devonian Flora of New York State; and, on application to Prof. Hall, that gentleman, with consent of the Regents of the University of New York, kindly placed in my hands the whole of his collections, embracing many new and remarkable forms. Prof. C. H. Hitchcock, State-geologist of Maine, had in the meantime further explored the deposits at Perry, and has communicated to me three new species discovered by him. The whole of these collections, amounting in all to more than sixty species, constitute an addition to the Devonian Flora equal in importance to all the plants previously obtained from rocks of this age, and establish for some of the species a very extensive distribution both geologically and geographically; they allow, also, more satisfactory comparisons than were heretofore practicable to be instituted between the Devonian Flora and that of the Carboniferous Period.

I shall first shortly notice the geological character of the localities, with lists of the fossils found in each, and shall then proceed to describe the new species.

I. NOTICES OF THE LOCALITIES OF THE DEVONIAN PLANTS.

1. *State of New York*.—The geology of this State has been so fully illustrated by Prof. Hall and his colleagues, and the parallelism of its formations with those of Europe has been so extensively made known by Murchison and others, that it is only necessary for me to state that the fossils entrusted to me by Prof. Hall range from the Marcellus Shale to the Catskill group inclusive, and thus belong to the Middle and Upper Devonian of British geologists. The plants are distributed in the subdivisions of these groups as follows:—

* Quart. Journ. Geol. Soc. vol. xv. p. 477.

† Vol. vii. May 1861.

UPPER DEVONIAN.

Catskill Group.

Aporoxylon.	Cyclopteris Jacksoni, Dawson.
Sigillaria Simplicitas, Vanuxem.	Rhachiopteris punctata, sp. nov.
Lepidodendron Gaspianum, Dawson.	— cyclopteroides, sp. nov.
Psilophyton princeps, Dawson.	

Chemung Group.

Sigillaria Vanuxemii, Gæppert.	Lycopodites Vanuxemii, sp. nov.
Syringodendron gracile, sp. nov.	Cyclopteris Halliana, Gæppert.
Stigmaria exigua, sp. nov.	Psilophyton princeps, Dawson.
Lepidodendron Chemungense, Hall.	Acanthophyton spinosum, sp. nov.
— corrugatum, Dawson.	Rhachiopteris striata, sp. nov.

MIDDLE DEVONIAN.

Hamilton Group.

Syringoxylon mirabile, sp. nov.	Psilophyton princeps, Dawson.
Dadoxylon Hallii, sp. nov.	Cordaites Robbii (?), Dawson.
Aporoxylon.	—, sp. nov.
Sigillaria.	— angustifolia, Dawson.
Didymophyllum reniforme, sp. nov.	Cyclopteris incerta, sp. nov.
Calamites Transitionis (?), Gæppert.	Rhachiopteris striata, sp. nov.
— inornatus, sp. nov.	— tenuistriata, sp. nov.
Lepidodendron Gaspianum, Dawson.	— pinnata, sp. nov.
— corrugatum, Dawson.	

2. *Maine.*—The only locality in this State that has hitherto afforded fossil plants is Perry, near Eastport, in the eastern part of the State. The plant-bearing rocks are grey sandstones, resembling those of Gaspé, and associated with red conglomerate and trappean or tufaceous rocks, which, according to the recent observations of Prof. C. H. Hitchcock*, rest unconformably on shales or slates holding Upper Silurian fossils†. I have little doubt that these beds at Perry are a continuation of part of the series observed at St. John, New Brunswick; and it is probable that they are Upper Devonian. The following species occur at this place:—

Lepidodendron Gaspianum, Dawson.	Megaphyton?
Lepidostrobus Richardsonii, Dawson.	Aporoxylon?
— globosus, Dawson.	Cyclopteris Jacksoni, Dawson.
Psilophyton princeps, Dawson.	— Brownii, sp. nov.
Leptholcæum rhombicum, sp. nov.	Sphenopteris Hitchcockiana, sp. nov.

3. *Canada.*—Devonian beds holding fossil plants occur in Eastern Canada, in Gaspé, and in Western Canada, at Kettle Point, Lake Huron. At the former place there is an extensive series of sandstones and shales, regarded by Sir W. E. Logan as representing the whole of the Devonian series, and containing plants throughout, but

* Report on the Geological Survey of Maine, now in the press.

† See also notices by Dr. Jackson and Prof. Rogers in the 'Proceedings of the Boston Society of Natural History.'

more abundantly in its central portion*. At the latter a few plants have been found in shales of Upper Devonian age. The plants found at Gaspé were described in my former paper, and are—

Prototaxites Logani, <i>Dawson.</i>		Psilophyton robustius, <i>Dawson.</i>
Lepidodendron Gaspianum, <i>Dawson.</i>		Selaginites formosus, <i>Dawson.</i>
Psilophyton princeps, <i>Dawson.</i>		Cordaites angustifolia, <i>Dawson.</i>

The plants from Kettle Point, noticed with doubt in my former paper, I may now refer to the following species:—

Sagenaria Veltheimiana, <i>Göppert.</i>		Calamites inornatus, sp. nov.
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4. *New Brunswick.*—The rocks in the vicinity of the city of St. John, constituting a part of the coast metamorphic series of New Brunswick, have been described in the official reports of Dr. Gesner and Dr. Robb†; and additional facts respecting their stratigraphical relations, ascertained by Mr. Matthew, were stated in my paper in the ‘Canadian Naturalist,’ already referred to. The new interest attached to these beds, in consequence of the discovery of their copious fossil flora, induced me to re-examine all the sections, in company with Mr. Matthew, during my late visit; and that gentleman has recently extended the limits of our observations eastward in the direction of Mispec. The results of these observations I shall state in some detail, as the precise age of the St. John series has not until now been determined.

The oldest rocks seen in the vicinity of St. John are the so-called syenites and altered slates in the ridges between the city and the Kennebeckasis River. These rocks are in great part gneissose, and are no doubt altered sediments. They are usually of greenish colours; and in places they contain bands of dark slate and reddish felsite, as well as of grey quartzite. In their upper part they alternate with white and graphitic crystalline limestone, which overlies them in thick beds at M’Clakeney’s and Drury’s Cones on the Kennebeckasis, and again on the St. John side of an anticlinal formed by the syenitic or gneissose rocks, at the suburb of Portland. These limestones are also well seen in a railway-cutting five miles to the eastward of St. John‡, and at Lily Lake. Near the Kennebeckasis they are unconformably overlain by the Lower Carboniferous conglomerate, which is coarse and of a red colour, and contains numerous fragments of the limestone.

At Portland the crystalline limestone appears in a very thick bed, and constitutes the ridge on which stands Fort House. Its colours are white and grey, with dark graphitic laminæ; and it contains occasional bands of olive-coloured shale. It dips at a very high

* Reports of the Geological Survey of Canada; paper on the Devonian Plants of Gaspé, Quart. Journ. Geol. Soc. vol. xv.

† Gesner’s Second and Third Reports on the Geological Survey of New Brunswick; Robb, in Johnston’s Report on the Agriculture of New Brunswick.

‡ At this place the limestone is penetrated by a thick vein of graphitic granite, holding black tourmaline; and at Drury’s Cove, not far distant, it contains dykes of dark-coloured trap.

Fig. 1.—Section taken along the Eastern Side of Courtney Bay, New Brunswick.

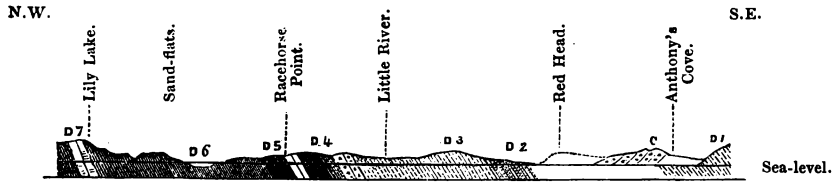
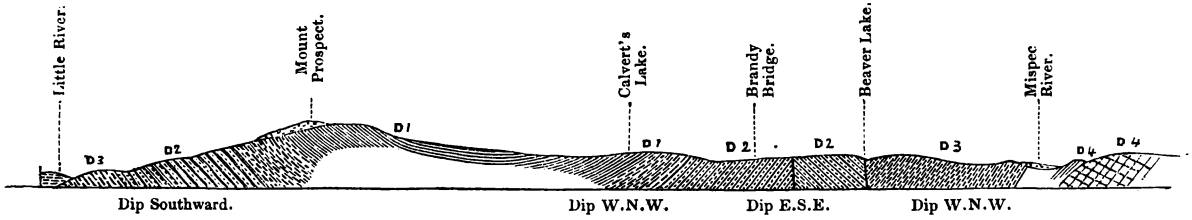


Fig. 2.—Section from the Valley of Little River to Mispec River, New Brunswick.



- C. Lower Carboniferous Conglomerate.
- D 1. Upper red sandstone and conglomerate of the Devonian Series.
- D 2. Second conglomerate, and red and green sandstone and shales of the Devonian Series.

- D 3. Conifer-sandstone and plant-beds of the Devonian Series.
- D 4. Trappean rock, sandstone, and conglomerate.
- D 5. Black papyraceous shale.
- D 6. St. John Shales, and Lingula-beds.
- D 7. St. John Limestone.

angle to the south-east. Three beds of impure graphite appear in its upper portion. The highest is about a foot in thickness, and rests on a sort of underclay. The middle bed is thinner and less perfectly exposed. The lower bed, in which a shaft has been sunk, seems to be three or four feet in thickness. It is very earthy and pyritous. The great bed of limestone is seen to rest on flinty slate and syenitic gneiss, beneath which, however, there appears a minor bed of limestone. Above the great limestone are beds of a hard grey metamorphic rock, apparently an indurated volcanic ash, associated with some sandstone; and this is succeeded by the great series of grey, olive, and black shales and flags which underlie the city of St. John. These rocks are well exposed on both sides of Courtney Bay, in the city of St. John, and in Carlton. Though somewhat contorted, they have a general dip to the south-east at angles of 50° to 70° . In some of the beds there are great numbers of *Lingulæ*, which have not as yet been identified with any described species. There are also trails of Worms, and scratches which may have been produced by the feet of Crustaceans or the fins of Fishes.

The comparatively coarse shales above described are succeeded by a thick band of black papyraceous shale, much contorted, and with a few thin seams of calcareous matter arranged in the concretionary form known as cone-in-cone. No fossils were found in them, but two thin seams of anthracitic coaly matter are stated to have been seen on their line of strike eastward of Courtney Bay*.

Overlying these beds is a group of very different character. It consists of purplish-red and green grit and shale, with beds of red conglomerate and red sandstone. Interstratified with these are massive beds of a greenish rock, consisting of trappean and felspathic fragments, imbedded in a shining reddish paste, or sometimes presenting the appearance of a compact trap or amygdaloid. This rock usually presents an appearance of greater alteration than the neighbouring beds, and contains veins of epidote, quartz, and calc-spar. Its hard and massive character causes it to resist denudation, and to project above the surface in irregular masses. It has usually been regarded as a trap; I am disposed, however, to consider it as more probably a tufaceous or volcanic ash rock, except in a few places, where it is either an amygdaloidal trap or a mass of fragments of such material too intimately connected to be separated from each other. It is evidently a stratified member of the series, though its beds are very unequal in hardness and texture, and probably also in thickness. This portion of the series is well exposed on the east side of Courtney Bay, in the southern part of the city of St. John, and in the direction of Carlton, where its tufaceous or trappean members constitute prominent elevations. It seems also to be this member of the series which, turning to the south, constitutes Cape Meogenes.

Reposing on the rocks last described is the most interesting member of the series, consisting of hard buff and grey sandstones, with black and dark-grey shales. The sandstones contain numerous Coniferous trunks; and the shales, which are sometimes highly

* Gesner's Second Report.

graphitic, abound in delicate vegetable remains, often in a very perfect state of preservation. These rocks appear on the east side of Courtney Bay, near Little River, at the extremity of the point of land on which the city of St. John stands, and in the ledges and cliffs on the shore westward of Carlton. In all these places they are quite conformable with the underlying rocks, though the dip gradually diminishes in ascending.

No rocks newer than the above are seen at Carlton or in the city of St. John; but near Little River a few beds of red shale and coarse sandstone seem to indicate the commencement of a new member of the series, the coast-section failing at this point. Mr. Matthew has, however, succeeded in finding a continuation of the section further inland, exhibiting first, in ascending order, grey sandstone and grit, with dark shale holding fossil plants, among which is *Calamites Transitionis*. This may perhaps be regarded as the top of the group last mentioned. Above it, and passing into it at their base, are reddish sandstones, grits, and conglomerate, alternating with green, greenish-grey, and red shale. Resting on these is a thick-bedded, coarse, angular conglomerate, succeeded by evenly bedded shales, shaly sandstones, and grits, of dark-red and purplish colours. These are the highest beds seen, as beyond this place they are bent in a synclinal, and reappear with reversed dips.

Another most important observation of Mr. Matthew is that near Red Head the member of the St. John series last described is overlain unconformably by a conglomerate similar to that of the Kennebeckasis, and probably the Lower Carboniferous conglomerate. It dips to the north-west, or in the opposite direction from that of the underlying beds, at an angle of 30° ; but Mr. Matthew regards the dip as due in part to false bedding.

The whole of the deposits above described may be summed up as follows, the thicknesses stated being from measurements and estimates made by Mr. Matthew, and to be regarded as merely approximate* (see figs. 1 & 2).

Carboniferous System.

Coarse red conglomerate, with pebbles of the underlying rocks, and constituting in this vicinity the base of the Carboniferous System. Feet.

Devonian System (or perhaps, in part, Upper Silurian).

1. Dark-red and greenish shales; flaggy sandstones and grits;
coarse angular conglomerate 1850

* In my paper in the 'Canadian Naturalist,' I gave a sectional view of the general arrangement, as observed on a line of section from the Kennebeckasis River to the extremity of the peninsula on which St. John stands. The sections referred to in the text represent the same series, as seen on the east side of Courtney Bay, immediately to the east of St. John, with the continuation ascertained by Mr. Matthew towards the Mispic River.

- | | |
|--|--------------------|
| 2. Reddish conglomerate, with quartz pebbles; reddish, purple, and grey sandstones and grits; deep-red, grey, and pale-green shales. A few fossil plants | Feet.
2350 |
| 3. Blackish and grey hard shale and arenaceous shale; buff and grey sandstone and flags. Many fossil Plants; Crustaceans and <i>Spirorbis</i> | 2000 |
| 4. Reddish conglomerate, with slaty paste and rounded pebbles; trappean or tufaceous rock; red, purplish, and green sandstones and shales. Thickness variable | 1000 |
| 5. Black papyraceous shale, with layers of cone-in-cone concretions | 400 |
| 6. Hard, generally coarse and micaceous, grey shales and flags, of various shades of colour, and with some reddish shale and tufaceous or trappean matter at the bottom. <i>Lingulæ</i> , Burrows, and Trails of animals | 3000 feet or more. |
| 7. White and grey crystalline limestone, with bands of shale and beds of graphite | 600 feet or more. |
| 8. Gneissose and other metamorphic beds, with bands of quartz-rock and slate. Thickness unknown. | |

The Devonian age of the upper members of this great series of beds I regard as established by their fossils*, taken in connexion with the unconformable superposition of the Lower Carboniferous conglomerate. The age of the lower members is less certain. They may either represent the Middle and Lower Devonian, or may be in part of Silurian age. Their only determinable fossil, the *Lingula* of the St. John shales, affords no decisive solution of this question, and the evidence of mineral character is not to be relied on in the case of beds so remote from those regions in which the Devonian rocks of America have been most minutely studied.

In mineral character, Nos. 1 & 2 of the above sectional list might very well represent the Old Red Sandstone, or Catskill group of the New York geologists. Nos. 3 & 4 might be regarded as the analogues of the Chemung and Portage groups. No. 5 would represent the Genesee Slate; No. 6 the remainder of the Hamilton group; No. 7 the Corniferous Limestone; and No. 8 might be regarded as a metamorphosed equivalent of the Oriskany and Schoharie Sandstones. The entire want of the rich marine fauna of these formations is, however, a serious objection to this parallelism. If, on the other hand, we employ as our scale of comparison the development of the Devonian system in Gaspé, Nos. 1 & 2 will correspond very well with the upper member of the Gaspé series, and No. 3 with the rich plant-bearing beds of the middle of that series; but no mineral

* The scanty animal remains of the plant-beds No. 3 accord very well with the evidence of the fossil Plants. They are a small Trilobite, apparently a *Philipsia*, three other Crustaceans, one of which is probably a *Stylonurus*, another a *Eurypterus*, and the third a Decapod not apparently referable to any described genus. These Crustaceans are now in the hands of Mr. Salter. (See his paper on these fossils, read before the Society, May 21, 1862.) There is also a shell, apparently a *Loxonema*, and a *Spirorbis*.

equivalent of the St. John shales and limestones occurs at Gaspé, unless we seek for it in the Upper Silurian.

The rocks of the St. John group extend along the coast as far as the frontier of Maine, and there can scarcely be any doubt that the plant-bearing beds at Perry represent some portion of the St. John series, most probably Nos. 2 & 3 of our sectional list. At Perry the plant-beds rest on a trappean bed, which may be the equivalent of our No. 4, a member of the series much more constant in its occurrence than would be anticipated from its composition. According to Prof. Hitchcock, this last bed at Perry rests unconformably on shales containing a *Lingula* which may be identical with that of St. John, and also other fossils of distinct Upper Silurian forms. The analogy of Perry, therefore, as well as of Gaspé, would point to an Upper Silurian age for the lower members of the St. John series, though at St. John they appear to be conformable with the overlying beds. On the other hand, the unconformability at Perry renders it possible that the lower members of the St. John series may be wanting there; and to assign a Silurian date to the lower beds at St. John would imply the entire absence of the copious and characteristic Lower Devonian marine fauna observed at Gaspé and in Nova Scotia, as well as in Maine, though not in immediate connexion with the Perry beds; while, if the whole series of St. John be Devonian, the absence of this fauna would be accounted for by the metamorphism of the lower beds.

In the present state of the evidence, it would be premature to decide this question, which may be settled either by the discovery of portions of the lower beds in a less altered state, or by tracing the St. John series into connexion with the similar deposits in Maine. In the meantime, therefore, we may be content to regard the upper members of the series as belonging to the later part of the Devonian Period, leaving the lower members to be regarded as Lower Devonian or possibly Upper Silurian.

The fossiliferous portion of the St. John series presents the richest local flora of the Devonian Period ever discovered. It far excels, in number of genera and species, the Lower Carboniferous flora as it exists in British America, and is comparable with that of the Middle Coal-measures, from which, however, it differs very remarkably in the relative development of different genera, as well as in the species representing those genera.

It is only just to observe, that the completeness of the following list is due to the industrious labours of an association of young gentlemen of St. John, who, under the guidance of Messrs. Matthew and Hartt, have diligently explored every accessible spot within some distance of the city, and have liberally placed their collections at my disposal for the purposes of this paper.

Dadoxylon Ouangondianum, Dawson.
Sigillaria palpebra, sp. nov.
Stigmaria ficoides (var.), Brongn.
Calamites transitionis, Gæppert.
 — *cannæformis*, Brongn.

Asterophyllites acicularis, sp. nov.
 — *latifolia*, sp. nov.
 — *scutigera*, sp. nov.
 — *longifolia*, Brongn.
 — *parvula*, Dawson.

- Annularia acuminata*, sp. nov.
Sphenophyllum antiquum, Dawson.
Pinnularia dispalans, sp. nov.
Lepidodendron Gaspianum, Dawson.
Lycopodites Mathewi, Dawson.
Psilophyton elegans, sp. nov.
 — *glabrum*, sp. nov.
Cordaites Robbii, Dawson.
 — *angustifolia*, Dawson.
Cyclopteris Jacksoni, Dawson.
 — *obtusa*, Gæppert.
 — *varia*, sp. nov.
 — *valida*, sp. nov.
Neuropteris serrulata, sp. nov.
 — *polymorpha*, sp. nov.
- Sphenopteris Hoeninghausi*, Brongn.
 — *marginata*, sp. nov.
 — *Hartii*, sp. nov.
 — *Hitchcockiana*, sp. nov.
Hymenophyllites Gersdorffii, Gæppert.
 — *obtusilobus*, Gæppert.
 — *curtilobus*, sp. nov.
Pecopteris (Alethopteris) decurrens,
 sp. nov.
 — (—) *ingens*, sp. nov.
 — (—) *obscura* (?), Lesquereux.
Trichomanites, sp. nov.
Cardiocarpum cornutum, sp. nov.
 — *obliquum*, sp. nov.
Trigonocarpum racemosum, sp. nov.

II. DESCRIPTIONS OF THE SPECIES.

(*Angiospermous Dicotyledon.*)

1. SYRINGOXYLON MIRABILE, gen. et sp. nov. Pl. XII. figs. 1 to 5.

Woody tissue close, thick-walled. Ducts many times the diameter of the wood-cells, thin-walled, with transverse pores in several series. Medullary rays of two or more series of muriform cells. Growth-rings distinct.

This genus and species are founded on a small fragment of wood, mineralized by carbonate of lime, silica, and iron-pyrites. It is evidently the wood of an angiospermous exogen, and does not differ materially from that of some modern trees. It is, in so far as I am aware, the first instance of such wood in Palæozoic rocks, and would imply the existence in the Devonian Period of trees of a higher grade than any that are known in the Carboniferous System. This fact is not, however, in itself more remarkable than the occurrence of a single Land-snail in the Coal-formation, more especially when we consider the perishable character of the wood of angiosperms as compared with that of gymnosperms and cryptogams, and the small amount of attention usually bestowed by geologists on fragments of mineralized wood. It is also to be remarked that, as I have elsewhere had occasion to note, the Devonian flora has in other points a more modern aspect than that of the Coal—a circumstance which may perhaps relate to a different distribution of land and water, and to the comparative absence of the wide inundated flats of the Coal-period. It may, however, merely result from the unequal and fortuitous preservation of some descriptions of plants rather than others in the beds of one or both of these periods.

The specimen is labelled as from Eighteen-mile Creek on Lake Erie, and was collected several years ago by Prof. Hall from a limestone in the upper part of the Hamilton group. It has unfortunately no matrix attached to it; but Prof. Hall assures me that he has no reason to doubt its genuineness.

*(Exogenous Gymnosperms.)**(Coniferæ.)*

2. DADOXYLON (ARAUCARITES) OUANGONDIANUM, Dawson.

'Canad. Naturalist,' vol. vi. pp. 165, 166, figs. 1 to 4.

"*Branching trunks, with distinct zones of growth, and a pith of the Sternbergia type. Wood-cells very large, with three to five rows of contiguous, alternate, hexagonal areoles with oval pores. Medullary rays with one to three series of cells, and as many as 14 rows of cells superimposed on each other*.*"

In sandstone at St. John, where many large trunks occur, calcified and silicified, and in part converted into anthracite and graphite†. My specimens are from the collection of Mr. Matthew, and are described at length and figured in the paper referred to in the footnote. I have no doubt that this is the Coniferous tree referred to by Dr. Gesner, 'Second Report,' p. 12.

3. DADOXYLON HALLII, sp. nov. Pl. XIII. fig. 11.

Wood-cells very large, with five rows of contiguous, alternate, hexagonal areoles. Medullary rays very frequent, and with as many as thirty rows of cells superimposed.

This species occurs in a pyritized state at Hemlock Creek, Ontario County, New York, in beds of the Hamilton group. It resembles *D. Ouangondianum* in the great size of the wood-cells and the numerous rows of areoles, but differs so markedly in the development of the medullary rays that I regard it as certainly belonging to a distinct species. The specimen, being completely pyritized, can be examined only as an opaque object, so that some of the details of its structure cannot be made out; but the forms of the wood-cells and their areoles, and of the medullary rays, are so beautifully modelled in pyrites that no uncertainty exists as to the points of structure above specified. I have dedicated this species to Prof. Hall, its discoverer.

4. APOROXYLON.

Among Prof. Hall's specimens is one, from Seneca Lake, which may possibly be allied to the plant on which Unger has founded the genus above named. It is a flattened pyritized stem or branch, one inch and a quarter in breadth at the larger end, and slightly tapering, and ten inches in length. It is marked with spirally arranged distant scars, as if of excurrent branches; and it seems to have been woody, with a thin bark and a large pith. The wood is imperfectly

* In the case of this and other species described in my paper on the Pre-carboniferous Flora of New Brunswick, I shall copy in this paper the specific characters merely, referring for fuller descriptions to my paper in the 'Canadian Naturalist,' vol. vi. pp. 161 *et seq.*

† This and other fossil plants found at St. John afford remarkable examples of the conversion of vegetable matter into graphite, without loss of its form or even of its internal structure.

preserved, but shows slender cylindrical fibres destitute of markings, and with mere traces of medullary rays. The general arrangement of parts resembles that in *Prototaxites*, but the markings on the cell-walls are absent. I regard it as quite possible that this may merely be wood of *Dadoxylon* or *Prototaxites*, in which casts of the interior cavities of the cells may have been taken in pyrites, while the cell-walls and medullary rays have been destroyed, and the spaces occupied by them partially obliterated by pressure. Whatever its precise character, it must have been an excurrent stem with many small branches proceeding from it, in the manner of ordinary coniferous trees*.

In the collections made by Mr. Richardson (of the Canadian Geological Survey) at Perry are fragments of stems or branches having a structure somewhat similar to that above described, but still more imperfectly preserved.

(*Sigillariæ.*)

5. SIGILLARIA PALPEBRA, sp. nov. Pl. XIII. fig. 12.

Ribs narrow, about a quarter of an inch in width. Leaf-scars transversely acuminate, small.

My only specimen is a small fragment, showing three or four ribs, and with only a few of the scars preserved. The most perfect leaf-scars are shaped much like a half-closed eye; but the specimen is only a cast, and very imperfect. Locality, St. John.

6. SIGILLARIA VANUXEMII, Gœppert. Pl. XII. fig. 7.

Hall's 'Report Geol. New York,' p. 184, fig. 51; Gœppert's 'Flora Silurisch.' p. 546.

Areoles hexagonal, rather longer than broad. Vascular scars indistinct, apparently two in each areole. Bark thick. Ligneous surface obscurely ribbed, with small elongated scars in the furrows. Woody axis sulcated longitudinally; its diameter equal to one-fourth that of the stem. There are about twelve rows of areoles on a stem half an inch in diameter.

This beautiful little *Sigillaria* is figured, but not named nor described, in Vanuxem's 'Report on the Geology of New York,' fig. 51, p. 184. It is named and described by Gœppert from Vanuxem's figure†. An examination of the original specimen—a sandstone-cast six inches in length, imbedded among brachiopodous shells—enables me to give the above more complete description. The bark is in a coaly state, and the woody axis, though flattened, is quite manifest, and still retains some carbonaceous matter, though destitute of structure. The plant must have been of slender growth, unless it were a branching species. It approaches *S. minima* of Brongniart, but is smaller and not ribbed; in which last respect it resembles *S. ele-*

* Similar stems, more nearly resembling those described by Unger in external form, occur in the Catskill group.

† 'Flora der Silurischen,' &c. p. 546.

gans, of which it may be regarded as a diminutive Devonian prototype.

Its locality is Allen's quarry, near Oswego, and the formation is the Chemung group.

7. SIGILLARIA SIMPLICITAS, Vanuxem.

Vanuxem's 'Report Geol. New York,' p. 190, fig. 54.

Ligneous surface with narrow, slightly rugose elevated ribs, about a quarter of an inch wide, in a stem five inches in diameter. Leaf-scars indistinct.

Under the above name Vanuxem has figured a *Sigillaria*, the only specimen of which is a portion of a decorticated stem, with only scarcely distinguishable traces of the leaf-scars. It is from the Catskill group, between Mount Upton and N. Bainbridge.

In Prof. Hall's collection there is a specimen in a similar condition, with wider ribs, and which may have belonged to another species, though it is possibly a part of an older stem of the above. It is from the Hamilton group, shore of Lake Erie, near Buffalo*.

8. SYRINGODENDRON GRACILE, sp. nov. Pl. XIII. fig. 14.

Ribs about a line in breadth, with elevated elongated areoles, each with three punctiform vascular scars in a vertical line. Areoles three-eighths of an inch distant vertically. Bark marked with delicate striæ converging toward the areoles. On the inner surface of the bark are fine longitudinal and transverse striæ, and the scars appear as elongate depressions.

This species is described from a small fragment of the bark in a slab from the Hamilton group of Akron, Ohio, in the collection of Prof. Hall. It resembles in some respects *S. pachyderma*, but is smaller and has thinner bark and more elongated areoles. On the same slab are *Cyperites*, which may have been the leaves of this plant, fragments of stipes of Ferns, and branchlets of *Psilophyton*.

9. STIGMARIA EXIGUA, sp. nov. Pl. XIII. fig. 13.

Scars small, in depressed spaces, six in an inch vertically. Stem cylindrical, an inch in diameter.

This diminutive *Stigmara* was probably the root of one of the slender Sigillaroid trees above described. It is evidently quite distinct from *Stigmara minuta*, Lesquereux, which is, however, a similar species of nearly as great age. Like many others of the Devonian plants from New York, it occurs in a marine bed; and the

* Some obscurely marked fragments in my collection, from Gaspé and St. John, appear to indicate the existence of a species with wider ribs than the above. Neither Vanuxem's specimens nor these are sufficiently perfect to admit of description; and the somewhat singular name which I have quoted from him may therefore be taken as representing one or more species of *Sigillaria* imperfectly known.

cylindrical cavity within the bark has been filled with sand and the stems of a small branching Coral, which may perhaps have grown within the hollow bark, which in this case, as in that of the *Stigmariæ* of the Coal-measures, seems to have been almost indestructible. The specimen is from the Chemung group, at Elmira, New York.

10. STIGMARIA FICOIDES (variety), Brongniart.

Large roots of *Stigmaria*, in some instances with rootlets attached, occur, though rarely, in the sandstone or arenaceous shale near St. John—only two or three specimens having been found. They are not distinguishable from some varieties of the *Stigmaria ficoides* of the Coal-measures.

11. DIDYMOPHYLLUM RENIFORME, sp. nov. Pl. XIII. fig. 15.

Areoles prominent, spirally arranged, reniform; each resembling a pair of small Stigmaroid areoles attached to each other. Areoles $\frac{1}{20}$ th of an inch in transverse diameter, and about $\frac{1}{4}$ th of an inch distant transversely, and $\frac{3}{8}$ ths vertically, in a stem $\frac{3}{4}$ ths of an inch in diameter.

The genus *Didymophyllum* was established by Gœppert for a plant of the Lower Carboniferous series of Silesia, resembling *Stigmaria*, but with double rootlets. The present plant, though specifically distinct, comes fairly within the characters of the genus. I believe it to have been a slender Stigmaroid root or rhizome, sending out its rootlets in pairs instead of singly. It occurs as a cast with the thin coaly bark in part preserved, and is from the Hamilton group, near Skaneateles Lake, New York. A flattened specimen, apparently of the same species, occurs on a slab from the Marcellus Shale. Both are in Prof. Hall's collection.

(*Calamitæ**)

12. CALAMITES TRANSITIONIS, Gœppert.

'Canad. Nat.' vol. vi. p. 168, fig. 5.

This species, so characteristic, according to Gœppert, of the Upper Devonian and Lower Carboniferous series in Europe, is abundant at St. John, both in the sandstone containing Coniferous trees, and the shales which afford Ferns, *Cordaites*, &c. Some of the beds of the latter are filled with flattened stems. This was one of the first fossils recognized in the St. John rocks, specimens having been shown to me in 1857 by the late Prof. Robb†.

A small specimen in Prof. Hall's collection, from the Hamilton group, may possibly belong to this species, though proportionally some-

* In placing the *Calamites* here, I do not mean to affirm that all the plants usually included in that genus are gymnospermous; but I believe that many of them are.

† Dr. Gesner mentions ('Second Report', 1840, p. 12) a *Calamite* (probably this species) as occurring near Little River.

what wider in its ribs. Being only a part of a single internode, it cannot be certainly determined, though it appears at least to indicate the presence of a species of *Calamites* in that group.

13. CALAMITES CANNÆFORMIS, Brongniart.

This species, presenting the characters which it exhibits in the Coal-measures, occurs in the ledges west of Carlton, associated with the last species, but in much less abundance. It is a widely distributed species, but has not, I believe, been found previously in rocks older than the Lower Carboniferous.

14. CALAMITES INORNATUS, sp. nov. Pl. XVII. fig. 56.

Ribs continuous, as in C. Transitionis, but flat and broad, the breadth of each being a quarter of an inch in a stem four inches in diameter. Nodes distinct, prominent in the flattened stem, owing to their greater density as compared with the internodes.

This species is allied to *C. Transitionis*, but has much wider ribs. It was a woody plant, as, when flattened, a stem four inches in diameter affords a film of compact coal about a line in thickness, which is quite as much as a *Sigillaria* or even a Conifer of the same size would yield under similar circumstances. It much resembles Gœppert's figure of *C. variolatus*, but wants the stigmata said to be characteristic of that species,—instead of which, it has, in the coaly matter representing the stem, numerous irregularly disposed round spots surrounded by concentric circles; but these are evidently concretionary, and of the same nature with the beautiful concentric concretions which appear in some specimens of cherry-coal and of albertite.

The specimen above described is in Prof. Hall's collection from the Genesee slate, from the shore of Cayuga Lake. A comparison of this specimen with the obscure Calamite-like fossils from Kettle Point, Lake Huron, in the collection of the Canadian Survey, referred to in my former paper, satisfies me that they probably belong to the same species.

(*Asterophyllitæ*.)

15. ASTEROPHYLLITES ACICULARIS, sp. nov. Pl. XIII. fig. 16.

Stems slender, striated, thickened at the nodes, leafy. Leaves one-nerved, linear, slightly arcuate, ten to fifteen in a whorl, longer than the internodes. Length of leaves one-half to three-fourths of an inch.

This plant is abundant in some layers of shale near St. John. It resembles *A. foliosa*, L. & H., but the leaves are longer, less curved, and more numerous in a whorl. Some of the specimens show that the stem was leafy, as well as the branches; and I have a specimen, apparently the termination of a main stem, showing the whorls of leaves diminishing in size toward the apex. My specimen of this and the following species of *Asterophyllites* are from the collections of Messrs. Matthew and Hartt, and were obtained from the ledges and cliffs west of Carlton.

16. ASTEROPHYLLITES LATIFOLIA, sp. nov. Pl. XIII. fig. 17.

Stem somewhat slender, with enlarged nodes. Leaves oblong-lanceolate, about thirteen in a whorl, one-nerved, longer than the internodes. Length of leaves varying from one-fourth of an inch, near the ends of branches, to an inch or more.

This species abounds in the same locality with the preceding, and is often very perfectly preserved. It has some resemblance to *A. galioides*, L. & H., and to *A. fertilis*, Sternberg; but it differs from the former in the number and form of the leaves, and from the latter in the acuteness of their points.

17. ASTEROPHYLLITES? SCUTIGERA, sp. nov. Pl. XIII. figs. 18, 19, 20.

Stems simple, elongated, attaining a diameter of half an inch, obscurely striated; bearing on the nodes whorls of round or oval scales, or flattened nutlets, which at the ends of the stems are crowded into a sort of spike, while on other parts of the stems the nodes are sometimes an inch apart.

This is a plant of uncertain nature, which I place only conjecturally in this genus. The stems, which are very long, may have been horizontal or immersed, and the apparent scales may either have constituted a sort of sheath, as in *A. coronata*, Unger, or may have been seeds or nutlets flattened like the rest of the plant. Near some of the specimens are fragments of linear leaves, which may have belonged to this plant, though I have not found them attached. When flattened obliquely, the stems appear as rows of circular marks, which represent the harder tissue of the nodes, and have a very singular appearance. This plant, though found with the preceding, does not occur in the layers which contain the other plants; and this may possibly mark a difference of habitat.

18. ASTEROPHYLLITES LONGIFOLIA, Brongniart.

In the shales containing the preceding species are some fragments of an *Asterophyllites* with slender stems, internodes about an inch in length, and linear leaves two or three inches in length, and about 6 to 8 in a whorl. It may belong to the species here named; but the remains are not sufficiently distinct to render this certain.

19. ASTEROPHYLLITES PARVULA, Dawson.

‘Canad. Nat.’ vol. vi. p. 168, figs. 6 a, b, c.

“*Branchlets slender. Leaves 5 or 6 in a whorl, subulate, curving upward, half a line to a line long. Internodes equal to the length of the leaves or less. Stems ribbed, with scars of verticillate branchlets at the nodes.*”

This diminutive species was originally found by Mr. Matthew in the graphitic shale, associated with the conifer-sandstone, at the southern part of the city of St. John. Small fragments of it have subsequently been obtained from the shales of Carlton.

20. ANNULARIA ACUMINATA, sp. nov. Pl. XIII. fig. 21.

Leaves oblong, acuminate, one-nerved, 6 to 9 in a whorl, erect or slightly spreading. Whorls usually found disconnected.

Detached whorls of this species occur, though rarely, on the surfaces of the shales of Carlton. It seems to be a plant of the same type with *A. sphenophylloides*, Unger, which, according to Lesquereux, occurs in the Coal-formation of Pennsylvania.

21. SPHENOPHYLLUM ANTIQUUM, Dawson.

'Canad. Nat.' vol. vi. p. 170, fig. 7.

"*Leaflets cuneate, one-eighth of an inch wide at the apex, and less than one-fourth of an inch long. Nerves three, bifurcating equally near the base, the divisions terminating at the apices of six obtuse, acuminate teeth.*" About 8 leaves in a whorl.

This plant was described from a few detached leaflets from the graphitic shale of St. John, which preserved their form and venation in the most wonderful perfection, though they were completely changed into films of shining graphite. I have since obtained from Mr. Hartt a specimen found at Carlton, which, though the individual leaflets are more indistinct, shows their general arrangement in whorls of 8 or 9 on a slender stem. It is a beautifully symmetrical little plant, quite distinct from any of the species in the Coal-measures.

22. PINNULARIA DISPALANS, sp. nov. Pl. XIII. fig. 22.

Smooth slender stems, producing nearly at right angles long branchlets, some of which produce secondary branchlets in a pinnate manner. Stem and branches having a slender vascular axis.

This plant was not very dissimilar from some common forms of Carboniferous *Pinnulariæ*. Its main stem must once have been cylindrical, and had a delicate central axis, now marked by a darker line of graphite in the flattened specimens. The branches were not given off in one plane, and also show traces of an axis. There are indications that the stems grew in bundles or groups. It was probably, as has usually been supposed in the case of the species in the Coal-formation, an aquatic root or submerged stem of an *Astero-phyllites* or some similar plant.

(*Acrogenous Cryptogams.*)

(*Lycopodiaceæ.*)

23. LEPIDODENDRON GASPIMUM, Dawson. Pl. XIV. figs. 26, 27, 28; and Pl. XVII. fig. 58.

Dawson, Quart. Journ. Geol. Soc. vol. xv. p. 483, figs. 3 a-3 d.

This species, originally discovered in Gaspé, and described in my paper* on the plants of that locality, was afterwards recognized among the fossils from Perry, and more recently at St. John; and numerous and beautiful specimens are contained in Prof. Hall's

* Quart. Journ. Geol. Soc. vol. xv. p. 483.

collections from New York State, where the species occurs in the base of the Catskill group and in the upper part of the Hamilton group. The varied aspects of the species presented in the numerous specimens thus submitted to me would, with a less perfect suite of examples, afford grounds for specific or even generic distinctions. Flattened specimens, covered with bark, present contiguous, elliptical, slightly elevated areoles, with an indistinct vertical line and a small central vascular scar (fig. 58). Decorticated specimens, slightly compressed, show elliptical depressed areoles, not contiguous, and with only traces of the vascular scars (fig. 26). In more slender branches the areoles are often elevated at one end in the manner of a *Knorria* (fig. 28); and in some specimens the areoles are indistinct, and the vascular scars appear as circular spots, giving the appearance presented by the plants named *Cyclostigma* by Haughton (fig. 27). All these forms are, however, merely different states of preservation of the same species.

This plant is closely allied to *L. nothum*, Unger, but differs in its habit of growth and in the size of the areoles relatively to that of the branches. The branches were long and slender, bifurcating rarely, and, unless they were very woody, must have been pendent or decumbent. No large trunks have been seen. It was a widely distributed and abundant species in the Upper and Middle Devonian Periods. The plant figured by Prof. Rogers in the 'Report on Pennsylvania,' p. 829, fig. 677, can scarcely belong to any other than this species; and it is also figured in Vanuxem's 'Report on New York,' p. 191, fig. 55, and p. 157, fig. 38.

24. LEPIDODENDRON CHEMUNGENSE, Hall.

Hall's 'Report Geol. New York,' p. 275, fig. 127.

Decorticated stem covered with oval, acuminate, scale-like areoles, more acute and smaller in proportion to the size of the stem than in L. Gaspianum.

The only specimen I have seen is a curved branch, very well figured in Prof. Hall's 'Report on the Geology of New York,' p. 275, fig. 127. It is a *Knorria* state of a *Lepidodendron* or *Sagenaria*, of more robust growth than *L. Gaspianum*, but with smaller areoles. It much resembles a decorticated branch of *L. elegans* of the Lower Coal. Göppert includes it in his protean species *Sagenaria Veltheimiana*, but it does not correspond precisely with any of the forms figured by him. I think it best, therefore, to retain Prof. Hall's specific name, until better specimens shall enable a satisfactory comparison to be made. Its locality is Elmira, New York, and its geological position is the Chemung group.

25. LEPIDODENDRON CORRUGATUM, Dawson. Pl. XII. fig. 10.

Dawson, Quart. Journ. Geol. Soc. vol. xv. p. 68, fig. 2.

Areoles elliptical, distant, and separated by a flat surface of corrugated bark. Vascular scar central, oval, or linear.

In Prof. Hall's collection are specimens from the Chemung and

Hamilton groups, from Akron, Ohio, which I cannot distinguish from the above species, first recognized by me in the Lower Coal-measures of Nova Scotia, and noticed in my paper on the "Lower Carboniferous Coal-measures of British America," Quart. Journ. Geol. Soc. 1858, vol. xv. p. 68. *L. corrugatum*, like other *Lepidodendra*, presents many varieties of growth and preservation; but Prof. Hall's specimens are quite undistinguishable from some of those in my cabinet from the Lower Coal-measures of Horton, Nova Scotia.

26. *LEPIDOSTROBUS RICHARDSONI*, Dawson.

'Canad. Nat.' vol. vi. p. 174, fig. 10.

"*Axis not distinctly preserved; form cylindrical (?); scales oblong, with an obscure midrib.*" From Perry, Maine.

27. *LEPIDOSTROBUS GLOBOSUS*, Dawson.

Round or roundish oval, covered with obscure pointed scales.

This and the preceding are very distinct but puzzling objects, collected by Mr. Richardson at Perry, and are probably the fructification of *Lepidodendra* or allied plants.

28. *LYCOPODITES MATTHEWI*, Dawson.

'Canad. Nat.' vol. vi. p. 171, fig. 8.

"*Leaflets one-veined, narrowly ovate-acuminate, one-tenth to one-fourth of an inch in length, somewhat loosely placed on a very slender stem, apparently in a pentastichous manner.*"

This species was described from specimens found by Mr. Matthew in the graphitic shale in the city of St. John. Somewhat larger specimens have since been obtained from the same bed; but I have not seen the plant elsewhere.

29. *LYCOPODITES VANUXEMII*, sp. nov. Pl. XVII. fig. 57.

Hall's 'Report on the Geology of New York,' p. 273, fig. 125;
Vanuxem's 'Report, Geol. New York,' p. 175, fig. 46.

Stem slender. Leaves pinnate, contiguous, linear, about half an inch in length.

This plant appears as graceful, feathered stems, apparently growing in groups. It seems to be very closely allied to *L. pinnæformis*, Gœppert, differing chiefly in its more slender stem and shorter pinnales. Still it is very doubtful if it were really a Lycopodiaceous plant. Its leaves were certainly in one plane, and some of the specimens show that they were flattened horizontally, like the filaments of a feather. It may have been related to Ferns rather than to *Lycopodiaceæ*. It occurs in the Chemung group, at Ithaca, New York. It is well figured in Hall's 'Report,' p. 273, fig. 125, and in Vanuxem's 'Report,' p. 175, fig. 46.

30. *PSILOPHYTON PRINCEPS*, Dawson.

Quart. Journ. Geol. Soc. vol. xv. p. 479, figs. 1 *a* to 1 *i*.

This remarkable plant, so characteristic of the whole Devonian system at Gaspé, filling many beds with its rhizomes, in the manner of the *Stigmaria* of the Coal-measures, and preserved in such abundance and perfection that it is much better known to us in its form, structure, and habit of growth than any other plant of the period, proves, as might have been anticipated, to have had a wide distribution in space as well as in time. Fragments of its stems are distinguishable in the sandstones of Perry, and numerous fine specimens occur among the plants from New York State committed to me by Prof. Hall. It occurs in the Hamilton group at Schoharie, New York, and at Akron, Ohio, in the Chemung group at Cascade Falls, and in the Catskill group at Jefferson. Most of the specimens are stems, which show the habit of growth very perfectly. They confirm my inference from the structure of the Gaspé specimens that the plant was woody and rigid, as they often do not lie in one plane, but extend upward and downward in the manner of firm branches buried in sand. Most of the New York specimens seem to have been drifted; but groups of rhizomes, possibly *in situ*, occur in argillaceous sandstone from Fullenham, Schoharie, and in similar beds at Cazenovia and Cascade Falls. These are the only instances presented by Prof. Hall's collections of root-beds resembling those of Gaspé. In New York only the Upper and Middle Devonian have as yet afforded land-plants; but in Gaspé *Psilophyton princeps* occurs in the Lower Devonian, and fragments which may have belonged to it occur in the Upper Silurian.

31. *PSILOPHYTON ELEGANS*, sp. nov. Pl. XIV. figs. 29, 30; and Pl. XV. fig. 42.

Stems slender, produced in tufts from thin rhizomes, bifurcating and curving at their summits. Surface smooth, with very delicate wrinkles. Fructification in groups of small, broadly oval scales, borne on the main stem below the points of bifurcation.

I distinguish this species from *Psilophyton princeps* by its smaller size, its smoother surface, its growth in tufts, and the different form of its organs of reproduction. Still it must be admitted that imperfect specimens could not readily be distinguished from branchlets of *P. princeps*. It was found by Mr. Matthew in the shales near Carlton.

32. *PSILOPHYTON* ? *GLABRUM*, sp. nov.

Smooth, flattened, bifurcating stems, two lines in width, with a slender woody axis.

These are objects of doubtful nature. They must have been stems or roots, bifurcating in the manner of *Psilophyton*, but having a very slender woody axis. They may have been either roots of some plant, or stems of a smooth and comparatively succulent species of *Psilophyton*.

33. SELAGINITES FORMOSUS, Dawson.

'Canad. Nat.' vol. vi. p. 176, figs. 11, 12; *Knorria* (?), Quart. Journ. Geol. Soc. vol. xv. p. 486, fig. 5.

"Stems covered with flat, broad, angular, imbricating scales of unequal size, and ornamented with minute scaly points."

This is the plant noticed in my paper on the plants of Gaspé* as probably a *Knorria*. Better specimens have subsequently enabled me to describe it as above, and to refer it to *Selaginites*, without, however, maintaining that it is certainly a Lycopodiaceous plant. It occurs in the shales associated with the Devonian coal-seam at Gaspé.

34. LEPTOPHLEUM RHOMBICUM, nov. gen. et sp. Pl. XII. fig. 8; and Pl. XVII. fig. 53.

Stem covered with contiguous rhombic areoles, each with a single small scar a little above its centre, and above this a very slight furrow. Decorticated stems with spiral punctiform scars in slight depressions. Bark thin. Pith-cylinder very large, with transverse markings of the character of Sternbergia.

This plant seems to have presented a straight cylindrical stem, supporting leaves with thick bases, and of which only traces remain. Its bark was thin; and it seems to have had a thin woody cylinder, within which was a very large *Sternbergia*-pith. One specimen shows a growth of young wood at the extremity of the stem, on which the rhombic scars are only imperfectly developed; and at the extremity of this younger portion, the transverse structure of the pith exhibits itself through the thin bark in such a manner that this portion, if separated from the remainder of the stem, might be described as a *Sternbergia*. This is another peculiar phase of these remarkable, transversely wrinkled piths that seem to have belonged to so many of the Carboniferous and Devonian plants. The markings on the surface of the stems of this plant somewhat resemble those of *Lepidodendron tetragonum*, *Ulodendron minus*, and *Lomatoflojos crassicaule*, but the vascular scars and the general structure of the stem are quite different. Still I believe this plant to be more nearly allied to *Ulodendrea* and *Lepidodendrea* than to any other plants.

35. CORDAITES ROBBII, Dawson. Pl. XIV. fig. 31 a, b, c.

Leaves elongated, lanceolate, sometimes three inches wide and a foot in length. Veins equal and parallel. Base broad, clasping the stem, point acuminate.

When this species was described in my paper in the 'Canadian Naturalist †,' only very imperfect specimens were in my possession; but numerous and fine specimens recently found now enable me more perfectly to characterize the species. The leaves vary much in form; and in their young state, as represented in fig. 31 a, were

* Quart. Journ. Geol. Soc. vol. xv. p. 486.

† May 1861, p. 168.

often of a regularly oblong form. They have numerous equal parallel nervures, which were probably fibro-vascular, like those of Ferns, as they present precisely the same appearance as the nervures of the plants of this family preserved with them, and which, in these beautiful graphitized specimens, are traced in deeper lines of graphite than the film of the same material which represents the intervening parenchyma. In the best-preserved specimens, the leaf is quite smooth; but in some the space between the nervures rises into little ridges, so as to give a striated appearance. These different aspects, however, often occur on different portions of the same leaf. The present species so closely resembles *C. borassifolia* of the Coal-formation that it might readily be mistaken for it; but it differs somewhat in the form of the leaf, and still more in the venation, the nervures in the present species being perfectly equal*.

In the paper already referred to, I have stated at length my reasons for preferring, in the case of this plant and *C. borassifolia*, the generic name *Cordaites*, to *Poacites*, *Flabellaria*, and *Næggerathia*, all of which have been applied to such plants, together with others having no affinity to them. To the name *Pschnophyllum*, proposed by Brongniart, this objection does not apply; but *Cordaites*, I believe, has priority, and is due to the describer of the typical species.

I associate the genus *Cordaites* with Lycopodiaceous plants without hesitation, notwithstanding the peculiar character of its foliage, because Corda has shown that its stem is strictly acrogenous in structure, and of the same type with those of *Lomatoflojos* and *Ulodendron*—a fact which excludes it alike from association with Monocotyledonous plants and with Ferns.

It is worthy of notice that, while the leaves of *Cordaites*, unlike those of *Sigillaria* and *Lepidodendron*, were not attached by narrow bases, but clasping, they were still, like those of nearly all other Devonian and Carboniferous plants, deciduous and capable of disarticulation, as is proved by the immense abundance of fallen leaves, while the stems, probably remaining attached to the soil, are rare. It is further to be observed that these leaves were rigid, and long resisted decomposition; on which account, no doubt, they formed a favourite base of attachment for the little *Spirorbes* which swarmed both in the Devonian and Carboniferous Periods. At St. John many of these leaves are covered with these little shells.

The leaves of the present species are very abundant in the shales of the vicinity of St. John, and indeed are eminently characteristic of them; and on this account I regard the dedication of it to my late lamented friend, Dr. Robb, as specially appropriate. I have not recognized this plant in the specimens from Gaspé or Perry; and the only indication of it in the New York collection is a fragment of a leaf from the Hamilton group of Cazenovia, New York, not sufficiently perfect to render its identification certain.

* The nervures in *C. borassifolia* are alternately thick and thin; but there is an undescribed species in the *Upper* Coal-measures of Nova Scotia which has equal nervures.

36. *CORDAITES ANGUSTIFOLIA*, Dawson.

Leaves linear, much elongated, one-tenth to one-fourth of an inch broad, with delicate, equal, parallel nervures.

This species, originally described from specimens collected at Gaspé, where it abounds in the roof of the little Devonian coal-seam, occurs also at St. John, and in the Marcellus Shale of New York; and it has also been found by Sir W. E. Logan in the *Upper Silurian* of Cape Gaspé, together with fragments which may have belonged to *Psilophyton*. It usually occurs as long riband-like detached leaves, not always easily distinguishable from the flattened stems and roots of other plants found in the same beds. I have not seen the apex nor the base of the leaf, but among Prof. Hall's specimens from the Marcellus Shale is one which appears to consist of the remains of several leaves, attached to a short stem, of which the structure and markings have perished.

Plants closely resembling this are described by Unger and Göppert, from the Devonian of Europe; but the characters given do not enable me to identify any of them with the present species. Such plants are placed by those writers in the genus *Næggerathia*, which I reject for the reasons above stated.

37. *CORDAITES* (?). Pl. XVI. fig. 59.

One of Prof. Hall's specimens from the Hamilton group is a cast of a stem which appears to have produced closely adpressed clasping leaves, obscurely striated, and widening upward. I refer it to this genus, but cannot determine whether it belonged to either of the species above described or to a third, though perhaps the latter is the more probable supposition.

38. *MEGAPHYTON* (?).

An obscurely marked stem in Mr. Richardson's collection, from Perry, appears to indicate a plant of this genus, but does not afford sufficient characters for description.

(*Filices.*)

39. *CYCLOPTERIS HALLIANA*, Göppert. Pl. XVII. figs. 54, 55.

Göppert, 'Flora Silurisch,' p. 498; *Sphenopteris laxa*, Hall, 'Report Geol. New York,' p. 275, fig. 127.

The original specimen of this beautiful plant has been submitted to me by Prof. Hall, and corresponds very closely with the figure above referred to, and with Göppert's description, based on that figure. The nervures, which Göppert notes as simple or dichotomous, are apparently the latter, and the pinnules seem to have been slightly lobed at the margins as in *Adiantum*. Its densely leafy rachis, with its rich terminal pinnules and delicate drooping lateral pinnæ, give it an appearance at once unique and graceful; while the form, arrangement, and venation of the pinnules are peculiar

features of that antique group of Cyclopteroid Ferns so highly characteristic of the Devonian and Lower Carboniferous beds.

This group of Ferns, including the present species, with *C. Jacksoni*, *C. obliqua*, *C. Hibernica*, and others, is no doubt generically distinct, as Lesquereux very properly maintains, from the *Cyclopterides* of the Coal-measures; but this industrious observer has unfortunately applied to it the generic name *Næggerathia*, which is used by Unger, Gœppert, and others for leaves with parallel striation and supposed to be monocotyledonous. On this account, rather than increase the confusion of the nomenclature, I in the meantime retain, with the above explanation, the name *Cyclopteris*. The present species occurs in the Chemung group of New York.

40. *CYCLOPTERIS JACKSONI*, Dawson.

'Canad. Nat.' vol. vi. p. 173, fig. 9.

"*Fronde bipinnate; rachis stout and longitudinally furrowed; pinnæ alternate; pinnules obliquely obovate, imbricate, narrowed at the base, and apparently decurrent on the petiole; nerves nearly parallel, dichotomous; terminal leaflet large, broadly obovate or lobed.*"

This species, first described, in my paper in the 'Canadian Naturalist,' from a specimen found at Perry, occurs also in small fragments at St. John, and large specimens occur in the collection of Prof. Hall from the Old Red Sandstone of Montrose, New York. It is closely allied to *C. Hibernica*, and is its American representative.

41. *CYCLOPTERIS OBTUSA*, Lesquereux. Pl. XV. fig. 33.

To this species, described by Lesquereux, from the Old Red Sandstone of Pennsylvania, I refer a beautiful Fern not unfrequent in the shales near St. John. Lesquereux places it, for the reasons above mentioned, in the genus *Næggerathia*.

42. *CYCLOPTERIS VALIDA*, sp. nov. Pl. XVII. fig. 52.

Tripinnate; primary divisions of the rachis stout and wrinkled. Pinnæ regularly alternate. Lower pinnules nearly as broad as long, deeply and obtusely lobed, narrowed and decurrent at the base; regularly diminishing in size and breadth toward the point, and the last pinnules narrowly obovate and confluent with the terminal pinnule. Nerves delicate, several times dichotomous.

This is the most perfect and beautiful of the St. John Ferns. It resembles at first sight *Sphenopteris macilentata*, L. & H.; but on examination it differs materially in details. It is an elaborate and ornate example of the peculiar type of *Cyclopteris* already referred to as characteristic of the Upper Devonian Period.

43. *CYCLOPTERIS VARIA*, sp. nov. Pl. XV. fig. 34.

Pinnate (or bipinnate). Pinnæ with a thick petiole. Pinnules decreasing in size to the terminal one, which is ovate and lobed. Pinnules oblique, decurrent on one side. Nerves frequently dichotomous.

This Fern has been found only in fragments. It seems to have

been a thick fleshy frond, but the specimens are insufficient to show its habit of growth. Its nearest allies seem to be *C. Villiersi*, Sternberg (*Neuropteris Villiersi*, Brongn.), and *Cyclopteris heterophylla*, Gœppert; but it differs from both.

44. *CYCLOPTERIS BROWNII*, sp. nov. Pl. XII. fig. 9.

Pinnules large, cuneate, with distant, once-forked nerves, and waved margins.

This is a mere fragment, but indicates a very distinct plant from any known to me elsewhere. It was collected at Perry by Prof. C. H. Hitchcock, and is named in honour of Mr. Brown, of Perry, one of the earliest explorers of the beds at that place.

45. *CYCLOPTERIS INCERTA*, sp. nov. Pl. XVI. fig. 44.

Stipes half an inch in diameter, giving off branches at acute angles, on which are borne, below, branching and recurved remains of fertile pinnules and, above, traces of terminal obovate pinnules.

I describe this plant rather as an indication of a species than as one actually known. The parts remaining are similar in arrangement to those of *Cyclopteris Acadica* of the Lower Coal-measures of Nova Scotia, and prove the existence of a somewhat similar species during the era of the Hamilton group in New York, from which this specimen is derived.

46. *NEUROPTERIS SERRULATA*, sp. nov. Pl. XV. fig. 35 *a, b*.

Bipinnate. Rachis thin and slender. Pinnæ alternate, sparsely placed, and of few pinnules. Pinnules obovate, narrowed at base, sessile, delicately but sharply serrate, especially at the apex. Terminal leaflet rounded and lobed, scarcely serrulate. Midrib visible nearly to the apex. Pinnules about two lines in length.

From the St. John shales, where it seems to be rare. It is a delicate little species, quite distinct, in so far as I am aware, from any heretofore described.

47. *NEUROPTERIS POLYMORPHA*, sp. nov. Pl. XV. fig. 36 *a, b, c*.

Pinnate or bipinnate. Rachis or secondary rachis irregularly striate. Pinnules varying from round to oblong, unequally cordate at base, varying from obtuse to acute. Terminal leaflet ovate, acute, angulated or lobed. Midrib delicate, evanescent. Nervures slightly arcuate, at acute angles with the midrib.

This Fern is very abundant in the shales near Carlton, at St. John. At first sight it appears to constitute several species, but careful comparison of numerous specimens shows that all the various forms figured may occur on the same frond. In its variety of forms it resembles *N. heterophylla*, Brongn., or *N. hirsuta*, Lesquereux; but it differs from the former in its delicate midrib and acutely angled nervures, and from the latter in its smooth surface.

48. *SPHENOPTERIS HÆNINGHAUSI*, Brongniart.

One of the Ferns from the shales near St. John appears to be

identical with the above species, which belongs to the Lower Carboniferous of Europe.

49. SPHENOPTERIS MARGINATA, sp. nov. Pl. XV. fig. 38 a, b.

This resembles the last species in general form, but is larger, with the pinnules round or round-ovate, divided into three or five rounded lobes, and united by a broad base to the broadly winged petiole.

Found with the preceding. One specimen, given to me by Mr. Hartt, shows a frond 6 inches in length.

50. SPHENOPTERIS HARTTII, sp. nov. Pl. XVI. fig. 48 a, b.

Bipinnate or tripinnate. Divisions of the rachis margined. Pinnules oblique, and confluent with the margins of the petiole; bluntly and unequally lobed. Nerves small, oblique, twice-forked.

This beautiful Fern very closely resembles *S. alata* from the coal-field of Port Jackson, but differs in several of its details. I name it in honour of Mr. Hartt, the discoverer of several of the St. John Ferns. Found with the preceding.

51. SPHENOPTERIS HITCHCOCKIANA, sp. nov. Pl. XVI. fig. 51 a, b, c.

Stipes stout, straight, rugose, giving off slender secondary petioles, which ramify dichotomously and terminate in minute obovate leaflets.

This beautiful plant, from Perry, which I name in honour of its discoverer, who worthily bears a name long noted in American Geology, has the aspect rather of a stem with excurrent branchlets than of a frond. Its venation cannot be distinguished. It belongs to a peculiar group or subgenus (*Davallioides* of Gœppert) characteristic of the Devonian and Lower Carboniferous, and represented in Europe by such plants as *S. petiolata*, Unger, *S. refracta*, Gœppert, and *S. Devonica*, Unger. Some of these plants (and this applies to the one now noticed) convey the impression that they may be sub-aquatic portions of Ferns bearing pinnules of different form in the air. Immense numbers of leaflets, apparently of this species, are scattered over certain surfaces of the St. John shales, but have not yet been seen in connexion with their rachis; and one of Prof. Hall's specimens from New York exhibits a stipe quite like that of the present species, but with mere traces of the pinnæ.

52. HYMENOPHYLLITES CURTILOBUS, sp. nov. Pl. XV. fig. 39.

Bipinnate. Rachis slender, dichotomous, with divisions margined. Leaflets deeply cut into subequal obtuse lobes, each one-nerved, and about one-twentieth of an inch wide in ordinary specimens.

According to Lesquereux, the genus *Hymenophyllites* is characteristic in America of the Upper Devonian. In Europe it is represented also in the Lower Coal. I have not seen any species in the Carboniferous rocks of Nova Scotia or New Brunswick. The present is the only new species occurring at St. John. It resembles a gigantic

variety of *H. obtusilobus*, Gœppert (*Sphenopteris trichomanoides*, Brongn.).

53. HYMENOPHYLLITES OBTUSILOBUS, Gœppert.

Found with the preceding.

54. HYMENOPHYLLITES GERSDORFFII, Gœppert. Pl. XV. fig. 37.

Found with the preceding.

55. PECOPTERIS (ALETHOPTERIS) DECURRENS, sp. nov. Pl. XV. fig. 40 *a, b, c*.

Bipinnate. Pinnules rather loosely placed on the secondary rachis, but connected by their decurrent lower sides, which form a sort of margin to the rachis. Midrib of each pinnule springing from its upper margin and proceeding obliquely to the middle. Nerves very fine and once-forked. Terminal leaflet broad.

This Fern so closely resembles *Pecopteris Serlii* and *P. lonchitica* that I should have been disposed to refer it to one or other of these species but for the characters above stated, which appear to be constant. *P. Serlii* is abundant in the Lower Carboniferous of Northern New Brunswick, and *P. lonchitica* is the most common Fern throughout the whole thickness of the Joggins Coal-measures; but in neither locality does the form found at St. John occur. On this account I think it probable that the latter is really distinct. In Murchison's 'Siluria,' 2nd edit., p. 321, a Fern from Colebrook Dale is figured as *P. lonchitica*, which, so far as I can judge from the engraving, may be identical with the present species. Locality, St. John.

56. PECOPTERIS (ALETHOPTERIS) INGENS, sp. nov. Pl. XV. fig. 41 *a, b*.

Pinnules more than an inch wide, and three inches or more in length, with nervures at right angles to the midrib and forking twice.

Only a few fragments of pinnules of this species have been found in the shales near St. John. They are usually doubled along the midrib, as if it had been their habit to be folded in a conduplicate manner. Their general aspect suggests a resemblance to the Mesozoic Tæniopterids rather than to the Pecopterids of the Coal-formation.

57. PECOPTERIS (ALETHOPTERIS). Pl. XVI. fig. 49.

Mr. Hartt has recently sent to me, from St. John, a pinna of a *Pecopteris* having oblong, obtuse pinnules attached by the whole base, with a slender midrib, and slightly repand edges. The nervures are not preserved. It closely resembles *A. obscura*, Lesquereux, from the Coal of Pennsylvania.

58. TRICHOMANITES (?). Pl. XVI. fig. 50 *a, b*.

A minute frond, collected at St. John by Mr. Hartt, may possibly represent a plant of this genus; but it may be merely the nervures of a leaf whose parenchyma has been removed by decay.

59. RHACHIOPTERIS PINNATA. Gen. et sp. nov. Pl. XVI. fig. 60.

Stipes half an inch wide or less, unevenly striate, giving off opposite branches, which are abruptly broken off at short distances from the stipe.

Unger has established as a provisional family, under the name of *Rhachiopterides*, a number of species, referred to several genera, of stipes of ferns showing structure; and I now propose under the above name to include such Devonian stipes as indicate the existence of distinct species of Ferns, of which the fronds have perished. This has the advantage of provisionally recognizing the existence of such species, and of preventing their stipes from being referred, in their flattened state, to other families of plants. It also serves to remind us of the fact that, while in some localities we have a number of species of Ferns in a good state of preservation, in others an equal number of species are represented only by fragments of stipes. The latter state of things is especially noteworthy in the Middle Devonian of New York, from the lower member of which, the Marcellus Shale, the present species is derived.

60. RHACHIOPTERIS CYCLOPTEROIDES, sp. nov.

Very thick stipes, not observed to branch, and marked with uneven longitudinal striæ.

Base of the Catskill group, New York.

61. RHACHIOPTERIS PUNCTATA, sp. nov. Pl. XVI. fig. 61.

Stipes marked with obscure longitudinal ridges, between which are transverse furrows or punctures; greatest diameter an inch.

These stipes are marked in the manner of those of *Cyclopteris Rimeriana*, Gœppert, of the Upper Devonian; and Unger figures a similar stem from the Devonian of Thuringia. The present specimens are from the Catskill group of New York. Fragments with similar markings occur both at St. John and Gaspé.

62. RHACHIOPTERIS STRIATA, sp. nov.

Stipes regularly and distinctly striated longitudinally.

Many short fragments of these stipes occur on the surfaces of beds of the Chemung group at Richfield, Ohio, and the Hamilton group at Akron, Ohio. They are not distinguishable from similar fragments of the stipes of *Cyclopteris Acadica*, and, like these, might, when flattened, be mistaken for leaves with parallel veins.

63. RHACHIOPTERIS TENUISTRATA, sp. nov. Pl. XIV. fig. 32 *a, b*; and Pl. XVI. figs. 45, 46.

Stipes smooth, finely striated, and in some specimens with little linear ridges scattered over the surfaces, and perhaps marking the position of minute hairs. Largest stems an inch in diameter, branching pinnately and dichotomously, and terminating in recurved divisions or in long flattened petioles.

More than one species may possibly be included under this name;

but all the specimens are apparently stipes of species of *Cyclopteris* or *Sphenopteris*. They occur in the Genessee Shale and Marcellus Shale. Many somewhat similar stipes occur at Perry and at Gaspé.

Note.—Since writing the above paper, I have received from Mr. Hartt two additional Ferns, collected by Mr. Lann and Mr. Payne, of St. John. One of them is a pinnule of a *Neuropteris*, in some points resembling *N. gigantea*. It is about an inch in length, broadly oval in form, and with a thick and persistent midrib and crowded nervures, forking twice. The other is a *Sphenopteris*, with elongated pinnatifid pinnæ, much in the style of *S. intermedia*, Lesquereux. Neither of these plants seems identical with any described species; but more perfect specimens are required for their description.

(*Incertæ sedis.*)

64. *CARDIOCARPUM CORNUTUM*, sp. nov. Pl. XIII. figs. 23, 24.

Broadly ovate, emarginate at base, dividing into two inflexed processes at top. A mesial line proceeds from the sinus between the cusps, downward. Nucleus more obtuse than the envelope, and acuminate at the top. Surface of the flattened envelope striate, that of the nucleus more or less rugose. Length about seven lines.

Numerous in shale near St. John. The specimens are all perfectly flattened, and many of them are also distorted, being elongated or shortened according to the direction in which they lie in the shale. The nucleus constitutes a strongly shaded spot of graphite. The flattened envelope appears as a less distinct wing or border.

65. *CARDIOCARPUM OBLIQUUM*, sp. nov. Pl. XIII. fig. 25.

Unequally cordate, acuminate, smooth, with a strong rib passing down the middle; length about three lines.

Found with the preceding. It somewhat resembles some of the forms of *C. acutum*, L. & H.

66. *TRIGONOCARPUM RACEMOSUM*, sp. nov. Pl. XVI. fig. 47 *a, b, c.*

Ovate, obtusely acuminate, in some specimens triangular at apex. In flattened specimens the envelope appears as a wing. Attached in an alternate manner to a thick, flexuous, furrowed rachis.

This is evidently a fruit or seed, borne in a racemose manner on a stout rachis. In some specimens the seeds are close to each other, in others more remote. Attached to some are apparently traces of calyx-leaves or bracts. Shales of St. John.

67. *ACANTHOPHYTON SPINOSUM*, gen. et sp. nov. Pl. XII. fig. 6 *a, b.*

Cylindrical branches, ramifying in an alternate manner, striated, and with scattered tubercles, on which are borne short spines or prickles.

These specimens, from the Hamilton group of New York, resemble fragments of branches of some spiny or prickly exogenous plant. The stipes of some Ferns, as *Neuropteris lineata*, have a spinous

appearance when deprived of their pinnules ; but the present specimens are obviously of different character. In Prof. Hall's collections from the Chemung group there are similar stems, with tubercles, but with a minutely punctured surface. These may possibly indicate a distinct species.

(*Algæ.*)

Among Prof. Hall's specimens are several which probably belong to *Algæ* ; but I regard them as too obscure in their affinities to merit detailed description, with the exception of the following.

68. *UPHANTÆNIA CHEMUNGENSIS*, Vanuxem. Pl. XVII. fig. 62.

Vanuxem's 'Report, Geol. New York,' p. 153, fig. 50.

Flabellate, invested, conical or hollow, cylindrical fronds, marked externally with cross striæ, dividing the surface into rectangular spaces ; and in the cylindrical forms with rows of tubercles.

Vanuxem has figured and described, under the above name, a flabellate frond which he represents as apparently consisting of tape-like bodies interwoven like basket-work. The specimens submitted to me have, however, rather the character of a continuous surface marked out into spaces by radiating and concentric striæ. With these fan-like forms are associated others that are bluntly conical, and others still that are elongately conical or cylindrical ; and some of the latter are covered with large tubercles arranged in vertical and transverse rows, so as to give an appearance like that of stems of the genus *Halonia*. One of these curious stem-like objects is illustrated by fig. 62 (from a photograph). Some of the specimens are much more finely marked than others, but there are gradations in this ; and there are indications that some of the more finely marked stems had flabellate or conical fronds upon them. These objects are very perplexing, and are found in marine beds, but mixed with remains of land-plants. On the whole I regard them as *Algæ* with funnel-shaped fronds sometimes prolonged into cylinders, and, when adult, bearing fructification in tubercles on the sides of the cylinders. In general form these plants may be compared with *Algæ* of the family *Dictyotææ* ; but there is no indication that they resembled these in details of structure. Some of the specimens have a slight carbonaceous coating. The cylindrical forms seem to have been regarded by Conrad as shells, and were named *Hydroceras*. The specimens in my possession are from the Chemung group in New York and Ohio. They may represent several species, but, on the other hand, it is quite possible that they may be different states and portions of the same plant.

Geological and Geographical Distribution of the Devonian Plants of Eastern America.

Names of Species.	Upper Silurian.	Lower Devonian.	Middle Devonian.		Upper Devonian.				Carboniferous.	
	Gaspé.	Gaspé.	Gaspé.	New York.	Gaspé.	New York.	Maine.	New Brunswick.		Pennsylvania.
1. <i>Syringoxylon mirabile</i>				*						
2. <i>Dadoxylon Ouangondianum</i>								*		
3. — <i>Halli</i>				*						
4. <i>Aporoxylon</i>				*			*			
5. <i>Prototaxites Logani</i> †			*							
6. <i>Sigillaria Palpebra</i>								*		
7. — <i>Vanuxemii</i>							*			
8. — <i>Simplicitas</i>				*						
9. <i>Syringodendron gracile</i>				*						
10. <i>Stigmaria exigua</i>							*			
11. — <i>ficoides</i>								*		*
12. <i>Didymophyllum reniforme</i>				*						
13. <i>Calamites Transitionis</i>								*		*
14. — <i>cannæformis</i>								*		*
15. — <i>inornatus</i>				*	*			*		*
16. <i>Asterophyllites acicularis</i>								*		*
17. — <i>latifolia</i>								*		*
18. — <i>scutigera</i>								*		*
19. — <i>longifolia</i>								*		*
20. — <i>parvula</i>								*		*
21. <i>Annularia acuminata</i>								*		*
22. <i>Sphenophyllum antiquum</i>								*		*
23. <i>Pinnularia dispalans</i>								*		*
24. <i>Lepidodendron Gaspianum</i>			*	*	*	*	*	*	*	*
25. — <i>Chemungense</i>						*	*	*	*	*
26. — <i>corrugatum</i>						*	*	*	*	*
27. <i>Sagenaria Veltheimiana</i> †					*			*		*
28. <i>Lepidostrobus Richardsoni</i>							*			*
29. — <i>globosus</i>							*			*
30. <i>Lycopodites Matthewi</i>							*			*
31. — <i>Vanuxemii</i>						*	*	*		*
32. <i>Psilophyton princeps</i>	*	*	*	*	*	*	*	*	*	*
33. — <i>elegans</i>						*	*	*	*	*
34. — <i>glabrum</i>						*	*	*	*	*
35. <i>Selaginites formosus</i>			*		*		*	*	*	*
36. <i>Leptophloeum rhombicum</i>						*	*	*	*	*
37. <i>Cordaites Robbii</i>						*	*	*	*	*
38. — <i>angustifolia</i>	*	*	*	*	*	*	*	*	*	* ?
39. <i>Cordaites</i> ?				*		*	*	*	*	*
40. <i>Megaphyton</i> ?						*	*	*	*	*
41. <i>Cyclopteris Halliana</i>						*	*	*	*	*

† This species was not noticed in the descriptions, as no new facts relating to it had been obtained.

‡ I have marked this species as occurring in Pennsylvania, being of opinion that it is the same with *Lepidodendron primevum* of Rogers.

Geological and Geographical Distribution of the Devonian Plants of Eastern America (continued).

Names of Species.	Upper Silurian.	Lower Devonian.	Middle Devonian.		Upper Devonian.				Carboniferous.	
	Gaspé.	Gaspé.	Gaspé.	New York.	Gaspé.	New York.	Maine.	New Brunswick.		Pennsylvania.
42. Cyclopteris Jacksoni							*	*		
43. — obtusa							*	*		
44. — valida							*	*		
45. — varia							*	*		
46. — Brownii							*	*		
47. — incerta				*			*	*		
48. Neuropteris serrulata							*	*		
49. — polymorpha							*	*		
50. Sphenopteris Hœninghausi							*	*		*
51. — marginata							*	*		
52. — Hartii							*	*		
53. — Hitchcockiana							*	*		
54. Hymenophyllites curtilobus							*	*		
55. — obtusilobus							*	*		
56. — Gersdorffii							*	*		*
57. Alethopteris decurrens							*	*		*
58. — ingens							*	*		
59. — obscura?							*	*		*?
60. Trichomanites							*	*		
61. Rhachiopteris pinnata				*			*	*		
62. — cyclopteroides							*	*		
63. — punctata							*	*		
64. — striata				*			*	*		*?
65. — tenuistriata				*			*	*		
66. Cardiocarpum cornutum							*	*		
67. — obliquum							*	*		
68. Trigonocarpum racemosum							*	*		
69. Acanthophyton spinosum							*	*		

III. CONCLUSION.

In the course of the preceding pages, I have endeavoured to notice points of general geological and botanical interest as they occurred; and it will now be necessary only to mention a few leading results, as to the Devonian Flora, which may be deduced from the observations above recorded.

1. In its general character the Devonian Flora resembles that of the Carboniferous Period, in the prevalence of Gymnosperms and Cryptogams; and, with few exceptions, the generic types of the two periods are the same. Of thirty-two genera to which the species described in this paper belong, only six can be regarded as peculiar to the Devonian Period. Some genera are, however, relatively much

better represented in the Devonian than in the Carboniferous deposits, and several Carboniferous genera are wanting in the Devonian.

2. Some species which appear early in the Devonian Period continue to its close without entering the Carboniferous; and the great majority of the species, even of the Upper Devonian, do not reappear in the Carboniferous Period; but a few species extend from the Upper Devonian into the Lower Carboniferous, and thus establish a real passage from the earlier to the later flora. The connexion thus established between the Upper Devonian and the Lower Carboniferous is much less intimate than that which subsists between the latter and the true Coal-measures. Another way of stating this is, that there is a constant gain in number of genera and species from the Lower to the Upper Devonian, but that at the close of the Devonian many species and some genera disappear. In the Lower Carboniferous the flora is again poor, though retaining some of the Devonian species; and it goes on increasing up to the period of the Middle Coal-measures, and this by the addition of species quite distinct from those of the Devonian Period.

3. A large part of the difference between the Devonian and Carboniferous Floras is probably related to different geographical conditions. The wide swampy flats of the Coal Period do not seem to have existed in the Devonian era. The land was probably less extensive and more of an upland character. On the other hand, moreover, it is to be observed that, when in the Middle Devonian we find beds similar to the underclays of the Coal-measures, they are filled, not with *Stigmaria*, but with rhizomes of *Psilophyton*; and it is only in the Upper Devonian that we find such stations occupied, as in the Coal-measures, by *Sigillaria* and *Calamites*.

4. Though the area to which this paper relates is probably equal to any other in the world in the richness of its Devonian Flora, still it is apparent that the conditions were less favourable to the preservation of plants than those of the Coal Period. The facts that so large a proportion of the plants occur in marine beds, and that so many stipes of Ferns occur in deposits that have afforded no perfect fronds, show that our knowledge of the Devonian Flora is relatively far less complete than our knowledge of that of the Coal-formation.

5. The Devonian Flora was not of lower grade than that of the Coal Period. On the contrary, in the little that we know of it we find more points of resemblance to the Floras of the Mesozoic Period, and of modern tropical and austral islands, than in that of the true Coal-formation. We may infer from this, in connexion with the preceding general statement, that in the progress of discovery very large and interesting additions will be made to our knowledge of this flora, and that we may possibly also learn something of a land fauna contemporaneous with it.

6. The *facies* of the Devonian Flora in America is very similar to that of the same period in Europe, yet the number of identical species does not seem to be so great as in the coal-fields of the two continents. This may be connected with the different geographical

On the FLORA of the DEVONIAN PERIOD in NORTH-EASTERN AMERICA.
By J. W. DAWSON, LL.D., F.G.S., Principal of M'Gill University,
Montreal.

APPENDIX, September 1862.—In a recent visit to Perry, the author (with the aid of Mr. Brown, of that place) thoroughly examined the present exposure of the plant-bearing bed. Among the specimens obtained were the following. (1.) Wood of a conifer of the genus *Dadoxylon*. (2.) A new *Stigmara* of the type of *S. exigua*. (3.) Specimens of *Lepidostrobus Richardsoni*, showing it to have been the fructification of a new and interesting species of *Lycopodites*. (4.) Another species of *Lycopodites* allied to *L. Erdmanni*, Germar. (5.) A new species probably of the genus *Anarthrocanna*, Gœppert. (6.) A new *Cordaites*. (7.) More perfect specimens of *Cyclopteris Browniana*, showing it to have been a large and beautiful flabellate leaf or frond, possibly identical with that from the Upper Devonian of Pennsylvania, figured by Prof. Rogers, 'Pennsylvania Report,' vol. ii. part 2. pl. 22. (8.) A Fern allied to *Cyclopteris Jacksoni*, but with a stem similar to that of *C. Roemeriana*, Gœppert. (9.) New species of *Sphenopteris*, *Trichomanites*, and *Carpolites*. (10.) Specimens of *Leptophloeum rhombicum*, showing its leaves and fructification. These, with some interesting specimens recently collected by Mr. R. Bell, of the Geological Survey, at Gaspé, Dr. Dawson hopes to describe in a future paper.

ADDITIONAL NOTE, October 23, 1862.—I am informed by Prof. Hall, in a letter* bearing date Oct. 13th, 1862, that recent observations made by Prof. Orton, Mr. Way, and himself, indicate that the beds which have afforded the plants noticed in this paper as from the Catskill group of New York really belong to a somewhat lower horizon, that of the Chemung group, while the Catskill group proper, as now restricted by Prof. Hall, has not afforded any of these fossils.

This restriction renders it desirable that the following *corrigenda* should be made in my paper:—

- Page 298, line 2, for Catskill Group read Chemung and Portage Groups.
 „ „ line 7, *dele* Chemung Group.
 „ 307, line 2 from bottom, foot-note, for Catskill read Chemung.
 „ 313, line 2, for Catskill read Chemung.
 „ 315, line 14, for Catskill Group read same group.
 „ 323, line 22, for Base of the Catskill group read From the Middle Devonian of.
 „ „ line 29, for Catskill read Chemung.

J. W. D.

* See letter from Professor Hall to Dr. Dawson, on the corrected range of the Catskill and Chemung groups in New York, in the *Canad. Nat. and Geol.* vol. vii. No. 5, October 1862, p. 377.

conditions in these two periods; but the facts are not yet sufficiently numerous to prove this.

7. The above general conclusions are not materially different from those arrived at by Gœppert, Unger, and Bronn, from a consideration of the Devonian Flora of Europe.

EXPLANATION OF PLATES XII.—XVII.

Illustrative of the Devonian Flora of North-eastern America.

PLATE XII.

- Fig. 1. *Syringoxylon mirabile*; longitudinal section, highly magnified. *a*, woody fibres; *b*, medullary rays; *c*, ducts.
 2. —; transverse section.
 3. —; portion of a duct, highly magnified, showing the pores.
 4. —; medullary ray, highly magnified.
 5. —; transverse section, highly magnified; letters of reference as in fig. 1.
 6. *Acanthophyton spinosum*: *a*, smooth species or variety; *b*, punctated species or variety.
 7. *Sigillaria Vanuxemii*: *a*, retaining the outside; *b*, decorticated; *c*, axis.
 8. *Leptophlœum rhombicum*: *a*, natural size; *b*, an areole enlarged.
 9. *Cyclopteris Brownii*.
 10. *Lepidodendron corrugatum*: *a*, portion of a small stem; *b*, part of a larger stem.

PLATE XIII.

- Fig. 11. *Dadoxylon Halli*; longitudinal section, magnified.
 12. *Sigillaria Palpebra*: *a*, natural size; *b*, an areole magnified.
 13. *Stigmaria exigua*.
 14. *Syringodendron gracile*: *a*, natural size; *b*, an areole magnified.
 15. *Didymophyllum reniforme*: *a*, natural size; *b*, an areole magnified.
 16. *Asterophyllites acicularis*: *a*, natural size; *b*, a leaf enlarged.
 17. *A. latifolia*: *a* and *c*, natural size; *b*, leaf enlarged.
 18. *A. scutigera*; ordinary aspect of the stem. 19. Apex of stem. 20. Stem compressed diagonally.
 21. *Annularia acuminata*.
 22. *Pinnularia dispalans*.
 23 & 24. *Cardiocarpum cornutum*.
 25. *C. acutum*.

PLATE XIV.

- Fig. 26, 27, 28. *Lepidodendron Gaspianum*, in various states.
 29 & 30. *Psilophyton elegans*: *a*, fructification.
 31. *Cordaites Robbii*: *a*, a group of young leaves; *b*, point of leaf; *c*, base of leaf; *d*, venation magnified.
 32. *Rhachiopteris tenuistriata*: *a*, natural size; *b*, a portion magnified.

PLATE XV.

- Fig. 33. *Cyclopteris obtusa*.
 34. *C. varia*.
 35. *Neuropteris serrulata*: *a*, natural size; *b*, a pinnule enlarged.
 36. *N. polymorpha*: *a* to *g*, various forms of pinnules.
 37. *Hymenophyllites Gersdorffii*: *a*, natural size; *b*, magnified.
 38. *Sphenopteris marginata*: *a*, natural size; *b*, magnified.
 39. *Hymenophyllites obtusilobus*; natural size.
 40. *Pecopteris decurrens*: *a*, a portion of a frond; *b*, terminal leaflet (*c*, magnified).
 41. *P. inœns*: *a*, natural size; *b*, magnified.

Fig. 42. *Psilophyton elegans*, portion of stipe.

43. Fragment of stem of *Asterophyllites*.

PLATE XVI.

Fig. 44. *Cyclopteris incerta*: *a*, stipe; *b*, remains of fertile pinnules; *c*, remains of leaflets.

45 & 46. *Rhachiopteris tenuistriata*.

47. *Trigonocarpum racemosum*: *a* and *b*, natural size; *c*, fruit, magnified.

48. *Sphenopteris Harttii*: *a*, terminal pinna; *b*, portion of frond.

49. *Alethopteris obscura*?

50. *Trichomanites* (?): *a*, natural size; *b*, portion enlarged.

51. *Sphenopteris Hitchcockiana*: *a*, natural size; *b*, *c*, pinnules magnified.

59. *Cordaites* (?) (from a photograph).

60. *Rhachiopteris pinnata* (from a photograph).

61. *R. punctata* (from a photograph).

PLATE XVII.

Fig. 52. *Cyclopteris valida*: *a*, natural size; *b*, pinnule enlarged.

53. *Leptophlaeum rhombicum*: *a*, immature portion of stem, showing Sternbergian structure.

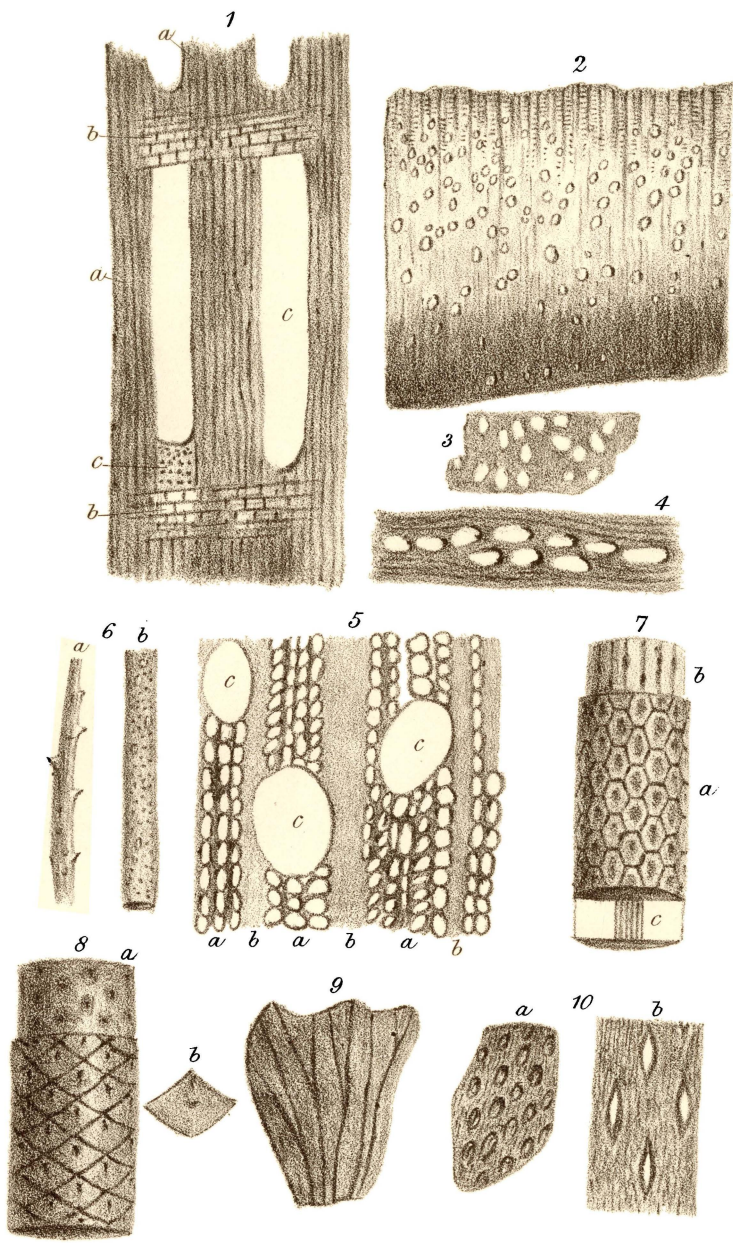
54. Terminal pinna of *Cyclopteris Halliana*. 55. Lateral pinna.

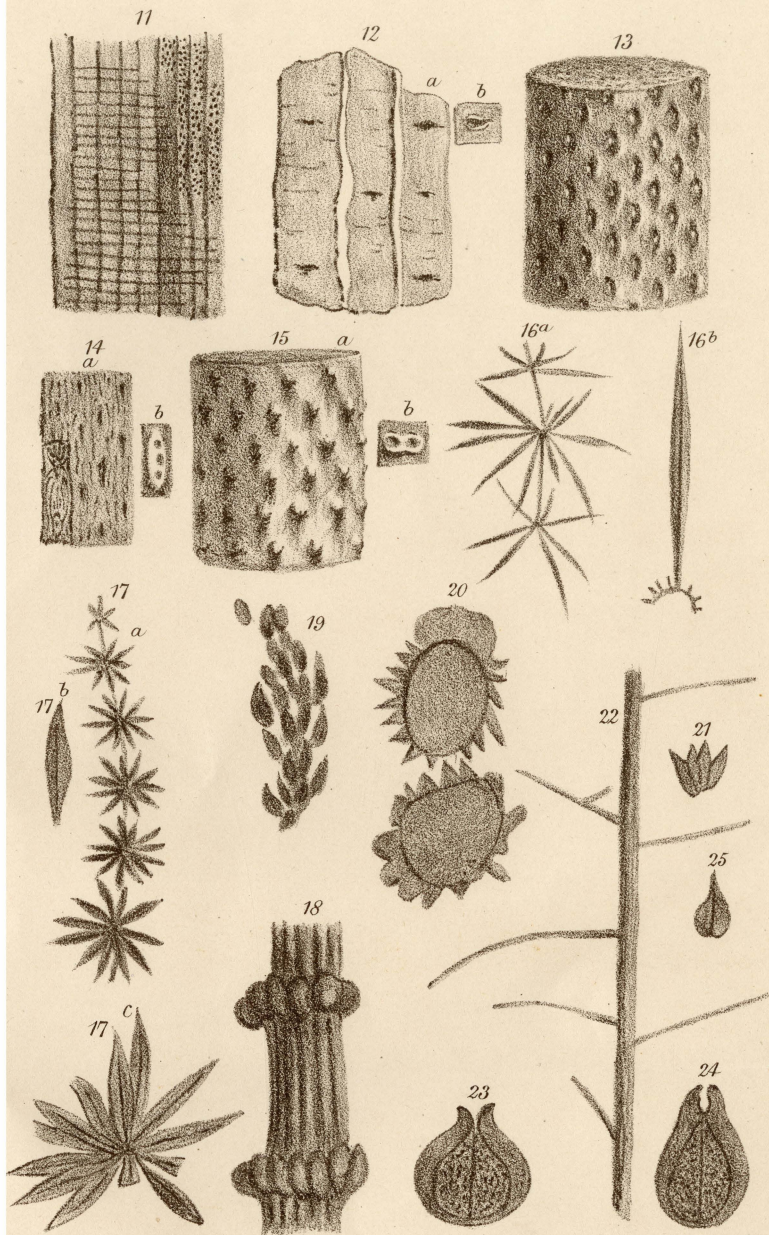
56. *Calamites inornatus*; one-third of natural size.

57. *Lycopodites Vanuxemii*.

58. *Lepidodendron Gaspianum*; portion of stem, flattened, covered with bark, and retaining remains of the leaves.

62. *Uphantenia Chemungensis* (from a photograph).





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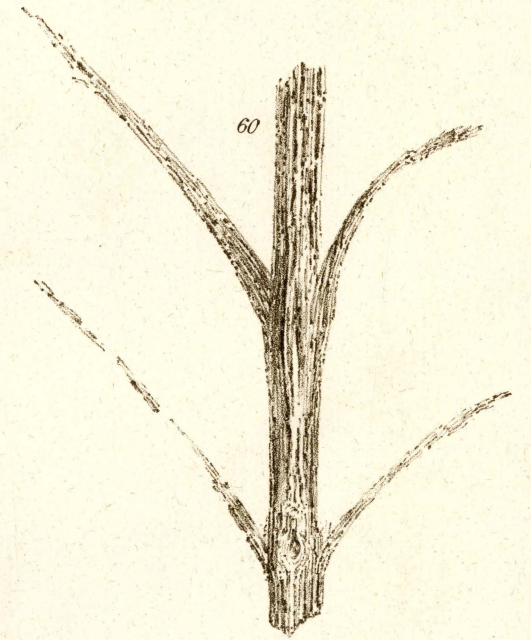
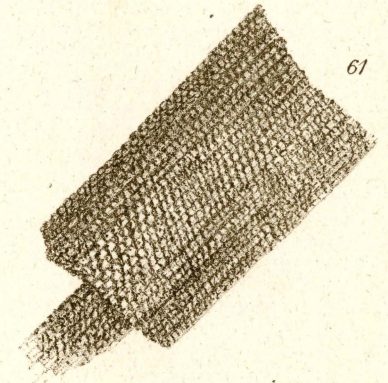
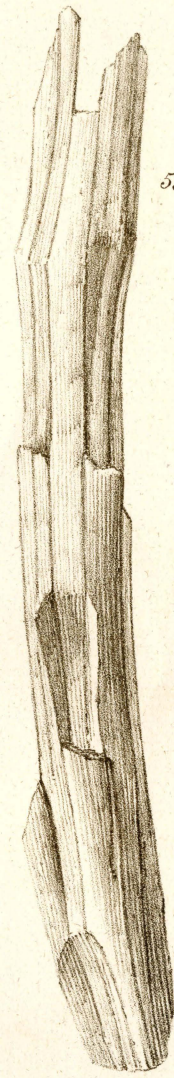
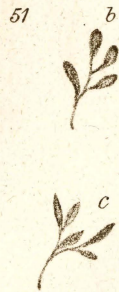
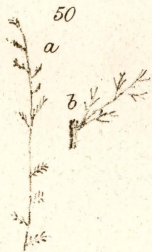
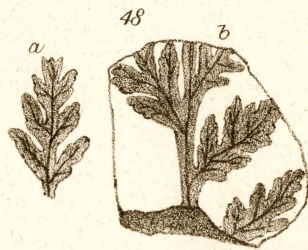
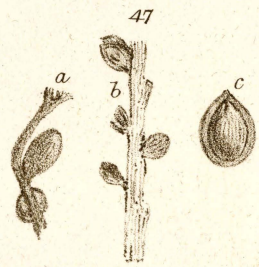
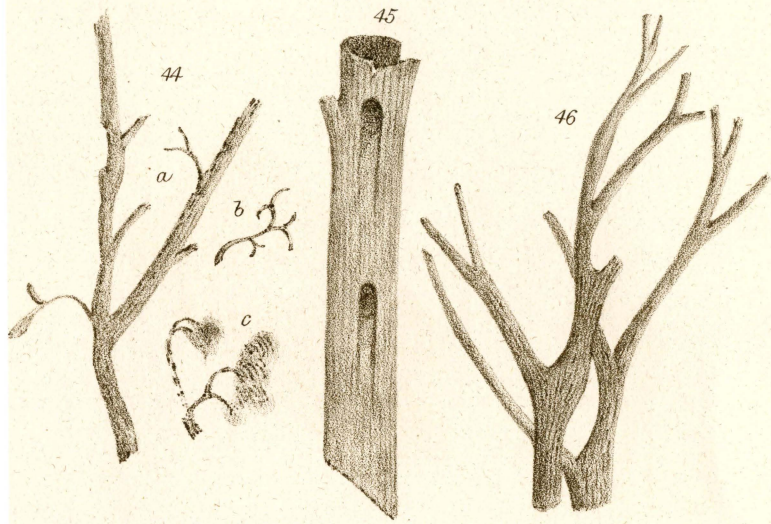
W. West imp.



F.W.D. del.

W. West imp.

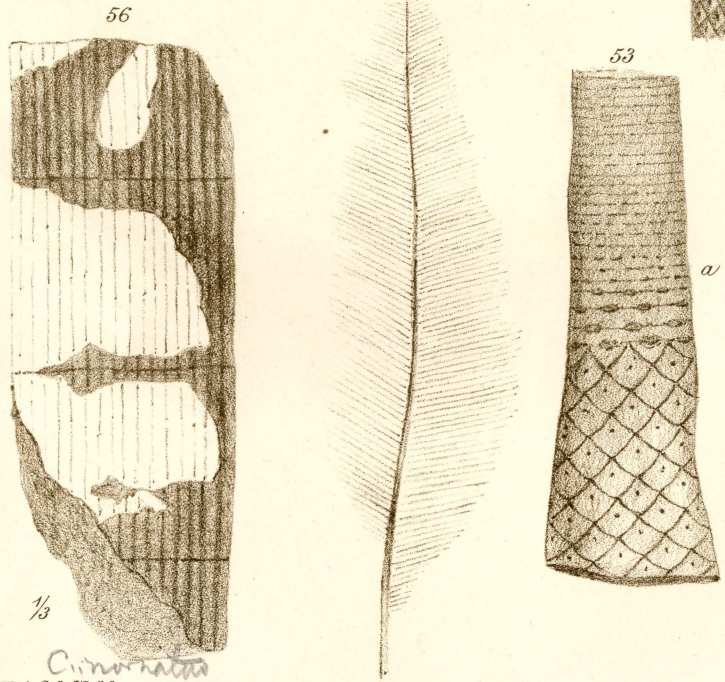




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DEVONIAN PLANTS OF NORTH-EASTERN AMERICA.



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