THE CORRELATION OF EARLY CRETACEOUS FLORAS IN CANADA AND THE UNITED STATES.

SIR J. WILLIAM DAWSON, LL.D., F.R.S., ETC.

VI.—*On the Correlation of early Cretaceous Floras in Canada and the United States, and on some new plants of this period.*

By Sir J. WILLIAM DAWSON, LL.D., F.R.S., etc.

(Read June 2, 1892.)

The purpose of this paper is to illustrate the present state of our knowledge respecting the flora of Canada in the early Cretaceous, and to notice some new plants from Anthracite, collected by Mr. H. M. Ami, F.G.S., and from Canmore, collected by Dr. Hayden. It is in continuation of my paper on the Mesozoic Floras of the Rocky Mountain Region of Canada in the Transactions of this Society for 1885; but is still to be regarded as merely introductory to the study of an interesting stage of the Cretaceous Flora, first recognized in North America in the Rocky Mountain Region of Canada, and which it is certain will yield many additional treasures in the progress of exploration and mining in the district in question.

I.—SUMMARY OF GEOLOGICAL FACTS.

Rocks of Lower Cretaceous age were first described in Canada by the late Mr. James Richardson in the Report of the Geological Survey for 1872-73. In appendices to that report, notes on the plants are given by the author, and on the marine animal remains by the late Mr. Billings. With respect to the former the most remarkable specimens were fruits and fragments of leaves of a fine species of *Dioonites*, which I described and figured as *Cycadeocarpus* (*Dioonites*) *Columbianus*.[1] and coniferous woods referred to the genera Cupressoxylon and Taxoxylon. These fossils, though few, indicated in my judgment an age somewhat greater than that of the Nanaimo coal formation of Vancouver Island and probably Lower Cretaceous or even Jurassic. A similar conclusion was arrived at by Mr. Billings from the associated animal fossils, on some of which he had also the opinion of the late Mr. Meek. Both these palæontologists compared them with the Shasta group of the California geologists. The animal fossils collected by Richardson were subsequently more fully described and figured by Mr. Whiteaves.[2]

In 1878, Dr. G. M. Dawson made a more thorough exploration of the Queen Charlotte Islands.[3] In this he divided the Cretaceous rocks into groups, and ascertained that the lowest rest unconformably on the Triassic. He also collected many additional fossils, which were described and figured by Mr. Whiteaves.[4] In this paper Mr. Whiteaves

[1] Report cited, Page 69 and Plate.
[2] Mesozoic Fossils of Canada, Vol. I., Part I.
[3] Rept. Geol. Survey of Canada, 1878-79.
[4] Mesozoic Fossils, Vol. I., Part III.

states his belief that, while related to the Shasta fossils, those of the Queen Charlotte Islands may be as high in the series as the Gault of Europe.

At a little later date, rocks approximately of this age were found by Dr. G. M. Dawson in the inland part of British Columbia at Tatlayoco Lake and elsewhere. The fossils obtained from these rocks were noticed by Mr. Whiteaves in 1882 in the Transactions of this Society.[1]

By these researches, extending from 1872 to 1884, the existence both in the Queen Charlotte Islands and in the interior of British Columbia of beds of Lower Cretaceous age was established, and their correlation with the Shasta beds of California and the Lower Cretaceous of Europe defined; but their flora had as yet appeared only in connection with the coal-bearing rocks of the Queen Charlotte Islands. A new and unexpected light, and one pregnant as we shall see with important geological results, was thrown on this subject by the discovery of plant-bearing beds in the Cretaceous rocks folded into the plications of that part of the Rocky Mountains included between the 49th parallel and the Bow River.

In the summer of 1884 collections of fossil plants were placed in my hands by Dr. G. M. Dawson, from beds which he believed to be stratigraphically in the lower part of the Cretaceous of the Rocky Mountains, as exposed in the Crow's Nest and Kootanie Passes, and which I at once recognized as indicating a subdivision of the Cretaceous lower than any which in that region had afforded fossil plants, and approaching in the character of its flora to the Wealden of Europe. This he had provisionally named the Kootanie series, and over it was another group, the Mill Creek series, with fossil plants a little more modern in aspect, but still apparently older than the beds from Peace and Pine Rivers, described in a paper in these Transactions in 1883 and referred to the Niobrara and Benton, and possibly in part Dakota, groups of the United States geologists. They connected themselves in my mind with the Lower Cretaceous of the Queen Charlotte Islands and with the beds which Tyson had called Wealden in Maryland, and which I had seen in his company many years before.

These plants were of so great interest that it was thought best to describe them at once, though occurring in a formation evidently richly stored with vegetable fossils and which contained beds of coal likely to be worked, and it was evident that the collections which had been made in a rapid reconnaissance of the region were only a first instalment of what might be expected. They were accordingly described and the more important species figured in a paper published in these Transactions in 1885.[2]

In this paper I referred these plants to the Lower Cretaceous, placing them as equivalents of the plant-bearing beds of the Queen Charlotte Islands, of the so-called Wealden of Maryland,[3] of the Komé group of Heer in Greenland, and of the Neocomian of Europe. I also indicated the close relationship of some of the species with those described by Heer from beds in Siberia referred to the Jurassic. I remarked on the importance of the discovery, and stated that the knowledge of this flora "will form a sure basis from which

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[1] Report Geol. Survey, 1875-76, p. 253. Whiteaves, Trans. R. S., Vol. I., Sec. IV., p. 81. Contributions to Canadian Palæontology, Vol. I., Part II., p. 151. See also Dr. G. M. Dawson in Am. Journal of Science, Vol. XXXVIII., p. 120.

[2] Vol. III., Sec. IV., p. 1.

[3] Now known as the Potomac Group, whose plants have been fully described by Fontaine.

to trace the development of the vegetable kingdom upward to the more modern forms," as represented in Western America, and will complete the series of Cretaceous floras extending from the Queen Charlotte Islands beds through the Dakota, Peace River, Nanaimo and Laramie series up to the Eocene period, which has been discovered through the labours of the Geological Survey in Western Canada. I anticipated that we should thus have a good scale for comparison with the Cretaceous floras farther south, already known to a considerable extent through the labours of Newberry, Lesquereux and others.

These anticipations have been more than realized by the magnificent volumes of Fontaine on the Potomac formation of the Eastern United States,[1] by the discovery by Newberry in 1887 of the Kootanie Flora in the Great Falls coal-field of Montana,[2] and by farther discoveries in the Kootanie district itself, to which I propose to direct attention in the present paper.

Prof. Fontaine's Report now affords excellent terms of comparison for our Kootanie flora; but Dr. Newberry's paper is in some respects of greater interest, as referring to a region geographically nearer, and in which he has recognized several of the species that had been previously described in Canada, along with others which occur in our more recent collections not yet published. We thus have now before us a very widely distributed flora characteristic of the transition from the meagre and peculiar types of the Jurassic to the richer vegetation of the Cretaceous, in which already some species of exogenous plants appear. It is to be remarked, however, in this connection, that while the Potomac flora of the south-east, like the Mill Creek flora of the Rocky Mountains, includes exogenous plants of primitive types, only gymnosperms and ferns have as yet been found in the Kootanie and Great Falls collections. Such a negative fact cannot be certainly relied on, especially since the collections from these localities, though abundant in individuals are not as yet rich in species. Still so far as this fact goes it would give the impression that the western floras of the Queen Charlotte Islands, Kootanie region and Great Falls coal-field may be somewhat older than that of the Potomac formation.

I have remarked incidentally in the previous papers on the Cretaceous floras already referred to, on the probable geographical arrangements which accompanied and contributed to the distribution at this time of a rich temperate flora from Greenland to the Southern States, and Dr. G. M. Dawson has discussed this subject more fully in his paper on the "Later Physiographical Geology of the Rocky Mountain Region of Canada."[1] It would appear from the stratigraphical and palæontological facts summed up in that paper, that in the early Cretaceous a great shallow-water Mediterranean existed in the interior of the American continent, bordered by low and fertile shores, and probably barred across at its northern extremity by low lands extending from Greenland to the nascent ridges of British Columbia, while the Appalachian district formed a land ridge on the east. Around this vast interior basin of warm water, and possibly on islands scattered over it, flourished that vegetation which closed the Jurassic age and inaugurated the reign of Angiospermous plants extending from the middle Cretaceous into the modern. If, as seems in every way probable, the Jurassic age was in America a period of

[1] Later Mesozoic Floras, U. S. Geol. Survey, 1889.

[2] Am. Journal of Science, March, 1891.

continental elevation with climate somewhat extreme, then the subsidence which allowed the warm waters of the equatorial current to circulate through the interior basin of the continent would restore warmth and humidity, and would afford the climatal conditions favourable to the introduction of a new and more varied flora and allow this to extend far to the north. Such a state of affairs would also afford the local causes necessary to the formation of the coals which characterize the Lower Cretaceous, and which, folded up and altered in the great earth-movements of the Tertiary period, constitute beds of true anthracite in the Queen Charlotte Islands and in the Rocky Mountains.

II.—Recent Collections of Plants from the Kootanie Formation.

The collections now under consideration were made in 1891 by Mr. H. M. Ami, F.G.S., at Anthracite, and by Dr. Hayden at Canmore, both places being situated in the Cascade Coal Basin of the Rocky Mountains.[1] Those from the latter place are limited to a few specimens in a dark gray shale. The Anthracite specimens are in a black shaly rock much jointed, with frequent slickensided surfaces and liable to break across the bedding. The fossils are represented by shining anthracitic films on the black matrix, and the more delicate leaves can be distinctly made out only in a favourable light. These peculiarities of preservation oppose considerable difficulties to their comparison with the fossil plants from other and less disturbed districts, and in the following descriptive list some allowance has been made for them in the identifications proposed with species from the Potomac and other formations. It is also to be remarked that though from the same formation which afforded the plants described in 1885, few of the species are identical. This may indicate some difference of horizon within the formation, or may depend on local differences, or on the fragmentary and imperfect nature of the collections. In any case it is plain that the collections hitherto made must very imperfectly represent the flora as a whole, either in number of species or in the completeness of the specimens. Hence the present notes must be looked upon as merely provisional and introductory, and their presentation to the Society is justified only by the great geological importance of the facts which, however imperfect from a palæobotanical point of view, they serve to indicate.

I may be permitted to add that the history of geological discovery in the Canadian North-west affords a convincing proof of the value of fossil plants when carefully collected with reference to the containing beds, in determining the geological ages of the formations in which they occur, while there can be no question of their paramount value in indicating geographical and climatal conditions.

[1] Annual Rept. Geol. Surv. Can., 1885, p. 126 B.

II.—Descriptive List of Species.

Equisetum Lyelli (Mantell.) (Fig. 1.)

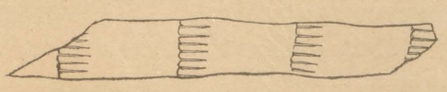

Fig. 1.—*Equisetum Lyelli.*

This is a widely distributed species, common in the English Wealden, found in the Potomac formation of Virginia, and one of the forms recognized at Grand Falls by Newberry. It is not uncommon in the shales from Anthracite, though the specimens are much flattened and crushed, and seem to represent branches rather than main stems. It is distinguished by the long linear spine-like teeth of the sheaths. The sheaths are 1 cm. long, and their teeth very long, narrow and pointed. The figure does not show the sheaths which are very indistinct.

Angiopteridium Canmorense (s. n.) (Fig. 2.)

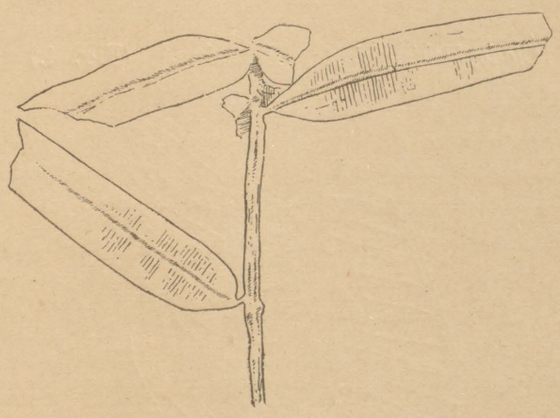

Fig. 2.—*Angiopteridium Canmorense.*

Frond pinnate, leaves 5 cm. or more long, 6 mm. broad. Points not seen. One specimen has four leaves somewhat widely separated. Another appears to be the apex of a frond with parts of six leaves somewhat close together. The texture seems to have been coriaceous and the veinlets are very fine and close, and at right angles to the midrib. It resembles *A. strictinerve* of Fontaine, but the materials are not sufficiently perfect for satisfactory comparison.

The genus was established by Schimper for a group of ferns resembling Tæniopteris in venation, but differing in form and arrangement. They are widely distributed in the Jurassic and Lower Cretaceous. The specimens are in Dr. Hayden's collections from Canmore, where no doubt more perfect fronds may be found. In the meantime it may provisionally named *A. Canmorense.*

Pecopteris Browniana (Dunker.) (Fig. 3.)

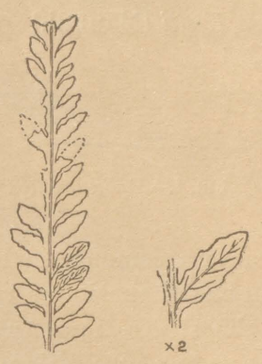

FIG. 3.—*Pecopteris Browniana.*

Single pinnæ occur in the Anthracite collections which are not distinguishable from this species, which is found both in the European Wealden and the American Potomac, and is nearly allied to *P. borealis*, Heer, from the Lower Cretaceous of Greenland. The name Pecopteris is of course provisional, and if the fructification were known it would, no doubt, be referred to some more modern genus. [1]

Cladophlebis falcata, (Fontaine.) (Fig. 4.)

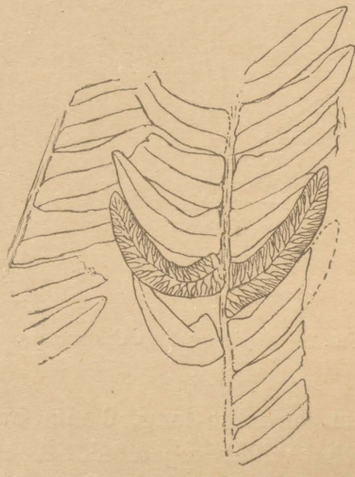

FIG. 4.—*Cladophlebis falcata.*

This provisional genus was established by Saporta and Schimper to include a number of ferns mostly Jurassic, and characterized by being pinnate with spreading pinnæ, the pinnules attached by the whole base, the apex pointed or obtuse, sometimes dentate, especially toward the apex, which is often turned upward, giving a falcate form. The midrib is strong but fading away into nerves toward the apex. Nerves at acute angles with the midrib, usually forking once or twice. The well known *Pecopteris Whit-*

[1] Trans. Royal Society of Canada, Vol. IV., Sec. IV., 1890.

byensis of the English Oolite may be considered as the typical form, which is represented by different species, sub-species and varieties in the Jurassic and Lower Cretaceous of nearly every part of the world.

This beautiful species, so common in the Anthracite shale, and which is better preserved than any other fern in the collection, is without doubt that named by Fontaine *C. falcata*, though I am by no means certain that this is distinct more than varietally from some of his other species and some of those figured by Heer. It is certainly distinct in venation from *C. Whitbyensis*, though closely resembling some varieties of that species in form. It is near to *Pecopteris recentior* and *P. ligata* of Phillips, and also to *Asplenium Albertum* from Mill Creek and *A. distans* from Canmore, described in my former paper.

Cladophlebis (Sp.)

This is a small fragment with delicate pinnules, somewhat resembling those of Fontaine's *C. inclinata*, but probably distinct. It is from Anthracite.

Aspidium Fredericksburgense (Fontaine.) (Fig. 5.)

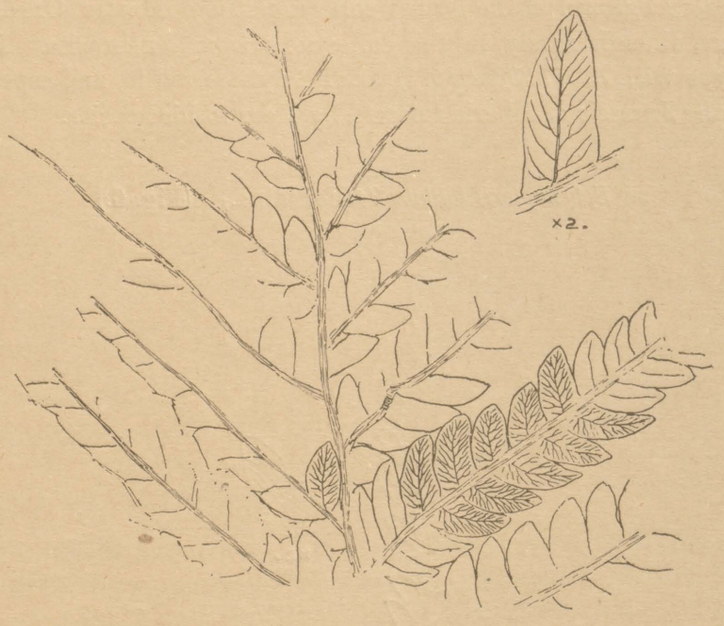

FIG. 5.—*Aspidium Fredericksburgense.*

In referring certain specimens from Anthracite to this species, I do so with the reservations stated below. My specimens, in so far as the fronds are concerned (and they do not show fructification) might be referred equally to Fontaine's species or to the *Pecopteris Whitbyensis* mentioned under the last head. In texture and venation however, they differ from *Cladophlebis falcata* and are probably generically distinct. The only difference observable as compared with *Pecopteris Whitbyensis* is that the nerves fork a little farther from the midrib. From Fontaine's figures our specimens differ in the nerves forking only

once, but this does not seem to be unusual in the Potomac specimens, though in many of these the veinlets divide into three. Fontaine's species has the fruit of *Aspidium* and may be compared to Heer's *A. Oerstedi* from Greenland, but the latter has simple veins.

As already stated the old *Pecopteris Whitbyensis* has been placed in the genus Cladophlebis; but specimens from Greenland referred by Heer to this species have the fruit of *Asplenium*, whence he has named the species *A. Whitbyense*. Thus we have fronds which when destitute of fruit would be referred to *Pecopteris* (Cladophlebis) *Whitbyensis*, but which may have belonged to *Aspidium Fredericksburgense* or to *Asplenium Whitbyense*. Our present specimens would be liable to either of these references. They seem to have presented broad pinnate fronds of the habit of Aspidium or Asplenium and for the present must remain generically doubtful. The figure will enable them to be recognized by subsequent collectors. It is closely allied to *Asplenium distans* of Heer, which I recognized in my former paper as a Kootanie species, and which Heer identified with *Pecopteris recentior* of Phillips; but the pinnules are closer and shorter and the texture of the frond different.

Asplenium Martinianum (Dawson.)

Fossil Plants of the Rocky Mountains of Canada. Trans. R. S. C., 1885.

This species, recognized in the former collections from Martin Creek and Old Man River, reappears, though rarely, in the collections from Anthracite. It belongs to the same general type with *A. Whitbyense* of Heer, already referred to, and especially resembles a variety from the Jurassic of Siberia referred by Heer to his species.

Sphenopteris lalíloba ? (Fontaine.) (Fig. 6.)

Fig. 6. *Sphenopteris lalíloba ?*

Fragments of a fern not distinguishable from Fontaine's figures are found at Anthracite, and would seem to represent that form. An allied though more delicate species, *S. Mantelli*, is characteristic of the English Wealden.

Other fragments from Anthracite may indicate another species of Sphenopteris, but none of them show the ends of the pinnules, which are narrow at base, spreading rapidly

and with branching veins. Whether entire or toothed at the extremity the specimens do not always show, but some seem to be entire and others toothed or divided. Still all may have belonged to one frond.

Zamites Montana (Dn.) (Fig. 7.)

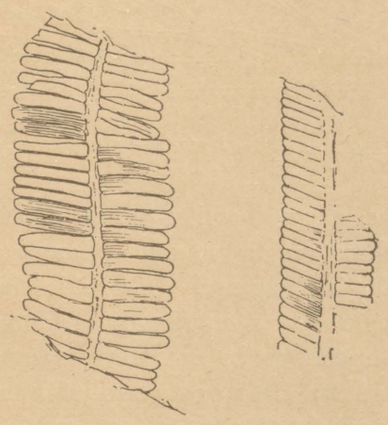

FIG. 7.—*Zamites Montana.*

Trans. Royal Society of Canada, 1885.

Leaves of this species, described by me from the Kootanie region in the paper above cited, are not infrequent in the collections from Anthracite. Some of the leaves are of larger dimensions than those from the Kootanie. One of these is figured. Notes as to the affinities of the species will be found in the paper of 1885.

Dioonites borealis (Dn.)

Trans. Royal Society of Canada, 1885.

Mr. Whiteaves has shown me, in the collection of the Geological Survey, a fine leaf of this species from Canmore.

Williamsonia ?

A group of curved and pointed bracts resembling those of this genus appears in the collection from Anthracite; but it is too imperfect to make the reference certain.

Baieropsis (Sp.)

Fragments of long forking leaves referable to this genus appear in the collections. They resemble *B. Cyekanouskiana*, Heer, but are too imperfect for determination.

Leptostrobus longifolius (Fontaine.) (Fig. 8.)

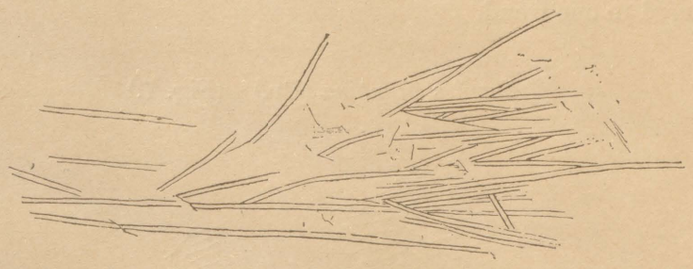

Fig. 8.—*Leptostrobus longifolius.*

Many long narrow linear leaves, solitary or in clusters, with appearance of having two nerves. Along with these are fragments of long lax cones with flabellate scales, furrowed obscurely in a radiating manner. Heer established this genus for certain pine-like plants with long two-nerved leaves and very elongated lax cones, from the so-called Jurassic of Siberia. There seems to be no certain means of distinguishing the present species from those described by Heer or from that named as above by Fontaine. As Fontaine's specimens on the whole seem more to resemble ours, I have adopted his name. The species is so plentiful that I anticipate before long the discovery of more perfect specimens which may serve more fully to establish its specific relations.

Pinus (*Cyclopitus*) *Nordenskioldii* (Heer.) (Fig. 9.)

Fig. 9.—*Pinus* (*Cyclopitus*) *Nordenskioldii.*

Long narrow one-nerved leaves, much broader, however, than those of the last species, are scattered very plentifully on the surfaces of shale from Anthracite. They are mostly detached, having evidently been deciduous, but in some cases appear to be in tufts, though this may be accidental. They are smooth and shining, and often more than

four centimetres in length. They are quite similar to those figured by Heer in the fossil flora of Siberia. Heer refers them in the text to Pinus, and in the legend of one of his plates to Cyclopitus, while he seems to believe that certain taxus-like fruits may be referable to this plant. Schenck (Fossil Botany) refers them to Cyclopitus and seems to believe that this genus is intermediate between Abietineæ and Taxineæ. Fontaine refers very similar leaves to the genus Cephalotaxopsis. Cyclopitus is described as having verticellate leaves, but there is no evidence of our species having had its leaves arranged in that way. Schenck refers to the modern Scyadopitys as possibly allied.

The leaves of this species have evidently been deciduous and drifted over the muddy bottom in immense quantities. With them are sometimes found small ovate flattened nutlets; but whether connected with the leaves is uncertain. It is to be hoped that the excavations for coal will disclose more perfect specimens.

Pinus anthraciticus (s. n.) (Fig. 10.)

FIG. 10.—*Pinus anthraciticus.*

A single winged seed referable to Pinus was found in the beds holding the above species and raises the question of its possible alliance to that genus. The seed is rounded, about 2 mm. in diameter. The wing expands slightly toward the distal end, and with the seed is about 1 cm. long, but its extremity is slightly broken, though it seems to be obliquely truncate. The wing is smooth with a few obscure veins.

Cephalotaxopsis (Sp.)

Very imperfect fragments are found at Anthracite, possibly referable to this genus, which belongs to the Lower Cretaceous.

Sphenolepidium pachyphyllum? (Fontaine.) (Fig. 12.)

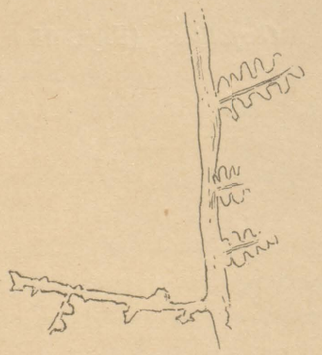

FIG. 12.—*Sphenolepidium pachyphyllum?*

Slender branches giving off small branchlets nearly at right angles, each having two

rows of short triangular scale-like leaves, becoming a little larger on the upper parts of the branchlets. It is very near to the species above named.

Sphenolepidium (Sp.) (Fig. 13.)

Fig. 13.—*Sphenolepidium.*

Differs from the above in having the leaves somewhat larger and more slender. These branchlets may, however, belong to some species of Sequoia.

Pagophyllum (Sp.) (Fig. 14.)

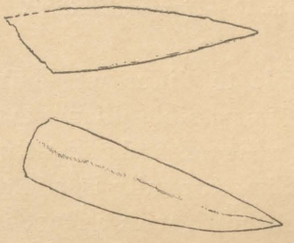

Fig. 14.—*Pagophyllum.*

Thick pointed leaves, length 3 cm., breadth at base 6 mm. Rounded at base and quickly widening to full breadth and then gradually narrowing to the point, and showing traces of longitudinal striæ. These seem to have been thick and fleshy leaves allied to *P. peregrina*, Heer (see Schenck, p. 26). They also resemble leaves referred by Fontaine to the genus Nageopsis, resembling his *N. ovata* from the Potomac formation.

Carpolites. (Figs. 15.)

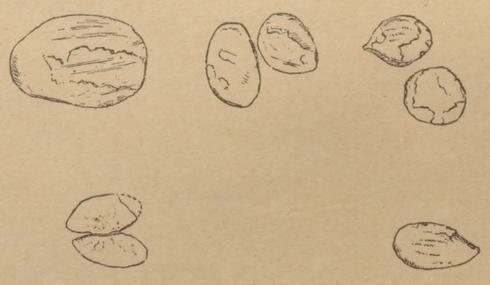

Fig. 15.—*Carpolites.*

There are in the collections many flattened oval or ovate nutlets of different size,

with smooth surfaces. They are not unlikely of different species. They are probably gymnospermous and may belong to Cycads or Taxineæ.

Cyperites (Sp.) (Fig. 16.)

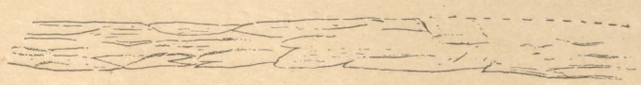

Fig. 16.—*Cyperites.*

A slender grass-like stem with linear finely striate leaves, alternately disposed, and not proceeding from enlarged joints. Apparently an herbaceous monocotyledonous plant.

III.—Lists of Plants of the Kootanie Group.

I give below a summary of the plants hitherto described from the Kootanie Group, including those in the previous papers referred to above.

I.—*From the Queen Charlotte Islands.*—Dawson in appendix to Richardson's Report of 1873. Report Geol. Survey of Canada for 1872-73, p. 66.

Dioonites Columbianus, Dawson.—Large fruits of the size of a hen's egg, petioles showing structure and fragments of leaves. For figure and description see Report cited.

Taxoxylon.—Wood showing structure and resembling that of modern Taxine trees.

Cupressoxylon.—Wood having structure not very dissimilar to that of the modern *Sequoia gigantea.*

II.—*From the Kootanie District and the region of the Suskwa River, the vicinity of Canmore and other places in the Rocky Mountains, north of the 49th parallel.*—Paper by J. W. Dawson on the Mesozoic Floras of the Rocky Mountain region of Canada, Trans. Geol. Society of Canada, 1885.

Dicksonia, Sp.—Martin Creek.

Asplenium Martinianum, Dawson, allied to *A. Whitbyense*, Heer, Martin Creek, etc.

Asplenium Dicksonianum, Heer, Crow's Nest Pass, Canmore, etc. This species is found in the Lower Cretaceous of Greenland.

A. distans, Heer, (Pecopteris recentior, L. and H.) Jurassic of Siberia and of England.

Dioonites borealis, Dawson, Martin Creek, Canmore, Willow Creek.

Podozamites lanceolatus, Lindley, Martin Brook, N. Kootanie Pass. Extensively distributed in the Upper Jurassic and Lower Cretaceous.

Zamites Montana, Dawson, Martin Brook, Kootanie Pass.

Z. acutipennis, Heer, Martin Creek; Heer's specimens were from the Lower Cretaceous of Greenland.

Z. (species)—Near Canmore.

Anomozamites, Sp.—Martin Brook.

Sphenozamites, Sp.—Martin Brook.

Antholithes horridus, Dawson, Peace River, Old Man River.

Salisburia (*Gingko*) *Sibirica*, Heer, Martin Brook. A species found in the so-called Jurassic of Siberia.

S. (*Gingko*) *nana*, Dawson, Coal Brook.

Salisburia, Nuts of, various places.

Baiera longifolia, Heer, Martin Creek ; also in Jurassic of Siberia.

Pinus Suskwaensis, Dawson, Suskwa Martin Creek and Coal Brook.

P. Nordenskioldii ? Heer. Broader linear leaves possibly of this species, Martin Creek.

Sequoia Smithiana, Heer, Coal Creek, Crow's Nest Pass. This is found in the Lower Cretaceous of Greenland.

Glyptostrobus Grœnlandicus, Heer, Old Man River, Lower Cretaceous, Greenland.

Taxodium cuneatum, Newberry. Found by Newberry in the Cretaceous of the West Coast.

Above the beds holding these fossils are layers (the Intermediate Series)[1] containing two angiospermous leaves, named respectively :

Sterculia vetustata, Dawson, Old Man River.

Laurus crassinervis, Dawson, Old Man River, Suskwa.

The next beds in ascending order, the Mill Creek series, contain several distinct species of angiospermous leaves.

III.—*Plants collected by Dr. Newberry at Great Falls, Montana.* American Journal of Science, March, 1891, Page 191.

Thyrsopteris rarinervis, Fontaine.*
" *insignis*, F.*
" *brevipennis*, F.*
" *brevifolia*, F.*
Aspidium Fredericksburgense, F.*† ?
Pecopteris Browniana, Dunker.*†
Cladophlebis distans, F.*
" *parva*, F.*
" *constricta*, F.*
Oleandra arctica, Heer.
Cheiropteris Williamsii, Newberry.
S. spatulata, N.
Cladophlebis angustifolia, N.
Zamites Montana, Dawson.†
" *acutipennis*, Heer.†
" *borealis*, Heer.
" *apertus*, Newberry.
Podozamites nervosa, N.
Baiera.
Sequoia Reichenbachii, Heer.*
" *Smithiana*, H.†
" *Gracilis*, H.
" *acutifolia*, Newberry.
Sphenolepidium Virginicum, F.*
Carpolithes Virginiensis, F.*

IV.—Plants from Anthracite and Canmore, noticed in the present paper, May, 1892. ‡

Equisetum Lyelli, Mantell, P.W.G.
Angiopteridium Canmorense, s.n. *A.*
Pecopteris Browniana, Dunker,‡ P.
Cladophlebis falcata, Fontaine, P.
" sp.
Aspidium Fredericksburgense, P. W.?
Asplenium Martinianum, Dawson.
Sphenopteris lalilobα, P.
Zamites Montana, Dawson.
Dioonites borealis, Dn.
Williamsonia, sp.
Baieropsis, sp.
Leptostrobus longifolius, P.
Pinus (cyclopitus) *Nordenskioldii*, Heer, S.
Pinus anthraciticus, Dn.
Cephalotaxopsis, sp.
Carpolithes, sp.
Pagophyllum, sp.
Sphenolepidium pachyphyllum ? P.
Cyperites, sp.

* Found in the Potomac Group.

† Found in Canadian Kootanie.

‡ (P.) Potomac, (W.) Wealden, (G.) Greenland, (S.) Siberia.

[1] This is not yet defined stratigraphically, but is supposed to indicate a transition from the Kootanie to newer beds.

With reference to the age of the above flora, it is to be observed that the species are almost entirely different from those of the middle and upper Cretaceous, that they include some forms usually regarded as Jurassic, but that the greater number have the facies of the Lower Cretaceous. It is also observable that no angiospermous exogens are included, though had these been present at least in any considerable numbers they could scarcely have escaped detection. In the next succeeding or Mill Creek Group plants of this type occur, though not in large numbers. In the Potomac Formation of Fontaine there are, however, considerable numbers of true exogens.

These facts seem to indicate that the Kootanie flora belongs to the lowest portion of the Cretaceous, and may be a little older than that of the main part of the Potomac Formation. It will be observed that while individuals of some species are abundant in the collection, they are in a condition so imperfect that some doubts must rest on their identification, and farther investigation may throw much light on their age and affinities. There can, however, be scarcely any doubt as to their general reference to the Neocomian Group of the Lower Cretaceous, and to the lower part of the earlier or Lower Cretaceous as held by the Canadian Geological Survey, and as recently fully illustrated for the United States in the Bulletin of the U. S. Geological Survey.[1]

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[1] White, No. 82, Correlation Papers, 1891.