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LOWER CRETACEOUS FLORAS OF WESTERN CANADA

By
W. A. Bell

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
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PREFACE

Lower Cretaceous rocks of Western Canada, comprising marine, non-marine, and volcanic strata, are an important source of coal, oil, and gas. The present report has been based on a study of fossil plants that were collected from non-marine rocks of this system at 365 localities. Most of this material was gathered by officers of the Geological Survey of Canada from 1883 to the present, but collections gathered in recent years include many made by companies engaged in oil exploration.

The fossil plants, described and fully illustrated in this report, should provide the most reliable basis for regional correlation of the non-marine Lower Cretaceous rocks of Western Canada, and thereby materially assist in their economic exploration. The evidence provided by the plants contained in the rock formations should also assist in the interpretation of rock structures, and aid in a reconstruction of the geological history of large parts of Western Canada during Lower Cretaceous time.

GEORGE HANSON,
Director, Geological Survey of Canada

OTTAWA, October 26, 1955

LOWER CRETACEOUS FLORAS OF WESTERN CANADA

CHAPTER I

PLANT-BEARING LITHOLOGICAL UNITS

Introduction

This chapter deals briefly with the stratigraphical status of each formation and group from which fossil plants have been obtained. It lists identifiable species, and presents the writer's opinion on the age of each flora or florule in terms of European chronology.

The age given to a flora contained in a formation or group is obviously applicable only to the plant-bearing beds and not necessarily to a formation as a whole. This is of course even more true for a group. In the case of a formation the Kootenay is a good example. In the Fernie area the base of this formation has been arbitrarily chosen by geologists as the base of a sandstone, some 60 feet thick, which supposedly lies above 'passage beds' from the Jurassic marine Fernie to non-marine strata. Recently the discovery of an ammonite, *Titanites occidentalis* Frebold, in this sandstone proved its marine origin and its age to be late Portlandian. Almost directly overlying the sandstone is a bed of coal. Owing to the established marine origin of the sandstone, its top rather than its base might now be a more suitable choice, at this locality, for the base of the Kootenay, for this choice would not necessarily imply continuous sedimentation from a marine sandstone to non-marine coal-bearing beds. As presently defined, however, the Kootenay does include the sandstone, and consequently a basal part of the Kootenay, at this locality at least, is Jurassic in age. Practically all the plants making up the known flora of the Kootenay were gathered several hundred feet above the base of whatever sandstone was chosen locally as the basal bed of the formation. An age assignment of the flora to some interval within the time limits of Neocomian-Barremian is naturally applicable only to the plant-bearing beds, and if it be *assumed* that sedimentation was continuous from the marine to the non-marine beds of the Kootenay, a very late Jurassic age for a part of the non-marine beds must be considered possible.

In the case of a group caution must be exercised in extending an age assignment for a series of plant-bearing beds within the group to a series in another area that has been correlated with the first series only on the basis of some lithological criteria, e.g. the occurrence of coal seams, composition, distribution of conglomerates, etc. The Hazelton group may be taken as an illustration. Coal-bearing beds in the Smithers area on fossil plant evidence are assigned an Aptian age by the writer, whereas coal-bearing beds in the Groundhog area, lying some 100 miles north of Smithers, until recently believed to be of the same age and included in the same Skeena formation, are now assigned a pre-Aptian early Cretaceous age, possibly Neocomian.

Although formations are lithological units rather than time units, their contained fossil faunas and floras, besides generally being necessary for their reliable correlation, may serve in guiding their differentiation. The differentiation of coal-bearing strata in the Groundhog area from coal-bearing strata within the same Hazelton group in the Smithers area has already been mentioned. In a sequence of non-marine flood plain or alluvial deposits conglomerates, like coal, may occur in members or formations of different ages. In the foothills of southern Alberta, for example, the Blairmore group is readily differentiated lithologically from the underlying Kootenay formation by the almost complete lack of coal, and by a basal chert-pebble conglomerate which in places lies upon the Kootenay with a marked erosional unconformity. In other areas of the foothills conglomerate is lacking, whereas in the Rocky Mountains to the west it occurs in numerous thick beds at different stratigraphic levels; some of which are intercalated between important coal-bearing strata. In these latter areas differentiation of the Blairmore from the Kootenay by lithological criteria is difficult and not wholly satisfactory, and in the Fernie and Flathead areas has led to an arbitrary boundary being chosen at the base of a thick conglomerate above which coal seams of workable size are lacking. Differentiation of the Blairmore group in a foothills belt between Bow and Panther Rivers has also presented some difficulty owing to the thinning and final disappearance of coals in the Kootenay formation. Although in the vicinity of Athabasca River and farther north a marked conglomerate similar to that in the Blairmore area continues to mark the base of the Blairmore group, it is the Blairmore group that now carries workable coal seams. Until the flora of the Luscar formation of this group was shown to be of the same age as that of the lower flora of the Blairmore in southern Alberta, the coal-bearing beds of the Luscar were assigned a Kootenay age.

It is evident from the above that fossil plants complement the lithology in providing invaluable evidence for reconstructing the geological history of a region during times of non-marine sedimentation.

Status and Age of Plant-bearing Beds

KOOTENAY FORMATION

Stratigraphic Status

A 'Kootenie series' was first proposed jointly by Sir William Dawson (1886, pp. 2-10; Pal. Ref.)[1] and G. M. Dawson (1886, p. 162)[2] for a series of shales, sandstones and conglomerates in a Rocky Mountain belt of southeastern British Columbia, which was characterized by the occurrence of important coal seams and of a flora considered by Sir William Dawson to be of early Cretaceous age. Neither the base nor the top of the formation was defined in terms of a lithological rock unit, although Sir William Dawson excluded an overlying 'Intermediate series' and a 'Mill Creek series' owing to the occurrence in them of Cretaceous floras later than that of the Kootenie. The series was subsequently named the 'Kootenay formation' by W. W. Leach (1912, p. 194), and diagnosed for the Blairmore area as lying conformably upon a Jurassic Fernie formation, marked at the top by a hard, cherty conglomerate, and overlain by a series of strata practically barren of coal, which he later called the Blairmore formation (Leach, 1914, opp. p. 234). Bruce Rose (1917, p. 110) subsequently, owing to the occurrence of an erosional unconformity at the base of the conglomerate, assigned the conglomerate to the base of the Blairmore. At present the definition of the Kootenay formation is in general accord with the usage of Rose, although both its lower and upper contacts have been chosen in some areas on an arbitrary basis.

Rose stated that the contact of the Kootenay and Fernie in the Blairmore area is not well marked, and that the passage from one formation to the other was transitional in character. Most workers agreed that this relationship was true in the Blairmore as well as in other areas (Cairnes, D. D., 1908b, p. 32; MacKenzie, J. D., 1914, p. 238; McLearn, F. H., 1916, pp. 111-112; MacKay, B. R., 1931, p. 159; 1932, pp. 17, 20; Crockford, M. B. B., 1949, p. 46). Nevertheless, apparent evidence of an erosional break in the sequence from Fernie to Kootenay was advanced by some workers. H. H. Beach (1943, p. 37), for example, stated that the Kootenay in Moose Mountain area rested upon an eroded surface of the Fernie formation. J. A. Allan and J. L. Carr (1947, p. 25) noted that the Kootenay in Highwood-Elbow area was marked at its contact with the Fernie by "a thin bed, less than an inch thick, of sandy iron stained shale, resting on the gently irregular surface of the Fernie sandstone" and they regarded this feature as denoting possibly an erosional contact between the two formations in that area.

[1]Dates in parentheses marked Pal. Ref. are those references cited at the end of Chapter II.
[2]Dates in parentheses without the above designation are of references cited at the end of Chapter I

In the type Blairmore area the definition of the contact of the Kootenay with the overlying Blairmore formation presented little difficulty. Yet, farther to the west in southeastern British Columbia the Kootenay was seen to contain a much larger percentage of sandstone and of conglomerate beds than in Alberta, the conglomerate beds individually ranging up to 20 feet or more thick or to the thickness of the basal conglomerate in the Blairmore group of the Blairmore area. In Michel map-area, for example, "the boundary between the Kootenay and the Blairmore formations is purely an arbitrary one, and is drawn at the base of the lowest massive conglomerate which persists over the map-area. All of the commercial coal seams of the district lie below this conglomerate" (MacKay, B. R., 1934, p. 5). In the Highwood-Elbow area Allan and Carr (1947, pp. 28-29) include a conglomerate-containing member, 368 feet thick, in the basal part of the Blairmore formation, whereas in the Ribbon Creek area adjoining the Highwood area on the north, M. B. B. Crockford (1949, pp. 31-32) included apparently the same member within the Kootenay formation. For that area Crockford concluded that the Kootenay was gradational into the Blairmore (op. cit., p. 34). He further stated that "in the lower part of the formation [Blairmore] there are two or three massive conglomerate beds, each 50 or more feet thick, and the Kootenay-Blairmore contact is placed at the base of the lower one. Though direct evidence is lacking it is thought that the basal conglomerate changes laterally into conglomeratic sandstones and sandstones, and hence may not be recognizable. In several measured stratigraphic sections which included the Kootenay and Blairmore conglomerates, definite correlations between beds could not be established. Therefore it is possible that the basal conglomerate bed described above may not everywhere in the area be of the same age" (op. cit., p. 39). Similar difficulty of recognizing a satisfactory Kootenay-Blairmore contact was encountered by Rose in the Crowsnest and Flathead areas, for he stated "It is also difficult to designate an upper limit to the formation [Kootenay]. The character of the strata above is much the same except that the sandstones are coarser and there are a number of conglomerate bands. On the Alberta side of the Crowsnest pass and in the Flathead valley a prominent conglomerate marks the upper limit of the coal formation, but in the Crowsnest areas of British Columbia there are a number of small coal seams above the first conglomerate.

"A section measured on the Elk River escarpment north of Morrissey, shows 216 feet of coal in 3,200 feet of strata. The lower 2,200 feet of the section contains 205 feet of coal in nineteen seams ranging in thickness from 1 to 46 feet and above this there is a conglomerate layer which may represent the upper limit of the Kootenay formation. . . .

"As described above, the Kootenay formation grades upward into conglomerate and coarse sandstones with shales and thin seams of a semicanal nature. These beds have been called the Elk conglomerates to distinguish them from the less conglomeratic strata below and above. The strata above the Elk conglomerates are mostly green and reddish shales, and sandy shales interbedded with sandstones and some conglomerates. This part of the series has been called the Flathead Beds.

"The combined thickness of the Elk conglomerates and the Flathead Beds is estimated at 6,500 feet. From their lithological character and their location in the stratigraphical column they are thought to be the equivalent of the Blairmore formation of the Crowsnest section in Alberta" (Rose, B., 1918, pp. 30-31).

Commenting on Rose's statements, Crockford (1949, p. 40) remarked that "the Elk formation apparently comprises the conglomerate series that spans the Kootenay-Blairmore contact and therefore possibly includes some Kootenay strata". If the Elk conglomerates on the basis of their lithological characters and position above the main coal-bearing formation are to be included in the Blairmore, it would be more correct to state that the Blairmore in the Crowsnest and Flathead areas carries a Kootenay flora in its basal part, and that the Kootenay-Blairmore contact transects a time horizon. For plants derived from the basal 340 feet of so-called Elk conglomerate beds on Coal Creek, and submitted to the writer by C. B. Newmarch, included no forms diagnostic of the Blairmore, but such characteristically Kootenay species as *Czekanowskia* cf. *rigida* and *Ctenis borealis*. Those received from somewhat higher horizons within the Elk conglomerate subdivision were too long-ranging to have age significance.

The Kootenay, notwithstanding local differences in definition of its boundaries, has been recognized as a coal-bearing formation within a belt of the Rocky Mountains and inner foothills, extending from the International Boundary to the headwaters of Red Deer River, a distance of about 200 miles. The formation occurs as infolded bands or as thrust-fault slices that are generally referred to as 'coal basins', chief of which from south to north are located in the Flathead, Crowsnest, Oldman, Highwood, and Cascade areas. The formation thickens markedly from east to west as shown below:

	Thickness in feet
Rock Creek (tp. 7, rge. 3, W.5th mer.)	350 (MacKay, B. R., 1932, p. 7)
Coleman (tp. 8, rge. 4, W.5th mer.)	600 (MacKay, B. R., 1932, p. 20)
Corbin (approx. lat. 49°30′ and long. 114°40′)	1,200 (MacKay, B. R., 1932, p. 7)
Crowsnest Pass (approx. lat. 49°40′ and long. 114°40′)	3,500 (MacKay, B. R., 1932, p. 7)
Pekisko Hills (subsurface—tp. 17, rge. 2, W.5th mer.)	100 (Hume, G. S., 1937, p. 4)
Highwood-Elbow (tp. 17, rge. 5, W.5th mer.)	750 (Allan, J. A., and Carr, J. L., 1947, p. 24)

	Thickness in feet
Highwood-Elbow (tp. 18, rge. 7, W.5th mer.)	2,400 (Allan, J. A., and Carr, J. L., 1947, p. 24)
Moose Mountain (tp. 23, rge. 6, W.5th mer.)	340 (Beach, H. H., 1943, p. 36)
Ribbon Creek (tp. 23, rge. 9, W.5th mer.)	3,400 (Crockford, M. B. B., 1949, p. 30)
Canmore (tp. 24, rge. 10, W.5th mer.)	3,100 (MacKay, B. R., 1935)

This increase in thickness is accompanied by increasing amounts of conglomerate in the upper part of the formation. The source of sediment was evidently from a highland farther west, which P. S. Warren (1938, p. 18) considered was located in the region of the Selkirk Mountains. F. H. McLearn (1916, p. 112) had previously concluded that conglomerates of the Blairmore indicate the uplift of a land mass to the west. Actually, uplift apparently began during deposition of some Kootenay sediments, for at Coal Creek the lowest conglomerate in the Kootenay lies about 420 feet above the base of the 'passage beds' which are there about 125 feet thick (Newmarch, C. B., 1947, personal communication).

Age and Correlation

The age of the basal Kootenay sandstone in the Fernie area has been fixed by H. Frebold (1953, p. 1239; 1954, p. 1) as late Portlandian Jurassic on the evidence of an ammonite, *Titanites occidentalis*. This sandstone is almost directly overlain there by a coal seam. All identifiable Kootenay plants have been found above this coal, and the majority came from the middle and upper parts of the formation. In collections from the Fernie area examined by the writer the lowest florule came from 355 feet above the base of the 'Passage beds', or about 230 feet above the base of the Kootenay. Those specifically identifiable are *Cladophlebis virginiensis* and *Ptilophyllum arcticum*, both of which range throughout the Kootenay and upward into the Blairmore in the Blairmore area. The lowest florule to hand from the Kootenay of the Blairmore area came from 25 feet above the top of the basal sandstone of the formation there, and comprised *Cladophlebis virginiensis* and *Cladophlebis heterophylla*. The latter species is one of the most characteristic species of the Kootenay.

The composition of the Kootenay flora is included in Figure 1 (in pocket) of this report. All the evidence presently to hand indicates that it cannot be subdivided into sub-floras. Of all collections studied, however, only those made by F. H. McLearn and C. B. Newmarch have on record the exact positions within the formation from which they were gathered. It is surprising on the whole to find within the Kootenay so few species that could be confused with Jurassic forms. Most important of these are

Czekanowskia cf. *rigida* and *Baiera* cf. *furcata*, both are macroscopically indistinguishable from the Jurassic species to which they are compared. So far as known, these two species do not occur in the Blairmore group of the type area of the Kootenay. A third Kootenay species worthy of note is *Nilssonia nigracollensis*, for *Nilssonia parvula* from the so-called Jurassic of Oregon is evidently conspecific. Other species, except the long-ranging *Podozamites lanceolatus*, while allied to Jurassic species, are specifically distinct. A few aberrant specimens of *Cladophlebis virginiensis* are scarcely distinguishable from *Cladophlebis denticulata*, although the normal Kootenay forms have entire pinnules. *Ctenis borealis*, too, is seemingly very close to *Ctenis orovillensis* from the Oregon Jurassic, although considered to be specifically distinct.

Those best defined Kootenay species that are not known as yet to range upward into the Blairmore group are *Sphenopteris cordai*, *Taeniopteris canmorensis*, *Baiera* cf. *furcata*, *Czekanowskia* cf. *rigida*, *Ptilophyllum robustum*, *P. hirtum*, *Nilssonia schaumburgensis*, *N. nigracollensis*, *Ctenis borealis*, *Pseudoctenis hazeltonensis*, *Pityospermum anthraciticum* and *Podozamites corbinensis*. *Czekanowskia* cf. *rigida* and *Ctenis borealis*, however, as already stated, occur in the Elk conglomerate subdivision (as defined by some workers), and others of the above-mentioned species may be expected to occur there as well.

Including only those forms to which specific names have been applied, the Kootenay flora contains 7 ferns, 1 equisetales, 5 ginkgoales, 8 cycadophytes, 2 conifers, and 3 gymnosperms of uncertain taxonomic relations. Six of these species, viz. *Cladophlebis virginiensis*, *Sphenopteris latiloba*, *Onychiopsis psilotoides*, *Coniopteris brevifolia*, *Equisetites lyelli*, and *Podozamites lanceolatus* are found in the Potomac group of the United States. Seven species occur in the Kootanie of Montana, viz. *Coniopteris brevifolia* (as *Dicksonia montanensis*, *D. pachyphylla* pars and *Thyrsopteris elliptica*), *Cladophlebis heterophylla*, *Cladophlebis virginiensis* (as *C. falcata montanensis* pars), *Equisetites lyelli*, *Nilssonia schaumburgensis*, *N. nigracollensis*, and probably *Pityophyllum* cf. *nordenskiöldi* (as *Cephalotaxopsis ramosa*? pars). Three species, viz. *Coniopteris brevifolia* (as *Dicksonia pachyphylla*), *Cladophlebis virginiensis* (as *C. falcata*) and *Ptilophyllum robustum* (as *Zamites arcticus*) occur in the Shasta group of California.

Species common to the Wealden of northwest Europe and England and the Kootenay flora are *Sphenopteris cordai*, *Onychiopsis psilotoides*, *Nilssonia schaumburgensis* and probably *Ginkgo nana* (as *Ginkgo brauniana*).

The occurrence of such characteristic Wealden species as *Sphenopteris cordai*, *Onychiopsis psilotoides* and *Nilssonia schaumburgensis* is considered to be sufficient evidence to date the Kootenay flora as early Cretaceous, and falling within the time unit from Infravalanginian to Barremian, inclusive. Evidence for a late Portlandian age of the basal sandstone in the

Kootenay in the Fernie area has already been cited. Although the writer considers it quite possible that a disconformity may occur at the top of this sandstone, and is inclined to favour a Barremian rather than a Neocomian age for the Kootenay flora, the present evidence is insufficient to substantiate this, and the Kootenay floras can be dated with any confidence only as Neocomian-Barremian.

BLAIRMORE GROUP

Stratigraphic Status

The term 'Blairmore formation' was first used by W. W. Leach (1914, map legend opp. p. 234) for a series of strata in the Blairmore area consisting mainly of sandstone and shale, which he formerly had called the Dakota (?) formation. He excluded from his Blairmore a cherty conglomerate, about 20 feet thick, which he placed at the top of underlying Kootenay formation. B. Rose (1917, p. 110) subsequently emended the Blairmore by inclusion of this conglomerate as its basal member because he recognized an erosional unconformity below it, a feature not recorded by Leach. The upper contact of the Blairmore in the type area was placed by Leach (1912, p. 196) at the base of a series of "volcanic breccias, tuffs and flows" that he named the 'Crowsnest volcanics'. These volcanic beds had previously been described by G. M. Dawson (1885, p. 109), particularly as they occur in Crowsnest Pass west of the Blairmore area.

The Blairmore in its type area consists essentially of sandstone and sandy shale, with thin zones of limestone and scattered thin beds or lenses of cherty conglomerate.

J. S. Stewart (1919, p. 28) stated that the Blairmore formation could be traced by means of its basal conglomerate member from Castle River to Bow River, a distance of about 120 miles. The upper limit of the Blairmore, however, as determined by the Crowsnest formation, can only be placed within less than half of this distance, owing to the thinning and final disappearance of the volcanic rocks, which have not been found far north of township 15 (Rose, B., 1920, p. 17). Beyond the boundaries of the Crowsnest formation the upper contact of the Blairmore is placed at the base of marine beds, generally shales or shales underlain by thin conglomeratic grit, which for long were known as the Benton formation (Dawson, G. M., 1886, p. 89; Rose, B., 1919, p. 14, etc.), but later designated the Lower Alberta shales by G. S. Hume (1930, p. 7), and the Blackstone formation by Allan and Carr (1947, p. 32).

West of the type Blairmore area, and within the Rocky Mountains, the Blairmore includes thick beds of conglomerate, and the formation there is more properly a group. Thicknesses of the Blairmore in typical areas south of the Bow River are as follows:

	Thickness in feet
Blairmore	2,865 (Leach, W. W., 1912, p. 196)
Hillcrest	2,316 (MacKay, B. R., 1932, p. 23)
Coleman	3,000 (MacKay, B. R., 1932, p. 4)
Moose Mountain	2,000-2,200 (Beach, H. H., 1943, p. 38)
Highwood-Elbow	3,300 (Allan and Carr, 1947, p. 27)
Elk River-Flathead	6,500 (Rose, B., 1918, p. 31)

In the Rocky Mountain areas difficulty was encountered in fixing the contact of the Blairmore with the Kootenay owing to the occurrence of rather thick conglomerate beds within the latter, and the contact was chosen at the base of a conglomerate locally 85 feet thick, above which only thin coal seams occur (MacKay, B. R., 1934, p. 5; Crockford, M. B. B., 1949, p. 39). This conglomerate in the Fernie and Flathead areas forms the base of a group of strata that were divided into two formational units, Elk conglomerate beds below and Flathead beds above (Leach, W. W., 1902b). No plant fossil collections from Elk beds in the sense used by Leach, Rose, and MacKay have been seen by the writer. Collections, however, from conglomerate-bearing beds from Coal Creek near Fernie were examined and proved to belong still to the Kootenay flora. These plants came from strata 2,600 to 2,650 feet above the base of the Kootenay formation, whereas the base of the Elk conglomerate beds of Leach in J. McEvoy's section was apparently 3,179 feet above the base of the Kootenay (McEvoy, J., 1901, p. 87, bed 19; Leach, W. W., 1902a, opp. p. 78).

North of the Bow River to Brazeau River the Blairmore has been differentiated from the Kootenay formation or its equivalent at very few localities. Within this belt, which is about 120 miles long, coal seams in the Kootenay become fewer and thinner, whereas thicker seams gradually appear within the Blairmore. This feature led for a time to much confusion in the application of the term 'Kootenay' to these northern areas, for it was assumed that the coal-bearing series of strata in the north must still belong to the Kootenay formation. It was only when fossil plants from the coal-bearing beds from Mountain Park and Brûlé areas proved to belong to the same flora as that contained in a lower part of the Blairmore at its type locality (MacKay, B. R., 1929b, p. 7) that the stratigraphic significance of the conglomerate member that lies at the base of these northern coal-containing strata became evident. It was inferred then to occupy a stratigraphic position comparable with that of the conglomerate or thick sandstone member at the base of the Blairmore in areas south of Bow River. The Kootenay, too, was seen to have an equivalent in the series of beds that lay between the conglomerate and Jurassic, and because these beds carried no significant coal seams, they were given a new formational designation, 'Nikanassin' (MacKay, B. R., 1929a). At the same time MacKay gave formational status to the conglomerate by naming it 'Cadomin', while the coal-bearing series above was named 'Luscar formation', and non-coal-bearing beds higher in a conformable sequence the 'Mountain Park formation'. 'Blairmore' was now used definitely as a group rather than as a formational name, consisting in the northern area of the Cadomin (5 to 70 feet thick), Luscar (about 2,000 feet thick) and Mountain Park (300 or less to 800 or more feet thick) formations. Of these only the Luscar has furnished as yet fossil plant collections.

The base of the Luscar formation is generally well defined by the top of a single band of Cadomin conglomerate lying below it, but in some areas more than one conglomerate band occurs, and, owing to occurrence as well of conglomerate beds and lenses in the lower part of the series of beds above, the contact between the two formations has been made apparently on an arbitrary basis (Irish, E. J. W., 1951, p. 18). Definition of the upper contact of the Luscar presents even more difficulty in areas north of the type Mountain Park area (MacKay, B. R., 1929b, p. 12; Lang, A. H., 1947b, p. 25). In the type area the overlying Mountain Park formation was differentiated by lack of coal seams, ridge-forming character and olive-green colour. MacKay (1929b, p. 12) states that the Mountain Park formation thins from 825 feet thick in its type area to only 320 feet thick at Luscar, and that it may be lacking in areas farther north. On the other hand he notes that changes of lithology may have taken place so that the formation is no longer separable from the Luscar.

Although the threefold subdivision of the Blairmore on the basis of lithology has not yet been found possible or practicable in the type Blairmore area, the Blairmore there contains one flora throughout most of its thickness, and another flora in its uppermost few hundred feet (McLearn, F. H., 1916, p. 112). This upper flora apparently occurs as well in the overlying Crowsnest formation. The flora of the Luscar clearly belongs to the lower flora at Blairmore, but if the upper flora occurs in the Mountain Park formation it has not yet been detected.

Age and Correlation

Lower Flora of the Blairmore Group

The composition of this flora, together with the occurrence of the same species in other formations or groups in Western Canada is included in Figure 1 (in pocket).

Including only forms to which specific reference is given, the flora contains 1 doubtful lichen, 18 ferns, 1 equisetales, 4 caytoniales, 1 pteridosperm *incertae sedis*, 2 ginkgoales, 2 conifers *incertae sedis*, and 1 dicotyledon.

Although all but a few of the species occurring in the Kootenay flora range up into the lower flora of the Blairmore, the latter is marked by the arrival of forms not yet found in the Kootenay formation. The most important of these may be grouped as follows:

(1) Species, or closely allied forms, that are generally considered more characteristic of the Jurassic than of the Cretaceous, and yet which are extremely rare or lacking in the earlier Kootenay flora. Of particular importance are *Nilssonia* of the *N. orientalis* group, species of *Sagenopteris*, one or two species of *Phoenicopsis*, and the conifer *Elatides curvifolia*.

(2) Conifers of the families Taxodiaceae and Taxaceae, e.g. *Athrotaxites berryi*, *Elatocladus* (*Metasequoia* ?) *smittiana* and *Elatocladus brevifolia*.

(3) Angiosperms, which, although extremely rare, herald the flora that occurs in the upper part of the Blairmore at its type locality, in which dicotyledons predominate.

In evaluating the age of the flora of the lower Blairmore one meets the difficulty that its most closely allied floras are not satisfactorily dated. The flora is in most respects most closely allied to the Kome flora of western Greenland, which Heer on inconclusive evidence assigned an Urgonian (Barremian) age. Both floras are marked by the rare appearance of dicotyledons, but, unfortunately, the stratigraphic relations of the Kome flora to a stratigraphically overlying flora in which dicotyledons are plentiful are not precisely known. On the other hand the stratigraphic relations of the lower Blairmore flora to the upper Blairmore flora at the type Blairmore area are well known. The lower Blairmore flora ranges upward to about 470 feet from the top of the series, and a dicotyledon, *Sapindopsis angusta*, occurs in it about the middle of this range. The flora from the uppermost 260 feet of the series is dominantly angiospermous, and there is no discernible break within the sequence of the 200 feet of beds that separates the two floras. Moreover, *Sapindopsis angusta* is one of the components of the upper flora. It is reasonable to infer, therefore, that the age of the lower flora cannot be much earlier than that of the upper flora, which with some confidence may be assigned an Albian age. With no breaks in the stratigraphic sequence the earlier flora could be either early Albian or Aptian, but the extreme rarity of dicotyledons within it, together with the survival of many species occurring in the Kootenay flora, certainly favours an Aptian age.

The best known Lower Cretaceous flora in the United States is the Potomac flora of Maryland and Virginia. Of the 15 Lower Blairmore species that occur in the Potomac group eight are known to be long-ranging in the Potomac, four, viz. *Coniopteris brevifolia* (*Onychyiopsis brevifolia* Berry), *Gleichenites nordenskiöldi*, *Elatocladus brevifolia* (*Cephalotaxopsis* *brevifolia* Fontaine) and *Elatocladus acifolia* (*Sequoia rigida* Fontaine) are confined to the Patuxent formation, one, viz. *Ctenopteris insignis*, occurs in both Patuxent and Arundel, and two, *Acrostichiopteris foliosa* Fontaine and *Sapindopsis variabilis* Fontaine (=*S. angusta*) are confined to the Patapsco. Of the above selected short-ranging species *Coniopteris brevifolia* may be disregarded for age comparisons, because it is known to be long-ranging in Western Canada, occurring commonly in the Kootenay formation. If the Patuxent and Arundel were deposited within the Neocomian-Barremian time unit as thought by Berry (1911, p. 172; Pal. Ref.) an explanation for the occurrence of the Aptian lower Blairmore species, *Gleichenites nordenskiöldi*, *Elatocladus brevifolia*, and *Elatocladus acifolia*, in the supposedly Neocomian Patuxent formation might be attributed to the distance between the occurrences. On the other hand there is a possibility that the Patuxent and Arundel florules may be as young as Aptian. Dorf (1952, p. 2176; Pal. Ref.) has recorded E. H. Colbert's summary of the age significance of Arundel dinosaurs as possibly pointing to "a high stage in the Lower Cretaceous". If these formations are as late as Aptian, the sudden influx of angiosperms that make up so large a part of the Patapsco flora would be comparable to the almost as sudden appearance of a dominantly angiospermous flora in the Blairmore, where there has not as yet been advanced the slightest evidence of any stratigraphic break between the beds carrying the two floras. But, since no plants have yet been gathered in the 200 feet of Blairmore beds separating the two floras, the possibility of a stratigraphic break in the sequence cannot be ignored, and, if such a break were detected, the argument for an Aptian rather than a Barremian age for the flora in the lower part of the Blairmore group would be substantially weakened. The argument essentially rests on the acceptance of an Albian age for the upper flora, and this in turn on an Albian age for the rather closely allied floras of the Cheyenne sandstone of southern Kansas and of the Patapsco formation of the Potomac group. However, if the age of the more closely allied Kome flora were definitely established as Barremian, the evidence would unquestionably swing in favour of a Barremian age.

Upper Flora of the Blairmore Group

The uppermost few hundred feet of undifferentiated Blairmore strata in its type area contains a dominantly angiospermous flora that is separated stratigraphically from the lower flora of the same formation by some 200 feet of strata (McLearn, F. H., 1929, pp. 90, 91). No plants have been found in these intervening strata, but an invertebrate, *Unio* (*Protelliptio*) *douglassi*, occurs about 50 feet from their top, the same species is found at lower level, within the zone containing the lower flora.

Specifically assigned species of the upper flora from the Blairmore of the type area comprise 3 ferns, 2 cycadophytes, 2 conifers and 9 dicotyledons, viz. *Cladophlebis alberta*, *Sphenopteris* (*Gleichenites* ?) *erecta* n. sp., *Sphenopteris mclearni* n. sp., *Pseudocycas* cf. *unjiga*, *Zamites tenuinervis*, *Sequoia condita*, *Populites dawsoni* n. sp., *Ficus ovatifolia*, *Trochodendroides potomacensis*, *Cinnamomoides ovalis*, *Celastrophyllum acutidens*, *Sapindopsis angusta*, *Sapindopsis belviderensis*, *Araliaephyllum westoni* and *Fontainea grandiflora*.

In the Beaver Mines area southeast of the Blairmore area, the Blairmore on Mill Creek, a tributary of Castle River, was the source of the first specimens of the upper Blairmore flora. These were collected by G. M. Dawson and T. C. Weston in 1881 and 1883, and were described by J. W. Dawson (1886, pp. 11-14; Pal. Ref.). The last mentioned author recognized that the flora in its abundance of angiosperms differed so greatly from that of his Kootenay series that he proposed the term "Mill Creek series" for the strata containing it. This term, however, has never been recognized as a lithological rock unit, because the series forms an integral part of what was originally the Blairmore formation and now designated the Blairmore group.

The original collections from Mill Creek contained the following plants, Dawson's identifications being revised in conformity with usage adopted in this report:

Gleichenia gracilis Dawson (non Heer) = *Cladophlebis* (*Gleichenites* ?) *munda* (Dawson pars)
Dicksonia munda Dawson = *Cladophlebis alberta* (Dawson) and *Cladophlebis* (*Gleichenites* ?) *munda* (Dawson pars)
Asplenium albertum Dawson = *Cladophlebis alberta* (Dawson)
Williamsonia recentior Dawson = *Williamsonia* ? *recentior* Dawson
Platanus affinis Dawson (non Lesquereux) = *Populites dawsoni* n. sp.
Liquidambar integrifolium Dawson (non Lesquereux) = *Araliaephyllum westoni* (Dawson)
Proteoides daphnogenioides Dawson (non Heer) = *Sapindopsis angusta* (Heer)
Laurus crassinervis Dawson = *Sapindopsis angusta* (Heer)
Aralia rotundata Dawson = *Araliaephyllum westoni* (Dawson)
Aralia westoni Dawson = *Araliaephyllum westoni* (Dawson)
Magnolia magnifica Dawson pars = *Magnolia* ? sp.
Paliurus ovalis Dawson = ? *Cinnamomoides ovalis* (Dawson)

Recent collections from Mill Creek have added the following species:

	Locality
Sphenopteris mclearni n. sp.	1264, 3065, 4022
Zamites tenuinervis Fontaine	3065
Cyparissidium ? *gracile* ? Heer	1247, 1249
Brachyphyllum crassicaule Fontaine	3065
Trochodendroides (*Cercidiphyllum* ?) *potomacensis* (Ward)	3065
Cinnamomoides ovalis (Dawson)	1250, 3066
Celastrophyllum acutidens Fontaine	1264, 3065, 3066
Fontainea grandiflora Newberry	3065

G. M. Dawson's collections from two other localities in an area adjoining the Blairmore area include representatives of the upper Blairmore flora. One of these localities is one quarter of a mile up a small creek that flows into Oldman River about 14 miles above the mouth of Livingstone River (formerly known as North Branch of North Fork of Oldman River). The plant-bearing beds were estimated by G. M. Dawson (1886, p. 88) to be about 400 feet below the Crowsnest volcanic formation. Plants from this locality were identified by J. W. Dawson as follows:

Alnites insignis ? (This specimen has not been located, but the suggested identification has evidently little to support it.)
Platanus affinis Dawson (non Lesquereux) = *Populites dawsoni* n. sp.
Macclintockia cretacea Dawson (non Heer) = *Cinnamomoides ovalis* (Dawson)
Laurophyllum debile Dawson = *Celastrophyllum acutidens* Fontaine
Aralia sp. Dawson (too poor for identification)
Paliurus montanus Dawson = ? *Cinnamomoides ovalis* (Dawson)

J. W. Dawson (1886, pp. 12-14; Pal. Ref.) included the above plants in his description of the flora of his Mill Creek series, but ambiguously referred to the locality as "Middle Branch, North Fork of Oldman River".

The second locality mentioned above from which G. M. Dawson collected plants is presumably the type locality of beds J. W. Dawson (op. cit., p. 10) named the 'Intermediate series'. Although J. W. Dawson first stated that these beds were from the "Middle Branch of the North Fork of Old Man River" in his following description of two of the species he gave the locality correctly as 'North Branch, North Fork, Old Man River', which is the Livingstone River. G. M. Dawson in a note to J. W. Dawson's paper (op. cit., p. 3) stated that the location of the plant-bearing beds was 8 miles above the Gap and within the Livingstone Range of mountains. This, therefore, must be considered the type locality of J. W. Dawson's 'Intermediate series', although this series like the Mill Creek series is not differentiated as a separate rock unit within the Blairmore group, and is correlated by the writer with upper beds of the latter. Among the plants mentioned or described by Dawson from this locality are:

Asplenium dicksonianum Dawson pars = *Sphenopteris mclearni* n. sp.
Sterculia vetustula Dawson = *Araliaephyllum westoni* (Dawson)
Laurus crassinervis Dawson = *Sapindopsis angusta* (Heer)

E. W. Berry (1929, p. 56, Pal. Ref.) considered the upper flora of the Blairmore to be the same age as that of the Cheyenne sandstone flora of southern Kansas, such species as *Asplenium dicksonianum* (= *Sphenopteris mclearni* n. sp.), *Sequoia condita*, *Sapindopsis magnifolia* (= *S. angusta*) and *Sapindopsis belviderensis* being common to both floras. He assigned the Cheyenne, and accordingly the uppermost Blairmore, a Cenomanian age, but invertebrate palæontologists now assign the Cheyenne an Albian age

(Cobban, W. A., and Reeside, J. B. Jr., 1952b). The writer agrees with Berry's correlation of the upper flora with the Cheyenne flora, but would assign both floras to the Albian. An Albian age is supported by species in the upper Blairmore flora that occur also in the Patapsco formation of the Potomac group, viz. *Zamites tenuinervis*, *Trochodendroides* (*Cercidiphyllum* ?) *potomacensis*, *Sapindopsis angusta*, *Celastrophyllum acutidens* and *Araliaephyllum westoni* (*Araliaephyllum crassinerve* in Patapsco). With the exception of *Zamites tenuinervis* these species are confined to the Patapsco. J. W. Dawson (1886, p. 11; Pal. Ref.) considered the upper Mill Creek flora to be somewhat older than that of the Dunvegan formation (Cenomanian) of the Peace River district, a conclusion with which the writer is in agreement, owing to the common occurrence within the Dunvegan, and not in the Blairmore, of such characteristic Upper Cretaceous genera and species, e.g. *Sphenopteris* (*Anemia* ?) *stricta*, *Tapeinidium* ? *undulatum*, *Callitrites reichii*, *Liriodendron*, *Liquidambar*, *Laurophyllum*, *Protophyllum*, *Pseudo-protophyllum*, *Credneria*, *Andromeda*, *Ficus*, and dentate, broad-leaved species of *Platanus*. At the same time some species or closely allied forms connect the Blairmore with the Dunvegan, chief of which are *Sequoia condita*, *Pseudocycas* sp. cf. *unjiga* and *Trochodendroides potomacensis*.

CROWSNEST FORMATION

Stratigraphic Status

G. M. Dawson (1885, p. 109) in an account of the geology of the Crowsnest Pass recorded the occurrence of agglomerates and ash beds intercalated within a series of sedimentary rocks that lay above what he and J. W. Dawson later called a 'Kootenie series' and below marine dark shales. The following year he gave a fuller description of these volcanic rocks, stating that they were traced in a north-south trending outcrop-belt, at least 45 miles long (Dawson, G. M., 1886, pp. 57, 69, 164). The volcanic rocks thin rapidly north and south of the Pass, so that their thickness near their northern termination on Oldman River was given by Dawson as only 20 feet.

W. W. Leach (1912, p. 197) first gave a formational status to the volcanic series, naming them 'Crowsnest volcanics'. He found their maximum thickness to be 1,150 feet at a locality about 1 mile west of Coleman. About 2½ miles to the southeast of this locality the formation is only 440 feet thick.

B. Rose (1917, p. 111) noted that the 'Crowsnest volcanics' probably graded into the Blairmore formation, and that they contain locally waterworn fragments. Where the volcanic beds thin, this gradation into, and interfingering with upper sediments of the Blairmore group, becomes more noticeable. J. A. Allan and J. L. Carr (1947, p. 30), for instance, in writing on the geology of the Highwood-Elbow area, state that "The upper member of the Blairmore formation consists of greenish shales, sandy shales, sandstones and arkoses, with tuffs and maroon shales interbedded with normal sediments near the top . . . at least the upper 300 feet of the formation carry beds of volcanic tuff". C. O. Hage (1943a, map 739A, descriptive notes), also, writing of the Crowsnest formation as it occurs in the Beaver Mines area, states that "Beds of tuff and agglomerate are interfingered with about equal amounts of grey and maroon shale and sandstone of the Blairmore group. The base of the formation is placed arbitrarily at the bottom of the lowest tuff bed. On Mill Creek, in sec. 25, tp. 5, rge. 2, the formation is 460 feet thick . . . it thins markedly to the east, and on Mill Creek in sec. 12, tp. 6, rge. 2 consists of 30 feet of light grey volcanic ash and bentonite interbedded with green shale". In the Dyson Creek area west of Turner valley Hage (1943b, p. 10) noted that the formation was represented only by a thin bed of bentonitic shale at the top of the Blairmore group.

The Crowsnest formation, therefore, is an uppermost part of the Blairmore group, restricted in its occurrence to a comparatively small area.

Age and Correlation

Only a few fossil plants have been gathered from the Crowsnest formation, all of them poorly preserved and fragmentary. The following identifications have been made by the writer:

	Locality
Sequoia condita	3134, 3135
Magnolia ? sp.	3134
Cinnamomoides sp.	3135
Platanus sp.	3134
Celastrophyllum acutidens	3134

Although inadequate for reliable judgment upon the age represented, this meagre florule points somewhat in favour of an Albian rather than a Cenomanian age, provided that the age of the uppermost flora in the Blairmore group in the Blairmore area has been correctly assigned by the writer to the Albian. Stratigraphically, however, a Cenomanian age would be possible, for the overlying Blackstone in the Blairmore area is considered by J. A. Jeletzky, on the basis of marine fossils, to be Turonian (interdepartmental, unpublished report, 1954).

BULLHEAD GROUP

(Gething formation and non-marine upper part)

Stratigraphic Status

A 'Bullhead Mountain formation' was proposed by F. H. McLearn (1918, p. 16) for non-marine strata in eastern Peace River foothills, Alberta, which lie between marine shales below, then thought to be Triassic, and marine shale of the Fort St. John group above. It was divided into two members, a lower, consisting mainly of coarse sandstone with conglomerate and a few thin coal seams near the top, and an upper of sandstone, shale, and coal beds. Later it was discovered that Jurassic shales, forming a part of the Fernie group, overlie the Triassic and conformably underlie the Bullhead (McLearn, 1940, p. 71). The lower member, which at certain localities was found to contain some marine beds (McLearn, 1921, p. 3), was estimated to be over 3,000 feet thick (McLearn, 1923, p. 4) and the upper, main coal-bearing member about 1,400 feet. This upper member was later named by McLearn the 'Gething member'; its lower contact was arbitrarily drawn between the dominantly coarse clastics of the lower member and finer clastics, including coal seams, of the upper. The term 'Bullhead Mountain formation' was subsequently changed to 'Bullhead group' (Wickenden, R. T. D., and Shaw, G., 1943, p. 2), and the lower member of the original Bullhead Mountain formation was called the Dunlevy formation (Beach, H. H., and Spivak, J., 1943, p. 4). This classification, although applicable to eastern Peace and Pine Rivers foothills, was found not to be satisfactory in some parts at least of the western Peace River foothills, where Mathews, W. H. (1947, p. 12) divided the Bullhead group into a lower marine division (2,000 to 3,000 feet thick) and an upper non-marine division (4,000 to 4,500 feet thick). The last mentioned corresponds to an upper part of the Dunlevy formation together with all of the Gething formation (Mathews, W. H., op. cit., p. 12; McLearn, F. H., and Kindle, E. D., 1950, p. 64).

No fossil plants from the Bullhead group outside of the area of the Peace River foothills have been seen or examined by the writer, except possibly a few collections furnished by the Phillips Petroleum Company from an area in Alberta near the British Columbia boundary, about latitude 54 degrees 10 minutes north. These plants were stated to have been collected from coal-bearing strata both above and below a thick conglomerate, which suggests that the strata might fall within the Bullhead group classification rather than within the Blairmore group. The plants are mostly species that occur in both the Gething and Luscar formations. The localities of their occurrence are listed in 'Index of localities' in this report under the heading 'Bullhead or Blairmore group'.

Age and Correlation

Collections of plants from the Gething formation or from non-marine strata of the Bullhead group yielded the following specifically identifiable species:

		Thallites zeilleri	r
o	x	*Coniopteris brevifolia*	c
o	x	*Coniopteris berryi*	r
o	x	*Cladophlebis virginiensis*	ac
o	x	*Cladophlebis strictinervis*	r
o		*Onychiopsis psilotoides*	ar
o	x	*Sphenopteris latiloba*	r
o	x	*Sagenopteris williamsii*	ac
		Baiera cf. *gracilis*	r
o	x	*Ginkgo pluripartita*	r
		Ginkgo cf. *lepida*	ar
		Stenorachis striolatus	r
		Phoenicopsis angustifolia f. *media*	ac
o	x	*Ptilophyllum (Anomozamites) montanense*	ar
o		*Pterophyllum rectangulare*	c
o		*Pterophyllum plicatum*	r
o	x	*Ptilophyllum arcticum*	ac
o	x	*Pseudocycas dunkeriana*	ar
		Pseudocycas sp. A cf. *unjiga*	r
o	x	*Nilssonia canadensis*	ac
o	x	*Elatides curvifolia*	ac
o	x	*Elatides splendida*	cc
o	x	*Pityophyllum* cf. *nordenskiöldi*	ac
o	x	*Athrotaxites berryi*	c
o	x	*Elatocladus smittiana*	r
o	x	*Podozamites lanceolatus*	c

o Occurs also in Luscar formation of Blairmore group
x Occurs also in lower flora of Blairmore in Blairmore area
r Rare, occurring at one locality
ar Rather rare, occurring at 2 localities
ac Rather common, occurring at 3 or 4 localities
c Common, occurring at 5 to 9 localities
cc Very common, occurring at 10 or more localities

With the exception of four species of *Ginkgoales*, all of the above forms occur either in the lower flora of the Blairmore or in the Luscar formation. The most significant species that occur in the Blairmore group, but not yet found in the non-marine Bullhead, are *Cladophlebis parva*, *Gleichenites nordenskiöldi*, *Klukia canadensis*, *Sphenopteris göpperti*, *Equisetites lyelli* *Sagenopteris mclearni*, *Sagenopteris elliptica*, *Phoenicopsis arctica*, *Ctenopsis insignis*, *Elatocladus brevifolia*, *Elatocladus acifolia*, *Nageiopsis striata* and *Sapindopsis angusta*. The lack of some at least of these may reasonably be ascribed to the fact that collections from the Bullhead came from only

35 localities as contrasted with Luscar collections from 93, and lower Blairmore collections from 63 in the Blairmore area. At any rate, the composition of the flora from non-marine upper Bullhead strata leads to no other conclusion than that it is of the same age as that of the flora of the Luscar and of the lower flora of the Blairmore, the age of which, as stated elsewhere in this report, is considered to be Aptian.

NIKANASSIN FORMATION

Stratigraphic Status

B. R. McKay (1929a) used the term 'Nikanassin formation' for sandstone and shale that in the Mountain Park area overlies beds of the Fernie group, and underlies a conspicuous conglomerate that he named the Cadomin conglomerate. A description of the formation as it occurs in the Brûlé area, 40 miles northwest of Mountain Park area, was published the same year (MacKay, 1929b, p. 7), whereby it was stated to comprise "a series of interbedded continental deposits of grey, brown-weathering sandstones and dark and sandy shales".

The base of the Cadomin conglomerate, which averages about 25 feet thick, clearly marks the upper contact of the Nikanassin, and separates it from the coal-bearing Luscar formation of similar lithology. The contact of the Nikanassin with the Fernie, however, was not clearly defined. In a measured section, 1,046 feet thick, presented by MacKay, the passage from Fernie to Nikanassin is seemingly gradational. A. H. Lang (1947b, p. 22 and map 905A) on the other hand gives a section of Fernie beds that occurs at head of Prine Creek, about 4 miles north of Brûlé Mines, and records a slight erosional unconformity at the top of the Fernie beds and at the base of an overlying thick bed of massive quartzitic sandstone that he regarded as the basal bed of the Nikanassin, although underlying, interbedded, thinner sandstones of similar lithology were assigned to the Fernie group. For the Moon Creek and Pierre Greys Lakes area, northwest of the Brûlé area, the Nikanassin, about 900 feet thick, was stated to lie conformably upon the Fernie group, and the base of the Nikanassin was chosen arbitrarily within 'passage beds' from Fernie to Nikanassin at the base of the lowest sandstone that had a thickness of 20 or more feet (Irish, E. J. W., 1947, p. 14; 1951, p. 17).

Although MacKay considered that the Nikanassin in the type Mountain Park area and in the Brûlé area was made up wholly of 'continental' deposits, A. H. Lang (1947a, p. 8) collected *Aucella* from the Nikanassin beds of the Moberly Creek area, northwest of Brûlé, proving a marine origin for a part of the formation.

Age and Correlation

Very little is known as yet about the flora of the Nikanassin, and all plants of known stratigraphic position were collected from near the top of the formation. These came from the Mountain Park and Brûlé areas, and comprised *Coniopteris brevifolia*, *Equisetites lyelli* f. *burchardti*, *Czekanowskia* cf. *rigida* and *Podozamites lanceolatus*. Three very small collections from the district of the Wildhay and Smoky Rivers from unknown positions within the formation, yielded *Coniopteris brevifolia*, *Phlebopteris* ? *elongata*, *Ginkgo pluripartita*, *Ginkgo nana*, *Czekanowskia* cf. *rigida*, *Nilssonia nigracollensis* and *Pityophyllum* cf. *nordenskiöldi*. All species mentioned above except *Phlebopteris* ? *elongata*, occur as well in the Kootenay formation, and it is concluded that the plant-bearing upper part of the Nikanassin is equivalent in age to a part of the Kootenay falling within the time range Neocomian-Barremian.

HAZELTON GROUP

Stratigraphic Status

The term 'Hazelton group' was introduced by W. W. Leach (1910, pp. 62-63) for a series of interbedded volcanic and sedimentary rocks in the Telkwa-Hazelton area. Its base was not exposed, and consequently not defined, but it was overlain conformably by a coal-bearing series of sandstones and shales that Leach (op. cit., p. 64) called the Skeena series, the upper contact of the Hazelton being drawn rather arbitrarily except locally where the base of the Skeena was a coarse, crumbly conglomerate (Leach, W. W., 1911, p. 94). In previous reports on the geology of the Skeena River district Leach included the Hazelton group in the 'Porphyrite group' of G. M. Dawson, which had been used to designate a series of predominantly volcanic rocks east of Tatlayoko Lake, over 200 miles southeast of Telkwa River. Subsequently Dawson included in this group rocks in areas as far north as Skeena and Kitsumkalum Rivers (Dawson, G. M., 1881, p. 101). Leach's introduction of a new group term was based primarily upon the fact that the rocks so designated in the Skeena River district included tuffs and sedimentary rocks as well as crystalline volcanic rocks.

J. D. MacKenzie (1917, p. 63) followed Leach in differentiating rocks of the Telkwa valley into an older Hazelton group and a younger Skeena formation, stating that "on account of the striking dissimilarity in the lithological nature of the Skeena and the Hazelton formations, the writer believes that an appreciable period of erosion took place previous to the deposition of the Skeena beds, and that they rest unconformably, or at any rate disconformably on the Hazelton formation". R. H. B. Jones (1926, p. 125) also thought that on Hudson Bay Mountain in the Smithers area the Skeena series rests unconformably on the Hazelton. Later workers, however, who mapped the Hazelton and Smithers areas, found difficulty in separating Skeena from Hazelton rocks, and for this reason redefined the Hazelton group so as to include the Skeena series. J. E. Armstrong (1944, descriptive notes), for instance, stated with reference to this new concept of the Hazelton group that "Coal is associated with continental strata of the Hazelton group in many localities, and fossil plants collected from the coal beds are all of Blairmore age. These continental, coal-bearing members of the Hazelton group have hitherto been thought to comprise the Skeena formation or series and to overlie the Hazelton group conformably, according to some geologists, or unconformably according to others. Recent studies in this and the adjoining Hazelton map-area have, however, indicated that no satisfactory stratigraphic division can be made, and that continental strata comparable with the Skeena appear at various horizons in the Hazelton group". According to Armstrong the Hazelton group may be as much as 10,000 feet thick in the Hazelton and Smithers areas. The group is intruded by granitic rocks, is much folded and broken by thrusts and normal faults.

The Hazelton group underlies the Groundhog coalfield, of which the southern boundary is about 105 miles north by west of Hazelton. G. S. Malloch (1914, p. 76) made use of Leach's classification into two mappable divisions, the Hazelton group below and the Skeena series above, assigning coal-bearing strata to the Skeena, and drawing the contact arbitrarily where sandstone with chert pebbles made their appearance. Malloch was probably influenced in his correlation with the Skeena by the occurrence of coal seams in these Groundhog measures. As stated below in the section on age and correlation, the age of these coals is not equivalent to those of the Skeena but to those of the Kootenay. While A. F. Buckham and B. A. Latour (1950, p. 16) retain Malloch's major divisions, they refer to them only as lower and upper parts, respectively, of the Hazelton group.

In the Groundhog area the lower part of the Hazelton group, thousands of feet thick, consists, according to Malloch, of dark grey to black tuffs and tuffaceous sandstones interbedded with black, more or less carbonaceous, shales. Malloch measured a section of 4,656 feet of strata, assigning 3,842 feet to the Skeena series, which include sandstones, shales, a few interbedded chert-pebble sandstones and conglomerate, and capped by a bed of chert-pebble conglomerate, 100 feet or more thick. The possibility that this thick conglomerate marks the base of the true Skeena series is worthy of investigation in subsequent field work.

On Cedar River about 35 miles west of the Telkwa River or Smithers area, G. Hanson (1923, pp. 40, 42) reported the occurrence of sedimentary rocks believed to be Lower Cretaceous, and which he tentatively placed in the Skeena formation. A small collection of fossil plants he collected from this formation on Little Cedar River, a tributary of Cedar River, locality 3319, was examined by the writer and identifiable species are included in following section on age and correlation of the upper sedimentary division of the Hazelton group of Hazelton-Cedarville area.

Age and Correlation

Fossil plants, all so far as known from the upper sedimentary division of the Hazelton group as now defined, and gathered by various geologists from 77 localities, were examined by the writer. Forty-one of these localities are in the Hazelton map-area, 4 in the vicinity of Cedarville, 8 in the Smithers map-area, 23 in the Groundhog coalfield and one in the Cedar River area.

Hazelton-Cedarville Area

In the Hazelton area, including Cedarville localities, the flora as a whole comprises the following species, their occurrence being indicated by locality numbers, which are indexed in a concluding section of this report. Their relative abundance by localities, not in individual beds, is also indicated.

	Locality
Coniopteris brevifolia, cc.[1]	390, 391, 392, 393, 394, 2386, 2387, 2390, 2392, 2404, 2405, 2407, 2408, 2410, 2412, 2413, 2414, 2415, 2416, 2418, 2420
Cladophlebis virginiensis, cc.	388, 389, 391, 392, 393, 394, 2325, 2386, 2387, 2390, 2392, 2404, 2405, 2407, 2408, 2409, 2410, 2414, 2416, 2419, 3316, 3317
Cladophlebis impressa n. sp., ac.	841, 2403, 2410, 3297
Dictyophyllum fuchsiforme n. sp., r.	2374
Phlebopteris ? elongata, r.	1801
Klukia canadensis, r.	2420
Sphenopteris acrodentata, ar.	2401, 2413
Equisetites lyelli, r.	2406
Equisetites lyelli f. *burchardti*, ac.	390, 391, 392, 2325, 2406
Sagenopteris williamsii n. comb., r.	2415
Baiera cf. *furcata*, r.	2392
Baiera cf. *gracilis*, r.	3027
Ginkgo pluripartita, c.	2389, 2392, 2416, 2419, 3008, 3316
Ginkgo nana, cc.	387, 389, 390, 391, 394, 395, 396, 2389, 2392, 2405, 2417
Czekanowskia cf. *rigida*, cc.	387, 388, 390, 391, 392, 393, 396, 1801, 2401, 2416, 3008

[1]For explanation symbols cc., ar., etc., *see* p. 18.

	Locality
Ptilophyllum (Anomozamites) montanense, c.	2413, 2415, 2417, 2418, 2419
Pterophyllum rectangulare n. sp., r........	2419
Ptilophyllum arcticum, c.................	2325, 2388, 2413, 2415, 2418, 3027
Ptilophyllum columbianum n. sp., r........	3297
Pseudocycas dunkeriana, ar..............	3027, 3297
Nilssonia schaumburgensis, ar............	2389, 2411
Nilssonia nigracollensis, ar...............	387, 388
Nilssonia brongniarti, r..................	244
Nilssonia canadensis n. sp., r............	2392
Pseudoctenis hazeltonensis n. sp., ar.......	397, 2410
Ctenopteris insignis, r..................	3319
Pityophyllum cf. *nordenskiöldi*, c..........	387, 389, 392, 396, 397, 2325, 3316
Elatides curvifolia, r.....................	3297
Podozamites lanceolatus, r................	3316

An early Cretaceous, Neocomian-Barremian age is assigned with some confidence to florules from 13 localities, viz., 387, 388, 390, 391, 392, 393, 396, 1801, 2389, 2401, 2411, 2416, and 3008.

A probable Aptian age, equivalent to that of the lower flora of the Blairmore group in Alberta or to the flora of the non-marine Bullhead group in British Columbia, is assigned to florules from 6 localities, viz., 2392, 2415, 2419, 3027, 3297, and 3319. Plants from the remaining 23 localities in the Hazelton area are too few in number for reliable judgment of age or contain either new species or species that occur in both Neocomian-Barremian and Aptian floras of Alberta. Their assignment even to an early Cretaceous age cannot be made with assurance. They are, however, considered to be of early Lower Cretaceous age rather than Jurassic because of the occurrence of one or more of *Cladophlebis virginiensis*, *Coniopteris brevifolia*, *Ginkgo nana* and *Ptilophyllum arcticum*, species that are particularly common in Alberta in the Kootenay formation and lower part of the Blairmore group as well as in the non-marine upper beds of the Bullhead group of British Columbia. It may be pointed out, however, that species assigned to *Cladophlebis virginiensis* may include forms similar to *Cladophlebis denticulata*, a common Jurassic type, and, for beds from which only the single species *C. virginiensis* was collected, a possibility of a Jurassic age cannot be wholly dismissed.

Smithers Area

Fossil collections from the Smithers map-area, which adjoins the Hazelton area on the south, came from only 8 nominal localities. Actually 5 of these collections came from coal-bearing beds of Glacier gulch east side of Hudson Bay Mountain, and 2 from coal-bearing beds on Goathorn Creek, a tributary of Telkwa River.

Specifically identifiable forms were distributed among the localities as follows:

	Locality
Coniopteris brevifolia, r.[1]	842
Cladophlebis parva, r.	836
Gleichenites nordenskiöldi, c.	836, 2374, 3300, 3304, 3305, 3306
Sphenopteris (Ruffordia) göpperti, ar.	2374, 3304
Phoenicopsis arctica, r.	3300
Ptilophyllum (Anomozamites) montanense, ac.	836, 3299, 3300
Ptilophyllum hirtum n. sp., r.	3029
Pseudocycas dunkeriana, r.	3305
Elatides splendida n. sp., r.	2374
Pityophyllum cf. *nordenskiöldi*, r.	3029
Athrotaxites berryi n. sp., r.	842

An Aptian age, or an age the same as that of the lower flora of the Blairmore group in Alberta, is assigned to the florules of all the above localities, except 3029 which provided no species for satisfactory age interpretation, and is probably Neocomian-Barremian.

It is relevant to comment here on a supposed conflict between fossil plant and invertebrate evidence in collections from locality 2374 in Glacier gulch. For J. E. Armstrong (1944, descriptive notes,—also in Buckham, A.F., and Latour, B.A., 1950, p. 15) stated that "In Glacier Gulch, however, fossil shells of Upper Jurassic or very early Lower Cretaceous age were collected from a bed 300 feet stratigraphically above a bed containing fossil plants of Blairmore age". As a result of the writer's inquiry to E. D. Kindle, who was co-collector of the fossils in question, it was learned that not only were some of the fossils collected from talus, but that the stratigraphic relation of the marine bed to the plant-bearing beds was doubtful. Kindle (personal communication) stated also that the coal and associated rocks at this locality were much sheared, and that the occurrence of a thrust-fault below the marine bed was quite possible. Indeed the geology of Hudson Bay Mountain is exceedingly complex in that thrust and normal faults and overturned beds are common. R. H. B. Jones (1926, p. 125) reported that "Besides faulting, lines of shearing are prevalent and mineralization appears to have been confined to zones of fracture which in some cases form parallel systems. The fractures and shear zones which were favourable to mineralization are closely associated with the southern and eastern sections of the mountain, which have suffered the greatest metamorphism; deformation and intrusion by stocks, sills and dykes." Locality 2374 is within this very disturbed belt, and one of the main thrusts of the mountain lies less than 3 miles west of it. It is obvious that much detailed work in the area is necessary before the true succession of beds is established.

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[1]For explanation symbols r, ar, etc. ,*see* p. 18.

Groundhog Coalfield

Although 22 collections from the Groundhog coalfield were examined by the writer, none contained more than 2 species. Individually, therefore, most of them are inadequate for satisfactory age interpretation. Of five collections, however, each yielded either *Nilssonia schaumburgensis* or *Ptilophyllum arcticum*, and their age is considered to be most probably early Cretaceous or Neocomian-Barremian. Species found in the remaining collections, with the exception of *Nilssonia* cf. *tenuicaulis* in collections from localities 26 and 2160, are all common forms occurring in early Cretaceous floras and are tentatively assigned that age, but when occurring singly as in these collections cannot be regarded as satisfactory evidence for an early Cretaceous rather than a Jurassic age.

A list of identified species from the Groundhog area, and their distribution by localities, follows:

	Locality
Coniopteris brevifolia, r.........	1556
Cladophlebis virginiensis, cc.....	26, 31, 32, 2136, 2278, 2280, 2304, 2306, 2307, 3169, 3836, 3896
Klukia canadensis, r...........	1557
Ginkgo pluripartita, r..........	2136
Ginkgo nana, r................	1800
Ptilophyllum arcticum, ar.......	2137, 2280
Nilssonia schaumburgensis, ac....	2137, 2276, 3165, 3832
Nilssonia nigracollensis, c.......	1557, 2278, 2279, 2306, 2837
Nilssonia cf. *tenuicaulis*, ar......	26, 2303(=26), 2160
Podozamites lanceolatus, r.......	32

Species collected by G. S. Malloch (1914, p. 86) were previously identified and listed by F. H. Knowlton, who commented "One specimen is absolutely indistinguishable from *Acrostichopteris pluripartita* (Font.) Berry, as figured in Md. Geol. Surv., Lower Cretaceous, 1912, Pl. XXIV, fig. 6. It has heretofore been known only from the Patuxent formation of Maryland and Virginia. Three specimens are not to be distinguished, at least from the fragments present, from *Nilssonia mediana* (Lec.) a well known Jurassic species. This is the first time, as far as I know, that it has been reported from higher beds. The other forms are the ordinary species usually associated with the Kootenay, and there can be no reasonable doubt as to the correctness of referring them all to the Kootenay." *Nilssonia mediana* of the above reference is described in this report as *Nilssonia* cf. *tenuicaulis*.

The lack of any fossil plants suggesting an Aptian age in the Groundhog coalfield is worthy of note. If the coal-bearing series of strata in the Groundhog area is actually equivalent in age to the Kootenay formation, a shift of coal deposition proceeding north from the Smithers-Hazelton area is indicated. This is compatible with coal deposits in the Tantalus formation of southern Yukon Territory, which are considered to be approximately of the same age as those of the Groundhog basin.

TANTALUS FORMATION

Stratigraphic Status

D. D. Cairnes (1910, p. 35) used the term 'Tantalus conglomerates' for a sedimentary series, mainly conglomerate, that includes coal-bearing beds at Tantalus and elsewhere in the Lewes and Nordenskiöldi Rivers coal district. The rock unit so-called was mapped and treated as a formation distinct from an underlying conformable series that Cairnes named the Laberge series. The Tantalus formation in the type area was stated to consist of "chiefly conglomerate, with pebbles largely chert or slate, interbedded sandstones and shales, containing upper coal horizon" (op. cit., map 10A). Because an uppermost part of the Laberge series also contained coal seams (lower coal horizon of Cairnes) the basal bed of the Tantalus conglomerates becomes the basal bed of the Tantalus formation. The immediately underlying Laberge beds were stated by Cairnes to consist mainly of white coarse sandstone, about 1,000 feet thick, at the top of which were intercalated dark shale beds with coal seams. The Tantalus formation, itself, in the type areas is at least 1,000 feet thick, and is overlain by volcanic rocks.

Prior to their differentiation in the Tantalus area, Cairnes had recognized these strata along Lewes River between Whitehorse and Tantalus, where they overlay a group of rocks he correlated with the Tutshi series (Cairnes, D. D., 1908a, pp. 11-13), and later included in the Laberge series. Later he found the Tantalus formation to occur as a coal-bearing series in the Wheaton River area, where it is 1,700 to 1,800 feet thick (Cairnes, D. D., 1912, p. 57). A possible maximum thickness of as much as 4,000 feet is reported in the Whitehorse area (Wheeler, J. O., 1952, p. 6).

Age and Correlation

A few plant fossils from the Tantalus coal mine, from Mount Bush in the Wheaton River area, and from Nordenskiöldi River have been examined by the writer. Identifiable species are few, and, with their locality distribution, are as follows:

	Locality
Coniopteris brevifolia	372
Coniopteris berryi	372
Coniopteris yukonensis	316, 374
Cladophlebis virginiensis	372, 3177 (316)
Ginkgo pluripartita ?	372
Nilssonia brongniarti	372
Nilssonia cf. *tenuicaulis*	372
Podozamites lanceolatus	372
Pagiophyllum sp. cf. *Sphenolepidium sternbergianum*	372
Pityophyllum cf. *nordenskiöldi*	372
Pityospermum anthraciticum	372
Pityospermum yukonense	372

In addition, localities 372 and 3176 yielded detached narrow leaves, not certainly identifiable, but seemingly belonging to *Phoenicopsis* and possibly to *Phoenicopsis arctica*. Except *Coniopteris yukonensis*, which doubtfully occurs at one locality in the Kootenay formation, *Nilssonia* cf. *tenuicaulis* and *Pityospermum yukonense*, all the above species occur in Lower Cretaceous beds of Alberta. *Nilssonia* cf. *tenuicaulis* is presently known elsewhere to occur only in the Groundhog coalfield. The writer tentatively considers the Tantalus flora to be Neocomian in age, but a late Jurassic (Portlandian) age is possible. The plant material so far gathered is too meagre for a satisfactory judgment on precise age.

F. H. Knowlton (in Wilson, W. J., 1916, p. 207, Pal. Ref.) reported on a collection from locality 372, perhaps the same as that examined by the writer, although this is not certain for none of the specimens are accompanied by individual marks of identification. Knowlton's list of plants from this locality is repeated here, accompanied by comments by the writer where these seem relevant.

Zamites arcticus— = *Ptilophyllum arcticum*. No specimens of this species were noted by the writer.

Ginkgo lepida ?—in writer's list above is referred to *Ginkgo pluripartita* ?; it is rather an aberrant form for *pluripartita*, and, if that species, converges toward *G. lepida* or *G. sibirica*.

Dicksonia clavipes—in writer's list a similar, if not same species, is referred to *Coniopteris berryi* n. sp.

Thyrosopteris murrayana—in writer's list is included in *Coniopteris brevifolia*, as a variant form.

Cladophlebis vaccensis—in writer's list is referred to *Cladophlebis virginiensis*. All pinnules seen by him in collections from 372 were entire and inseparable from Fontaine's species.

Pterophyllum nathorsti—probably this is the species referred to in writer's list as *Nilssonia brongniarti*.

Ctenophyllum sp.; nearest *C. angustifolium*—possibly this is same species that writer listed above as *Nilssonia* cf. *tenuicaulis*. The material consists of only a few fragments.

According to Knowlton's identifications all except *Zamites arcticus* and *Dicksonia clavipes* occur in the 'Oregon Jurassic' of Douglas County. The age of these Oregon plant-bearing beds has long been in doubt. They were originally considered by Fontaine, Ward, and Knowlton to be early Mid-Jurassic (Bajocian). Diller, however, on the evidence of marine invertebrates, included the Buck Peak plant-bearing beds in the Myrtle formation, which is largely Lower Cretaceous, but which possibly has some Jurassic Knoxville beds in its basal part. Yet F. M. Anderson (1938, p. 58) at one time expressed some doubt of a late Jurassic age for any of the Oregon Jurassic by stating "If any Knoxville [*sensu strictu*] beds occur in this district they may include the lowest plant-bearing beds in the 'Myrtle formation' about Buck Peak, described by Diller, though they contain only a scanty suggestion of the rich Tithonian faunas found on the west border of the Sacremento valley. Their determination as Knoxville can hardly be regarded as conclusive, although future collections of molluscan and plant remains from these beds may fix their age as definitely Jurassic (Tithonian)". Later, however, Anderson (1945, p. 948) was seemingly ready to accept a very late Jurassic age (Tithonian or Portlandian) for beds on Buck Creek and N. L. Taliaferro (1942, p. 92) even suggested that the Buck Peak plant-bearing beds may underlie rocks of the Dothan formation of late Jurassic age, although he added with caution that "sufficient evidence of the relation between the plant beds and the Dothan is lacking". A very late Portlandian or Jurassic age for the plant-bearing beds of Oregon would be consistent with the occurrence of some species that are found in the Kootenay formation, and the flora as a whole seems to indicate a somewhat earlier age than that of the Canadian Kootenay, although possibly not earlier than the flora from the Tantalus formation. It may be recalled that the basal sandstone of the Kootenay in Fernie area on the evidence of an ammonite is very late Jurassic (late Portlandian), and that beds with the Kootenay flora lie well above this sandstone. Although the writer considers it possible that the non-marine beds above this sandstone may be disconformable to it, this has never been recognized by stratigraphers working in the region. Although the conglomerate at the base of the Blairmore in the foothills of southern Alberta is generally considered to mark an important unconformity, conglomerates within the Kootenay itself are a feature in the Kootenay of the Fernie-Elk River area. The lowest in the Fernie area occurs only about 300 feet above the base of the formation, and rests on an irregularly eroded surface of dark shale (C. B. Newmarch, 1947, personal communication). One collection of fossil plants obtained about 70 feet below this conglomerate or some 190 feet above the basal sandstone provided only *Cladophlebis virginiensis*, *Ptilo-*

phyllum arcticum and *Pagiophyllum* sp., not sufficient evidence for an earlier age than that of Kootenay plants found higher in the sequence, nor does it provide data to assist in correlation of the Tantalus formation.

USLIKA FORMATION

Stratigraphic Status

The Uslika formation was proposed by E. F. Roots (1948, p. 14) for conglomerates, 5,500 feet or more thick, occurring in the Aiken Lake area of north-central British Columbia. Included in the formation are about 300 feet of black to dark grey carbonaceous argillite on Vega Creek, which lies just west of the conglomerate, and is apparently conformable with it, although not actually observed in contact.

Age and Correlation

Fossil plants from these argillite beds yielded the following species:

	Locality
Sphenopteris latiloba	3839
Cladophlebis virginiensis forma *acuta*	3838, 3839
Cladophlebis parva	3838, 3839
Coniopteris brevifolia	3519
Gleichenites giesekianus	3838, 3839
Gleichenites porsildi	3519
Phlebopteris muensteri ?	3839
Saginopteris sp.	3838
Nilssonia canadensis ?	3838, 3839
Athrotaxites ? *berryi* ?	3838

This florule is considered to be of same age as that of the lower flora of the Blairmore group of Alberta or Aptian.

JACKASS MOUNTAIN GROUP

Stratigraphic Status

The term 'Jackass Mountain group' was first used by A. R. C. Selwyn (1872, p. 60) for a sedimentary series of "hard, close-grained and thick-bedded greenish sandstone or quartzites, green and black shales, and above these, massive thick-bedded pebbly conglomerates" that outcropped on the east side of Fraser River on the western slope of Jackass Mountain south of Lytton. The stratigraphic relations of the group were not defined, although the group was considered to be younger than the Cache Creek group of Palæozoic age. Later G. M. Dawson (1877, p. 253) placed in this group similar sediments, believed on fossil evidence to be Cretaceous, that he found east of Tatlayoko Lake, about 150 miles northwest from

Jackass Mountain. At this latter locality Dawson thought that the group overlay conformably volcanic rocks of his 'porphyritic group'.

The Jackass Mountain group in the type area was divided by S. Duffell and K. C. McTaggart (1952, p. 39) into three divisions designated A, B, C from the base upwards: A, 2,200 feet thick, is largely greywacke; B, 1,500 feet thick, largely coarse conglomerate; and C, 5,000 feet thick, greywacke and argillite with minor conglomerate. They showed that all the divisions were partly marine, and, of non-marine parts, Division C was the only one from which they gathered identifiable plant remains.

Age and Correlation

The writer examined collections from 6 localities from rocks placed in Division C, which yielded the following forms:

	Locality
Coniopteris ? brevifolia ?	3511
Cladophlebis virginiensis forma *acuta*	3511, 3512, 3515
Cladophlebis parva	3514
Cladophlebis heterophylla ?	3511
Cladophlebis impressa n. sp.	3515
Sphenopteris latiloba	3511
Ruffordia ? göpperti ?	3515
Gleichenites nordenskiöldi	3716
Sagenopteris sp.	3718
Ptilophyllum (Anomozamites) montanense (cf. *Zamites speciosum* Heer)	3718
Pterophyllum rectangulare n. sp. (cf. *Zamites concinnum* Heer)	(?) 3511, 3718
Nilssonia sp.	3718
Desmiophyllum (Phoenicopsis) sp.	3511
Elatides curvifolia	3716, 3718
Elatides splendida n. sp.	3718
Elatocladus (Metasequoia ?) smittiana	3512

The plants from all the 6 localities are considered to be Lower Cretaceous, and, excepting those from localities 3511 and 3515, more probably Aptian than Neocomian-Barremian in age. Plants from locality 3511 are considered to be possibly Neocomian-Barremian. Locality 3515 has not yielded sufficient species to indicate more precise correlation than Lower Cretaceous, but species considered probably to be indicative of an Aptian age occur at nearby localities 3512 and 3514.

SPENCE BRIDGE GROUP

Stratigraphic Status

'Spence Bridge volcanic group' was a designation used by C. W. Drysdale (1914, p. 136) for a series of volcanic flows and pyroclastic rocks, with minor interbedded arkose and conglomerate, that occur in the vicinity of Spence Bridge on Thompson River and that underlie a belt of country up to 14 miles wide. The contact relationships of the group, which was estimated to be over 5,000 feet thick, were not originally defined. Duffell and McTaggart (1952, p. 54) state that the group in places rests unconformably upon Câche Creek group rocks or upon granitic rocks. They show that the western boundary of the group is a fault, and that in the vicinity of Fountain the group is in fault-contact with rocks of the Jackass Mountain group.

Age and Correlation

Only three small collections from the Spence Bridge group were examined by the writer. One of these, from locality 3173, had previously been examined by F. H. Knowlton. The writer's identifications are as follows:

	Locality
Sphenopteris latiloba	3456
Cladophlebis virginiensis	3173
Cladophlebis parva	3456
Gleichenites giesekianus	3173, 3456, (?) 3455
Gleichenites nordenskiöldi	3173
Cladophlebis (Gleichenites ?) porsildi	3456
Sagenopteris elliptica ?	3173, 3455
Pseudocycas sp. A (cf. *P. unjiga* Dawson)	3456
Podozamites lanceolatus	3173
Nilssonia sp.	3173
Nilssonia canadensis n. sp.	3173
Desmiophyllum sp.	3173
Athrotaxites ? berryi ? n. sp.	3456
Elatides curvifolia	3455
Pityophyllum sp.	3173

This florule is considered by the writer to be of the same age as that in the lower part of the Blairmore group of Alberta, which he considers to be Aptian.

Knowlton's list of species (Drysdale, C. W., 1914, p. 137) from locality 3173 is as follows:

Nilssonia cf. *schaumburgensis* (Dunbar)
Taeniopteris cf. *orovillensis* (Fontaine)
Sequoia reichenbachii
Podozamites lanceolatus
Podozamites cf. *graminaefolia*
Sagenopteris cf. *S. paucifolia* Ward
Cladophlebis cf. *C. falcata montanensis* Font.
Oleandra
Equisetum ?
Sphenolepidium sp.

Of the above list *Nilssonia* cf. *schaumburgensis* is *Nilssonia* sp. of the writer's list, being a more robust form than *schaumburgensis; Taeniopteris* cf. *orovillensis* is identified by the writer as *Nilssonia canadensis; Sequoia reichenbachii* is identified as *Elatides curvifolia; Podozamites* cf. *graminaefolia* is apparently the writer's *Desmiophyllum* sp., which may be compared with *Phoenicopsis angustifolia* that occurs in the Bullhead group; *Oleandra* is presumably *Pityophyllum* sp., and *Sphenolepidium* sp. is presumably *Athrotaxites ? berryi ?.*

Knowlton regarded the age of the flora as probably the same as that of the Kootenay. At the time of his examination the flora of the lower part of the Blairmore with its common Jurassic holdovers, e.g. *Sagenopteris, Nilssonia* of the *N. orientalis* group, *Elatides curvifolia, Phoenicopsis angustifolia* and *Podozamites lanceolatus* was not differentiated from the flora of the earlier Kootenay in which most of these forms are very rare or lacking.

The dating of plant collections, few as they are, from Division C of the Jackass Mountain group as probably Aptian, taken in conjunction with an Aptian dating of the Spence Bridge volcanic group, naturally brings up the question of the precise age relationships of the two groups. Most of the few fossil plants gathered from Jackass Mountain beds came from the vicinity of Lytton close to a fault-contact of the group with granitic rocks, and not far from a fault-contact with plant-bearing rocks of the Kingsvale group. Plants from locality 3718 near Fountain, were collected presumably more than half a mile west of a fault-contact with beds of the Spence Bridge group. The stratigraphic position of the plant-bearing beds within Division C of the Jackass Mountain group at both localities is unknown to the writer. Duffell and McTaggart (1952, p. 44) stated that "faults are everywhere an abundant and characteristic feature of the Jackass Mountain group . . . Because of the lack of continuity due to faulting, the positions of the strata of some of the fault blocks in the stratigraphic section are in doubt". Under these circumstances the sparse collections so far examined from the 5,000 feet of strata assigned to Division C of the group cannot be considered at all representative of the flora of that division as a whole. Although the balance of evidence provided by most of the Jackass Mountain plant collections rather favours in the writer's opinion an Aptian age, more and better collections will be necessary for more precise dating. The plants so far gathered from the Spence Bridge group, although few and poorly preserved, permit in the writer's opinion an assignment of an Aptian age with greater confidence than do the Jackass Mountain group collections, and tentatively the beds yielding them are considered probably somewhat younger than the beds that yielded the presently known Jackass Mountain flora.

PASAYTEN GROUP

Stratigraphic Status

The term 'Pasayten formation' was first used by G. O. Smith and F. C. Calkins (1904, p. 29) for a series of sedimentary rocks in Washington State immediately south of the International Boundary, and occupying an area between Pasayten River and Lightning Creek. It was thought to be at least 6,000 feet thick. In an earlier paper on some phases of his work on the Canadian side of the border R. A. Daly (1906, p. 359) adopted this term for similar rocks, referring to them only as 'Pasayten Lower Cretaceous'. But later, in a full report Daly (1912, p. 479) modified the original concept of the formation by naming it the 'Pasayten series', and including within it at the base a volcanic member that Smith and Calkins had considered to be stratigraphically higher than their Pasayten, and Tertiary in age. H. M. A. Rice (1947, pp. 19-24) emended the definition of the Canadian Pasayten still further by naming it the 'Pasayten group', and placing its upper limit at a fault that runs along Chuwanten Creek in the boundary district, and continues northwest well east of Skagit River. The rocks west of this fault were removed from the Pasayten group, and designated the 'Dewdney Creek group', which, on evidence of marine fossils, was shown to be in part mid-Lower Cretaceous, in part early Lower Cretaceous, and in part possibly late Jurassic.[1]

Rice divided the Pasayten group into 5 divisions, which are lettered A to E inclusive. Division A, Daly's volcanic member, about 1,400 feet thick, lies unconformably upon granitic rocks. Division B, which forms the major part of the group, about 12,000 feet thick, consists of arkose and greywacke, lying conformably upon Division A; it grades upward into Division C, 4,000 feet thick, which consists mainly of arkosic sandstone with dark argillite partings, a few thin beds of conglomerate and possibly some tuff at the top. Division D, conformable with C, is 900 feet thick and is made up of purple to green tuffaceous greywacke, argillite and tuff, andesite porphyry, and conglomerate. Division E, 2,000 feet thick, is cut off by the Chuwanten fault, along which it is brought into contact with the Dewdney Creek group. Of the above divisions only B and C provided fossil plants. Rice considered the Pasayten group to be non-marine in origin, in contrast to a marine origin for a large part of the Dewdney Creek group.

Age and Correlation

The writer examined 7 collections made by Rice from Divisions B and C. Those stratigraphically located were from beds 9,700 to 11,490 feet above the base of the formation. In addition, he studied 2 collections

[1] J. A. Jeletzky recently reported that yet another part of the Dewdney Creek group on the basis of an ammonite is early Albian (personal communication).

made by R. A. Daly, one of which, from locality 3320, was reported to have come from beds about 4,900 feet above the base, and the other, from locality 3321, from beds about 10,500 feet above the base of the group.

Generically or specifically identifiable forms with their distribution are as follows:

	Locality
Cladophlebis virginiensis	3321
Cladophlebis alberta	3126, 3127, 3137, 3321
Cladophlebis frigida	3126
Sphenopteris mclearni n. sp.	3126, 3127, 3137
Sphenopteris newberryi (*Asplenium dicksonianum* Newberry pars, non Heer)	3126, 3127
Onychiopsis psilotoides	3127, 3128, 3129
Gleichenites giesekianus	3126, 3127, 3129, 3137
Gleichenites nordenskiöldi	3320
Sagenopteris elliptica	3320
Pseudocycas sp. A, cf. *P. unjiga* Dawson	3126, 3321, 3136
Pseudocycas sp. B, cf. *P. unjiga* Dawson	3129
Cyparissidium ? gracile ?	3126, 3136
Menispermites reniformis	3126
Capparites ? sp.	3126
Platanus sp.	3127
Celastrophyllum acutidens	3321
Araliaephyllum westoni	3137
Antholithes sp. (Penhallow)	3321

The age of this flora is considered to be approximately the same as that of the flora occurring in an upper part of the Blairmore group in Blairmore area, Alberta, considered by the writer to be Albian.

D. P. Penhallow (1907, pp. 301-311, 328-331, Pal. Ref.; Daly, R. A., 1912, p. 487) had previously reported on Daly's collections from localities 3320 and 3321, and reported the following identifications:

	Locality
Cladophlebis skagitensis n. sp.	3321
Gleichenites gilbert-thompsoni n. sp.	3320
Gleichenia sp.	3321
Aspidium fredericksbergense	3321
Nilssonia pasaytensis n. sp.	3321
Cycadites unjiga	3321
Pinus sp.	3320
Glyptostrobus sp.	3320
Salix sp.	3320
Populus cyclophylla	3321
Myrica serrata n. sp.	3321
Quercus flexuosa ?	3321
Quercus coriacea	3321
Sassafras cretaceum	3321
Dorstenia ? sp.	3321

This list, as revised by the writer, would be:

Cladophlebis virginiensis
Gleichenites nordenskiöldi
Nilssonia cf. *schaumburgensis*
Pseudocycas sp. A, cf. *P. unjiga* Dawson
Celastrophyllum acutidens
Sapindopsis angusta
Antholithes sp.

Some forms not included in the revised list are too fragmentary and poor for identification.

Penhallow (op. cit., p. 331) correlated the plant-bearing beds with a part of the Shasta-Chico groups.

KINGSVALE GROUP

Stratigraphic Status

The 'Kingsvale group' was a name given by H. M. A. Rice (1947, p. 25) to a series of predominantly volcanic rocks that occur in the vicinity of Kingsvale and Brookmere and to a lesser extent elsewhere in the Princeton map-area. The group in the Princeton area is separated from the Spence Bridge group by an inferred erosional unconformity, as attested by numerous fragments of Spence Bridge lavas in the agglomerate that commonly forms there the base of the Kingsvale. Waterlain non-marine sediments in the form of greywacke, dark argillite, arkose, and tuffaceous sandstone make up a minor part of the group, particularly at or near its base.

Kingsvale group rocks extend northwest from the Princeton area into the adjoining Ashcroft and Nicola map-areas, where they underlie the Nicoamen plateau between Nicoamen and Nicola Rivers. The thickness of the group in the Ashcroft area is variable, but may be as much as 3,500 feet (Duffell, S., and McTaggart, K. C., 1952, p. 56).

Age and Correlation

Fossil plants from the type area of the group at Kingsvale, and from 4 localities in the Ashcroft map-area were examined by the writer. Specifically identifiable forms and their locality distribution are as follows:

	Locality
Cladophlebis frigida	3449
Cladophlebis alberta	3125
Cladophlebis oerstedi	3449
Gleichenites giesekianus	3020, 3125
Phyllites asplenioides ?	3125
Nilssonia canadensis	3020, 3125
Elatocladus brevifolia	3125
Elatocladus brevifolia forma *lata*	3020
Sequoia condita	3449

Cyparissidium ? gracile ?	3125
Pagiophyllum ambiguum	3020
Trochodendroides (Cercidiphyllum ?) potomacensis	3125
Menispermites potomacensis	3125, 3449
Celastrophyllum acutidens ?	3452
Myrtophyllum boreale	3449
Sapindopsis angusta	3449, 3513
Cinnamomoides ovalis	3513

The flora is considered to be of the same age as that in the upper part of the Blairmore group of Alberta or of the Patapsco formation of the Potomac group, and is assigned to the Albian.

LECKIE GROUP

Stratigraphic Status

C. E. Cairnes (1943, p. 7) gave the name 'Leckie group' to predominantly volcanic rocks between Leckie and Gun Creeks, Tyaughton Lake map-area. The volcanic rocks consist of agglomerates, breccias, and tuffs intercalated with lavas and minor zones of dark grey shale and conglomerate. The group overlies conformably the Eldorado group that mainly consists of argillites from which marine fossils have been obtained. The Leckie group in the type area is unconformably overlain by the Sheba group consisting mainly of lavas and tuffs, but has a thin formation of shales, arkoses, and conglomerate at its base. The Leckie group underlies a belt of country that trends northwest from its type area, and was described previously by V. Dolmage (1929, pp. 83, 84) under the term 'Cretaceous volcanics'. Dolmage stated that "In the lower part of the formation are several layers of black argillaceous and tuffaceous sediments, in places thickly crowded with plant remains" (op. cit., p. 83). He gave the thickness of the group as 10,000 feet or more.

Age and Correlation

The writer examined only two lots of plant fossils from the Leckie group, one collected by Dolmage and the other by C. H. Crickmay. The latter, collected south of Mount Sheba, provided only one species, viz. *Cladophlebis* (*Gleichenites* ?) *waltoni* Seward. Judging the age on this species alone would be unwarranted, for it occurs in western Greenland in association with some forms that occur in Canadian strata assigned an Aptian age by the writer, and with other species that occur in strata assigned an Albian age. A mid- or late-Cretaceous age is all that may be considered probable.

The other collection from the Leckie group examined by the writer came from a locality on lower part of Powell Creek, tributary to Taseko

River, and some 16 miles northwest of the above-mentioned locality near Mount Sheba. It furnished only two species of fern, viz. *Tapeinidium ? undulatum* (Hall) Knowlton and *Microtaenia variabilis* Knowlton, both found in the Frontier formation of southwestern Wyoming, about 500 feet above its base (Cobban, W. A., and Reeside, J. B. Jr., 1952a, p. 1928), and probably Cenomanian in age. The former species occurs also in the Dunvegan formation of Alberta, which is generally considered to be Cenomanian. If the beds that furnished this flora are part of the Leckie group, and not of a basal part of the Sheba group, the time range of the Leckie group may lie within Aptian-Cenomanian.

Berry, E. W. (Dolmage, V., 1929, p. 83) reported on a poor plant collection made at a locality about 3 miles from the Powell Creek one, as follows: "Insofar as the indefinite character of the fossils permits a tentative opinion I should say that the horizon is early Upper Cretaceous and perhaps not very different from that of the Upper Blairmore east of the mountains. It might be late Lower Cretaceous, but the evidence is more favourable to the preceding opinion".

COMMOTION FORMATION

Stratigraphic Status

'Commotion formation' was first used by R. T. D. Wickenden and G. Shaw (1943, p. 5) to designate a series of sandstone, shale, and chert-pebble conglomerate, mainly marine, 1,300 to 1,500 feet thick, that stratigraphically overlies the Moosebar formation of shale and sandstone and underlies the Hasler formation of predominant shale. Type sections are on Hasler Creek, a tributary of Pine River, and Commotion Creek near its mouth in the Mount Hulcross-Commotion Creek map-area (Wickenden and Shaw, 1943, map 43-13a).

Age and Correlation

Plant fossils from the type area were all gathered near the mouth of Commotion Creek from beds of sandstone, shale, and some intercalated coal, totalling 180 feet thick, which occur above a prominent bed of chert-pebble conglomerates at the top of the formation.

The plants, which are very fragmentary, comprise the following:

	Locality
Pterophyllum validum ?	3202
Ficus ? fontainii ?	3202, 3203
Menispermites reniformis	3204, 3205
Menispermites potomacensis	3204
Fontainea grandiflora	3204

The number of species that may be identified specifically are too few for reliable judgment between a late Albian and Cenomanian age. The florule can only be regarded as falling within a time-range Albian-Cenomanian. At first sight a Cenomanian age would seem to be more probable, but one species *Fontainea grandiflora*, hitherto reported only from the Raritan formation of New Jersey and Maryland, occurs at locality 3065 in Alberta, about 400 feet below the contact of the Blairmore group there with Blackstone formation, and is stratigraphically overlain by a florule that has *Araliaephyllum westoni* and *Paliurus ovalis*, two species considered characteristic of the upper flora (Albian) of the Blairmore group. Tentatively, therefore, a late Albian age for the plant-bearing Commotion beds is considered quite possible, and the flora for that reason is so regarded in this report. Marine fossil evidence for the age of the Commotion formation depends on the age of the overlying marine formations which tentatively are placed in the Lower Cretaceous (McLearn, F. H., 1944, figure 1).

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CHAPTER II

DESCRIPTION OF SPECIES

Summary List

Phylum Bryophyta (?)
Class Hepaticae (?)

Thallites blairmorensis (Berry) Lundblad
Thallites zeilleri (Seward) Harris

Phylum Pteridophyta
Class Filicineae
Order Filicales

Coniopteris brevifolia (Fontaine) n. comb.
Coniopteris yukonensis n. sp.
Coniopteris berryi n. sp.
Cladophlebis virginiensis Fontaine emend. Berry
Cladophlebis frigida (Heer)
Cladophlebis strictinervis (Fontaine) n. comb.
Cladophlebis alberta (Dawson) n. comb.
Cladophlebis oerstedi (Heer) Seward
Cladophlebis parva Fontaine
Cladophlebis impressa n. sp.
Cladophlebis heterophylla Fontaine
Onychiopsis psilotoides (Stokes and Webb) Ward
Dictyophyllum fuchsiforme n. sp.
Phlebopteris ? elongata n. sp.
Gleichenites giesekianus (Heer) emend. Seward
Gleichenites nordenskiöldi (Heer) emend. Seward
Cladophlebis (Gleichenites) porsildi Seward
Cladophlebis (Gleichenites ?) waltoni Seward
Cladophlebis (Gleichenites ?) munda (Dawson, pars) n. comb.
Sphenopteris (Gleichenites ?) erecta n. sp.
Cladophlebis (Gleichenites ?) sp.
Klukia canadensis n. sp.
Sphenopteris (Ruffordia) göpperti (Dunker) Seward
Sphenopteris acrodentata Fontaine
Acrostichopteris foliosa (Fontaine) Berry
Sphenopteris latiloba Fontaine
Sphenopteris bidens n. sp.

Sphenopteris brulensis n. sp.
Sphenopteris newberryi n. sp.
Sphenopteris mclearni n. sp.
Sphenopteris cordai (Dunker) Schenk
Sphenopteris sp. A
Sphenopteris sp. B

Incertae sedis

Taeniopteris canmorensis (Dawson) n. comb.
Phyllites asplenioides ? Berry

Order Equisetales

Equisetites lyelli (Mantell) Unger

Order Lycopodiales

Selaginellites sp.
Selaginellites ? sp.

Order Isoëtales

Isoetites horridus (Dawson) Brown

Phylum Spermatophyta
Class Pteridospermae
Order Caytoniales

Caytonia canadensis (Berry) n. comb.
Sagenopteris williamsii (Newberry) n. comb.
Sagenopteris mclearni Berry
Sagenopteris elliptica Fontaine

Incertae sedis

Hydropterangium canadense (Berry) n. comb.

Class Gymnospermae
Order Ginkgoales

Baiera cf. *furcata* (Lindley and Hutton) Braun
Baiera cf. *gracilis* (Bean) Bunbury
Ginkgo pluripartita (Schimper) Heer
Ginkgo nana Dawson
Ginkgo cf. *lepida* Heer

Incertae sedis

Carpites (*Ginkgo* ?) sp. Dawson
Stenorachis striolatus (Heer, pars) Nathorst
Stenorachis sp.

Stenorachis ? sp.
Czekanowskia cf. *rigida* Heer
Phoenicopsis angustifolia Heer forma *media* Krasser
Phoenicopsis arctica (Heer)

Orders Bennettitales and Cycadales

Ptilophyllum (*Anomozamites*) *montanense* (Fontaine) n. comb.
Pterophyllum rectangulare n. sp.
Pterophyllum plicatum n. sp.
Pterophyllum validum ? Hollick
Pterophyllum sp.
Ptilophyllum arcticum (Göppert) Seward
Ptilophyllum robustum n. sp.
Ptilophyllum columbianum n. sp.
Ptilophyllum hirtum n. sp.
Pseudocycas dunkeriana (Göppert) Florin
Pseudocycas sp. A cf. *P. unjiga* (Dawson)
Pseudocycas sp. B cf. *P. unjiga* (Dawson)
Zamites tenuinervis Fontaine
Zamites ? sp. (Dawson) n. comb.
Zamites ? sp.
Williamsonia ? *recentior* Dawson
Cycadolepis sp. Berry
Cycadolepis sp.
Cycadospadix sp.
Nilssonia schaumburgensis (Dunker) Nathorst
Nilssonia nigracollensis Wieland
Nilssonia cf. *tenuicaulis* (Phillips) Fox-Strangways
Nilssonia brongniarti (Mantell) Dunker
Nilssonia canadensis n. sp.
Nilssonia sp.
Ctenis borealis (Dawson) n. comb.
Ctenis sp.
Pseudoctenis hazeltonensis n. sp.
Ctenopteris insignis Fontaine

Order Coniferales

Elatocladus brevifolia (Fontaine) n. comb.
Elatides curvifolia (Dunker) Nathorst
Elatides splendida n. sp.
Pityophyllum cf. *nordenskiöldi* (Heer) Krystofovich
Pityophyllum cf. *longifolium* (Nathorst) Moeller
Pityophyllum sp.

Pityospermum anthraciticum (Dawson) n. comb.
Pityospermum yukonense n. sp.
Pityocladus sp.
Athrotaxites berryi n. sp.
Elatocladus (*Metasequoia* ?) *smittiana* (Heer) Seward
Sequoia condita Lesquereux
Geinitzia ? *jenneyi* ? Ward
Cyparissidium ? *gracile* ? Heer
Elatocladus acifolia n. sp.
Pagiophyllum magnifolium n. sp.
Pagiophyllum sp. cf. *Sphenolepidium sternbergianum* (Dunker) Heer
Pagiophyllum ambiguum (Heer) Seward
Pagiophyllum sp. A
Pagiophyllum sp. B
Brachyphyllum crassicaule Fontaine

Incertae sedis

Nageiopsis striata n. sp.
Podozamites lanceolatus (Lindley and Hutton) Schimper
Podozamites corbinensis n. sp.
Desmiophyllum (*Podozamites* ?) sp.
Podozamites ? *stenopus* ? Lesquereux

Class Angiospermeae
Subclass Dicotyledones

Salix inaequalis ? Newberry
Populites dawsoni n. sp.
Ficus ovatifolia Berry
Ficus fontainii ? Berry
Trochodendroides (*Cercidiphyllum* ?) *potomacensis* (Ward) n. comb.
Menispermites reniformis Dawson
Menispermites potomacensis Berry
Menispermites sp.
Menispermites ? sp.
Nelumbites sp.
Magnolia ? sp.
Cinnamomoides ovalis (Dawson) n. comb.
Cinnamomoides sp.
Capparites ? sp.
Platanus sp.
Celastrophyllum acutidens Fontaine
Rhamnites sp.
Myrtophyllum boreale Seward and Conway

Sapindopsis angusta (Heer) Seward and Conway
Sapindopsis belviderensis Berry
Fontainea grandiflora Newberry
Araliaephyllum westoni (Dawson) n. comb.
Dicotylophyllum sp.

Subclass Monocotyledones (?)

Culmites sp. (Dawson) n. comb.
Phyllites sp.
Antholithes sp. (Penhallow) n. comb.
Antholithes sp.

Detailed Descriptions

Thallites blairmorensis (Berry) Lundblad

Plate I, figure 1

Marchantites blairmorensis Berry, Nat. Mus., Canada, Bull. 58, p. 34, Pl. 4, figs. 1, 2 (1929).

Description. Dichotomously branched, ribbon-like laminae, 5 to 10 mm. wide. Medially there is a vein-like, microscopically striated band, 0.5 to 1 mm. wide. The consistency of the lamina is thin.

Remarks. Although the occurrence of thin, oblique 'rhizoids' noted by Berry could not be confirmed, in rare places obscure, hair-like, microscopic lines do occur. Some of these are transverse, others oblique to the midrib. The resemblance to the living genus *Marchantia* does not indicate any real affinity. Some specimens are associated with *Acrostichopteris foliosa*, suggesting a possibility they may be creeping stems or rhizomes of that species.

Occurrence. Blairmore group (lower flora), Alberta, locality 4025; Luscar formation, Alberta, locality 1233.

Types. Syntype, G.S.C. No. 5374 (Pl. 4, fig. 2, Berry).

Thallites zeilleri (Seward) Harris

Plate I, figure 7

Original Description. " 'Frond' repeatedly divided by forked branching, apparently dichotomous. Average breadth about 3 mm.; the branches have a distinct and fairly broad midrib, and on either side of the central axis are thin and filmy" (Seward, 1894, p. 18).

Remarks. A characteristic of this species as compared to *Thallites blairmorensis* is its small size, and the profuseness of its branching.

Occurrence. Bullhead group, British Columbia, locality 3527.

Types. Hypotype, G.S.C. No. 6630.

Coniopteris brevifolia (Fontaine) n. comb.

Plate I, figures 2-5; Plate II, figures 1-4; Plate III, figures 1, 2, 4-6; Plate IV, figure 4; Plate VI, figure 2

Pecopteris browniana Dawson (non Dunker), Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 84, fig. 3 (1893).

Sphenopteris latiloba ? Dawson (non Fontaine), ibid., p. 86, fig. 6 (1893).

Sphenolepidium sp. Dawson, ibid., p. 90, figs. 1, 3 (1893).

Onychiopsis psilotoides Berry pars (non Stokes and Webb), Nat. Mus., Canada, Bull. 58, p. 37 (1929).

Coniopteris pachyphylla Berry pars, Nat. Mus., Canada, Bull. 58, p. 42, Pl. 7, figs. 1, 2 (non figs. 3, 4) (1929).

Description. Frond, tripinnate; rachis, up to 3 mm. or more broad, smooth, except for obscure, longitudinal ridges. Primary pinnae, lanceolate, attached 35 degrees or more to rachis, but commonly lax and spreading at wide angles, deltoid at apical end; rachis, distally winged, but otherwise like parent axis. Secondary or ultimate pinnae, alternate to opposite, attached 35 to 70 degrees to rachis, touching or more distant, rather lax, linear, acutely pointed, up to 11 cm. or more long by 1.5 cm. or more wide; rachis, distally winged. Pinnules, oblique, decurrent, very variable according to position in frond, elliptical or oblong-elliptical to lanceolate, subrhomboidal or deltoid, generally with narrowly rounded or acute apices, up to 7 mm. long by 4 mm. wide, the largest constricted at base by a narrow, anterior sinus, and cut halfway to centre by two to five pairs of oblique, rounded to bluntly pointed lobes; pinnules in an intermediate position, more pecopteroid, only marginally lobed or crenulated; distal pinnules, more elongate, slightly lobed, crenulated or entire. Veins, sphenopteroid, strongly ascending, with one vein to each pinnule giving off a simple or once to several times divided branch to each lobe.

Fertile pinnules, slightly to strongly reduced, lobate or entire, with a subcircular sorus, 0.8 to 1.5 mm. diameter, at end of each lobe or at end of simple, stalked, reduced pinnules. The sori are apparently enclosed in an indusium, and details of sporangia not known, although rarely faint indications of an annulus are seen.

Remarks. The species, as represented by prevailing forms, is differentiated from *Coniopteris hymenophylloides* by its more elongate, ultimate pinnae, and by the form of its typical pinnules which are more elongate, less dissected, and more pecopteroid than those of the Jurassic species. The ultimate pinnae are much more elongate and lanceolate than those of *Onychiopsis elliptica* Fontaine (*Onychiopsis göpperti* Berry), and bear relatively shorter pinnules.

The species seemingly occurs abundantly in the Black Hills under the names of *Thyrsopteris elliptica* (non *T. elliptica* Fontaine from the Potomac group), *T. densifolia*, *T. brevifolia*, *T. pecopteroides* and *Gleichenia zippei*

Fontaine (non Corda). It occurs in the Kootanie formation of Montana as *Dicksonia montanensis*, *D. pachyphylla* pars (U.S.G.S. Mon. 48, Pl. 71, figs. 7-11, non figs. 5, 6) and *Thyrsopteris elliptica*, and also in the Shasta group of California and Oregon as *Dicksonia pachyphylla*.

For the list of synonymous species that occur in the Potomac group of the Atlantic region the reader is referred to Berry's description of *Onychiopsis brevifolia* (= *Coniopteris brevifolia*) (Berry, 1911a, p. 278).

The reconstruction of tripinnate fronds of the size of those of *C. brevifolia* on the basis of fragmentary material presents great difficulty, and the degree of variation in form of ultimate segments, here attributed to position in a frond, may be overestimated. Specimen 5364 (Pl. III, fig. 1), for example, is interpreted by the writer to be an apical end of a frond that has parts of five primary pinnae, whereas specimen 5379 (Pl. III, fig. 2) is considered to be an apical part of a primary pinnae; an alternative diagnosis might well assign these specimens to different species.

Occurrence. Kootenay formation, Alberta, localities 35, 256, 257, 322, 323, 1248, 1574, 1590, 1642, 1643, 1648, 2122, 2158, 2378, 3221, 3702, 3710, 3712, 3807, 4038, 4043, 4044, 4045, 4047, 4048, 4049, 4051; Kootenay formation, British Columbia, localities 276, 1222, 2093, 3755, 3846, 3848; Nikanassin formation, Alberta, localities 346, 1808, 2055; Hazelton group, British Columbia, localities 390, 842, 1556, 2413, 2415, 2416, 2418, 2420, 3319; Uslika formation, British Columbia, locality 3519; Tantalus formation, Yukon Territory, locality 372; Bullhead group, British Columbia, localities 3166, 3208, 3209, 3527, 4016, 4018, 4019; Blairmore group (lower flora), Alberta, localities 1246, 1257, 1623, 1629, 1667, 1668, 1669, 1727, 3160, 3313, 4026, 4027, 4033, 4035, 4036; Luscar formation, Alberta, localities 324, 1233, 1610, 2052, 2053, 2054, 2138, 2492, 2494, 3058, 3152, 3181, 3183, 3193, 3296, 3332, 3334, 3812, 3827.

Types. Hypotypes, G.S.C. Nos. 573, 574, 3997, 4005, 4006, 4010, 4015, 4017, 4018, 4040, 4041, 4840 (*Pecopteris browniana* Dawson, non Dunker), 4844 (*Sphenopteris latiloba* ? Dawson, non Fontaine), 4857 (*Sphenolepidium* sp. Dawson), 5364, 5367, 5379.

Coniopteris yukonensis n. sp.

Plate I, figure 6; Plate IV, figures 1-3, 5, 6; Plate VI, figure 1

Description. Frond, seemingly tripinnate. Primary (?) pinnae, known only from fragments; rachis, macroscopically smooth, up to 2 mm. broad. Ultimate pinnae, alternate, linear-acuminate, up to 8 cm. or more long by 1.5 cm. broad, inserted at right angles or obliquely to parent rachis, commonly curved; rachis, distally winged. Pinnules, variable, elliptical to rhomboid to sub-triangular, with broadly to narrowly rounded apices, the largest much contracted at base and at open angles to rachis, more or less deeply cut into one to three pairs of alternate, rounded lobes, in addition to the terminal one; remaining pinnules, only marginally lobed or entire, distally becoming more oblique, pecopteroid and decurrent. Veins, well marked; in the largest pinnules a branch goes off from the midvein close to its base and divides once to three times in the basal lobe; the branches to remaining lobes are less divided to simple; in intermediate, marginally lobed or entire pinnules the midvein, which enters close to the posterior margin, gives off about three alternate pairs of strongly ascending, lateral veins, the lowermost once or twice divided.

Fertile pinnules, more or less reduced, bearing a sub-circular sorus, about 1 mm. diameter, at end of lobes or at apex of distal pinnules that are commonly so reduced as to appear as stalks to the sori. Rarely there are indications that the sori contain annulate sporangia.

Remarks. The fertile pinnae are indistinguishable macroscopically from those of *Coniopteris brevifolia*. The sterile pinnae, however, on account of the prevalence of broader or more rotund pinnules are generally readily distinguishable from those of that species. Sterile pinnae of *C. yukonensis* with non-lobate pinnules resemble those of *Cladophlebis heterophylla*, although the posterior basal margin of a pinnule in the latter is more constricted, and the base less decurrent.

Occurrence. Tantalus formation, Yukon Territory, localities 316, 374, 3177; ? Kootenay formation, Alberta, locality 4046.

Types. Holotype, G.S.C. No. 5786; paratypes, G.S.C. Nos. 4016, 4059, 5785, 6567, 6568.

Coniopteris berryi n. sp.

Plate III, figure 3; Plate V, figure 4; Plate VI, figure 6; Plate VII, figure 3

Coniopteris pachyphylla Berry pars (non Fontaine), Nat. Mus., Canada, Bull. 58, p. 42, Pl. 7, figs. 3, 4 (non figs. 1, 2) (1929).

Description. Frond, apparently tripinnate. Primary (?) pinnae, lanceolate, more or less gradually narrowed to an acute apex; rachis, smooth. Ultimate pinnae, linear-lanceolate, alternate to subopposite, commonly 45 degrees or more to parent rachis, straight or slightly curved, up to 2 cm. or more long. Pinnules, rhomboid to triangular, pinnately cut more or less deeply into openly oblique, finger-like lobes that commonly occur as one to four lateral, alternate pairs, which may be about equal width throughout, or slightly expanded in middle part and abruptly pointed or narrowly rounded at apex, or appearing obtuse owing to burial of ends in matrix.

Fertile segments, greatly reduced, at least in distal parts of pinnae, to stoutly stalked, single, large oval sori. Sori up to 2.5 mm. long by 0.75 mm. wide.

Remarks. The pinnule-cutting resembles that of *Coniopteris quinque-loba* (Phillips) Seward (1900a, p. 112, Pl. 16, fig. 8) from the Jurassic. Specimen 5357 (Pl. V, fig. 4) is the only one showing fertile and sterile pinnules on same pinna. It is seemingly the apical end of a primary pinna, and the largest ultimate pinnae are little over 1 cm. long; they bear six or seven pairs of pinnules, of which the ones nearest the main axis are trilobed and sterile, whereas in the distal ones the lamina is reduced to a stalk and a simple, expanded, distal blade which bears a single large sorus.

The oval, large sorus distinguishes the species from *Coniopteris brevifolia* (Fontaine) which bears sub-circular sori described by Fontaine as *Dicksonia pachyphylla*, and which are illustrated by Berry in figures 1 and 2 of above reference.

Occurrence. Blairmore group (lower flora), Alberta, locality 4027; Luscar formation, Alberta, localities 1233, 3335; Bullhead group, British Columbia, locality 4018; Tantalus formation, British Columbia, locality 372.

Types. Holotype, G.S.C. No. 5357; paratypes, G.S.C. Nos. 4997, 5354, 5355.

Cladophlebis virginiensis Fontaine emend. Berry

Plate V, figures 1-3; Plate VI, figures 3-5, 7; Plate VII, figures 2, 4; Plate VIII; Plate IX, figure 4

Asplenium martinianum Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 5, Pl. 1, fig. 1 (1886).
Asplenium distans Dawson (non Heer ?), ibid., p. 5, Pl. 3, fig. 7 (1886).
Cladophlebis falcata Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 84, fig. 4 (1893).
Aspidium fredericksburgense (Fontaine) Dawson, ibid., vol. 10, sec. 4, p. 85, fig. 5 (1893).
Cladophlebis skagitensis Penhallow, Roy. Soc. Canada, Trans. 1907, Ser. 3rd, vol. 1, sec. 4, p. 306, fig. 2 (1907).
Cladophlebis virginiensis Berry, Nat. Mus., Canada, Bull. 58, p. 41 (1929).

Description. Frond, tripinnate. Primary pinnae, large, with deltoid summits; rachis, smooth, except for obscure, low, longitudinal costae, and, more rarely, transverse wrinkles. Ultimate pinnae, opposite or sub-opposite, linear-lanceolate, up to 14 cm. or more long by 4 cm. wide, commonly crowded and touching, inclined from 45 degrees to a right angle to rachis; rachis, distally winged. Pinnules, variable, entire or rarely toothed, generally more or less falcate, but more rarely nearly parallel-sided, acutely pointed or more or less rounded at apex, attached by whole base, which is commonly expanded anteriorly, or slightly constricted posteriorly, free or united by a narrow wing of rachis, generally two to five times as long as broad. Midvein, pronounced, thinning to apex; laterals, moderately oblique, for most part bifurcating only once about one quarter way to margin, the resulting arms becoming nearly parallel, or in broader pinnules laterals may divide a second or third time after dividing close to midvein.

Fructifications, unknown.

Remarks. Although it is possible that more than one species are included in material assigned here to *C. virginiensis*, all attempts at specific differentiation on basis of spacing, size, outline and vein-division of the pinnules proved impracticable. Nevertheless, it is convenient to recognize the following three main variants, even though numerous gradations exist between them:

(a) *C. virginiensis* forma *acuta* Fontaine n. comb.

This form is characterized normally by acutely pointed pinnules, which are from two to five times as long as broad, and by lateral veins that generally divide only once about one quarter way to the margin, the resulting arms being subparallel. The basal, posterior, lateral vein, and commonly also the basal anterior, may have each arm resulting from the first division divide again. Also some of the lateral veins in the posterior half of a pinnule may divide twice, whereas those in the anterior or anadromous half divide only once, grading thus towards the vein pattern of the other forms, *martiniana* and *fisheri*. An aberrant variant of this form, G.S.C. No. 5725 (Pl. VI, fig. 5) has the inferior, basal pinnule provided with a spreading, posterior, basal lobe. Another variant, represented by G.S.C. No. 5729 (Pl. VI, fig. 4) has dentate pinnules somewhat similar to those of the Jurassic species, *C. denticulata* (Brongniart). *Asplenium distans* Dawson (non Heer) is included by the writer in this form. The single type specimen is poorly preserved, and Dawson's drawing (Dawson, 1886, Pl. 3, fig. 7) errs in showing rounded bases of the pinnules, which actually are attached by the whole base and united by a narrow wing of the rachis.

(b) *C. virginiensis* forma *martiniana* Dawson n. comb.

Normally the pinnules of this form are proportionately broader as compared with their length than those of forma *acuta*, have many of their lateral veins divided more than once, and have bluntly pointed to rounded apices. The degree to which the pinnules are falcate is variable, some having the outline of *C. falcata*, whereas others are almost parallel-sided. Both *Asplenium martinianum* Dawson and *Cladophlebis falcata* Dawson are included here. The former species by strict rule of priority takes precedence over *C. virginiensis*, but Dawson's type in the writer's opinion was too poorly preserved for adequate diagnosis of a species; most of the apical ends of the pinnules are buried in the matrix and were represented by Dawson as much more rounded than they actually are; moreover, most of the lateral veins are not seen, and where observed fork twice and not once as in Dawson's drawing. Dawson, however, in the description of his species mentioned this double forking of the veins. Forma *martiniana* grades into forma *fisheri*.

(c) *C. virginiensis* forma *fisheri* Knowlton n. comb.

This form is characterized by stout deltoid pinnules that have commonly an ear-like expansion of the anterior base. The lateral veins commonly divide twice, particularly those in posterior half of the pinnules. The form is particularly abundant in the Hazelton group of British Columbia.

Occurrence. Kootenay formation, Alberta, localities 260, 322, 323, 864, 1248, 1574, 1591, 2106, 2378, 3158, 3221, 3712, 4039, 4040, 4041, 4043, 4044, 4045, 4046, 4048, 4051, 4052; Kootenay formation, British Columbia, localities 1222, 2093, 2105, 3172, 3710, 3711, 3712, 3752, 3756, 3760, 3765, 3804, 3809, 3848; Hazelton group, British Columbia, localities 26, 31, 32, 388, 389, 391, 392, 393, 394, 2136, 2278, 2280, 2304, 2306, 2307, 2325, 2386, 2387, 2390, 2391, 2394, 2395, 2404, 2405, 2407, 2408, 2409, 2410, 2412, 2414, 2416, 2419, 3169, 3171, 3316, 3317, 3319, 3836, 3896; Uslika formation, British Columbia, localities 3519, 3838, 3839; Tantalus formation, Yukon Territory, localities 372, 3177; Jackass Mountain group, British Columbia, localities 3511, 3512, 3515; Blairmore group (lower flora), Alberta, localities 1626, 4025, 4027, 4029, 4033, 4037; Luscar formation, Alberta, localities 1233, 1234, 1868, 2053, 3183, 3296, 3334, 3495, 3532, 3750, 3827; Bullhead group, British Columbia, localities 1997, 3210, 3211, 3213, 4018; Pasayten group, British Columbia, 3126, 3127, 3129, 3137, 3139, 3321; Blairmore group (upper flora), Alberta, localities 1247, 4020, 4023.

Types. Hypotypes, G.S.C. Nos. 4814 (f. *martiniana*, type of *Asplenium martinianum* Dawson), 4816 (f. *acuta*, type *Asplenium distans* Dawson), 4841 (f. *martiniana*, type of *C. falcata* Dawson), 4843 (f. *acuta*, type of *Aspidium fredericksburgense* Dawson), 5717 (f. *acuta*), 5724 (f. *acuta*), 5725 (f. *acuta*), 5726 (f. *acuta*), 5727 (f. *acuta*), 5729 (f. *acuta*), 5730 (f. *martiniana*), 5745 (f. *martiniana*), 6571 (f. *fisheri*), 6666 (f. *acuta*).

Cladophlebis frigida (Heer)

Plate VII, figure 1; Plate IX, figure 1

Remarks. No very satisfactory criteria can be presented to differentiate this species from some forms of *Cladophlebis virginiensis* Fontaine. Normally, however, the pinnules are larger, more narrow proportionately to their length, and more acuminate than normal forms of *C. virginiensis*. The veins, too, bifurcate more regularly close to their origin and are well pronounced.

Occurrence. Pasayten group, British Columbia, locality 3126; Kingsvale group, locality 3449.

Types. Hypotypes, G.S.C. Nos. 5844, 5968.

Cladophlebis strictinervis (Fontaine) n. comb.

Plate IX, figures 2, 3; Plate X, figures 1-3

Cladophlebis montanense Berry pars, Nat. Mus., Canada, Bull. 58, p. 39 (1929).

Description. Frond, large, at least tripinnate. Penultimate pinnae, linear-lanceolate, apically acute; rachis, smooth. Ultimate pinnae, closely spaced, alternate, oblique, linear-lanceolate, commonly asymmetric, acutely pointed, up to 3 cm. long by 8 mm. wide; rachis, smooth, distally winged. Pinnules, pecopteroid, crowded, up to 7 mm. long by 2.5 mm. wide, oblong to subelliptical, obtuse or bluntly pointed; proximal ones, slightly crenulated or entire, constricted at base by narrow, anterior sinus; remaining pinnules, entire, decurrent, becoming progressively more united towards apex of pinna. Ultimate pinnae in mid-regions of frond are in form of pinnatifid pinnules, up to 1.5 cm. or more long by 0.5 cm. wide; in more apical positions on frond they are crenately toothed, and finally entire. Veins well marked; midvein, generally straight, except close to apex; laterals, up to five alternate pairs, oblique, generally straight and simple, or lower ones once divided.

Remarks. The pecopteroid, non-falcate pinnules, and generally straight, simple, lateral veins give this species a distinctive appearance among its associates. The union by Berry (1911a, p. 243, Pal. Ref.) of the species with *Cladophlebis browniana* (Dunker) is decidedly questionable.

Occurrence. Blairmore group (lower flora), Alberta, localities 4025, 4026, 4027, 4031, 4033, 4037; Luscar formation, Alberta, localities 1233, 3296; Bullhead group, British Columbia, locality 3526.

Types. Hypotypes, G.S.C. Nos. 4053, 4054, 4055, 4057.

Cladophlebis alberta (Dawson) n. comb.

Plate XI, figures 2, 4, 6; Plate XII, figure 4

Dicksonia munda Dawson pars, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 11, Pl. 3, fig. 5a (non fig. 5) (1886).
Asplenium albertum Dawson, ibid., p. 11, Pl. 3, fig. 6 (1886).

Description. Frond, large, at least tripinnate; rachis, up to 8 mm. broad, obscurely ridged. Primary pinnae, alternate, from 70 degrees to axis in lower part of frond to 45 degrees or less in upper part, up to 15 cm. or more long; rachis, up to 3 mm. broad. Secondary or ultimate pinnae, alternate, 45 degrees or more to parent rachis, lanceolate, acutely pointed at apex, up to 5 cm. or more long by 1 cm. broad; rachis, canaliculate above with wing-like borders. In upper parts of frond secondary pinnae take the form of pinnatifidly lobed pinnules. Pinnules, pecopteroid, only the basal pair constricted at base, free in lower parts of pinna, becoming more and more confluent to apex, short-lanceolate to triangular, acute at apex, up to 7 mm. long by 2 mm. wide, the larger ones obliquely crenulated, the superior basal one commonly a little longer than the others, and inserted at more open angle to parent rachis. Most pinnules are nearly straight, but some are slightly curved forwards. Midvein, prominent, straight except near apex, generally running to apex, giving off up to six alternate pairs of oblique, simple laterals, which in larger pinnules are nearly straight and run to the teeth or crenulations; in smaller, confluent pinnules they commonly curve towards the apex of pinnules. In pinnatifid pinnules on primary pinnae from apical position on frond, e.g. in G.S.C. No. 5104 (Pl. XI, fig. 4), veins that enter mucronate lobes or teeth give off one or more simple laterals.

Remarks. *Cladophlebis alberta* agrees with *Aspidium montanense* Fontaine (1893, p. 490, Pl. 82, figs. 1-3; Pl. 83, figs. 2, 3; Pal. Ref.) in that, unlike *Cladophlebis strictinervis* Fontaine, the lateral veins in pinnules that are partly confluent have a pronounced curve towards apex of pinnule. The writer considers that *Aspidium montanense* Fontaine is probably conspecific with *C. alberta*, although pinnules from low positions on a frond of *C. alberta* are commonly crenulate and not entire. Fontaine's interpretation of the positions on a frond from which some of his type specimens of *Aspidium montanense* were derived appears unrealistic. The specimen represented by his figure 1, Plate 82, for example, which he assigns to a low part of a frond, has a much narrower rachis than that of specimen figure 2, Plate 83, that he assigns an upper position. The marginally lobate pinnules of the former specimen came in the writer's opinion from a high position in a frond where such pinnules take the place of secondary pinnae.

The material from the Pasayten group includes several poorly preserved fragments of fertile pinnae. The sori appear as small circular elevations that form a row on each side of midrib about midway to margin, resembling a fertile specimen of *Aspidium montanense* Fontaine (op. cit., Pl. 72, fig. 2).

Cladophlebis oerstedi (Heer) (1882, p. 30, Pl. 34), to which Seward (1927, p. 86, Pal. Ref.) united *Aspidium montanense* Fontaine, is apparently very close to *C. alberta*, but differs in the more triangular and commonly subfalcate form of the pinnules, as well as in the common bifurcation of the lateral veins in the free or little confluent pinnules.

Occurrence. Blairmore group (upper flora), Alberta, locality 1815; Luscar or Mountain Park formation, locality 3340; Kingsvale group, British Columbia, locality 3125; Pasayten group, British Columbia, localities 3126, 3127, 3137, 3321.

Types. Holotype, G.S.C. No. 5104; hypotypes, G.S.C. Nos. 5101 (syntype of *Dicksonia munda* Dawson), 5842, 5843.

Cladophlebis oerstedi (Heer) Seward

Plate XII, figure 1; Plate XIII, figure 4

Description. Frond, tripinnate; axis up to 7 mm. or more wide, smooth. Primary pinnae, alternate, inserted at open angles of 70 degrees or more in lower parts of frond, of unknown total length, but up to 15 cm. or more; rachis, up to 4 mm. wide, smooth. Secondary or ultimate pinnae, alternately inserted at open angles (basal ones up to 90 degrees), lanceolate, up to 5 cm. long by 1.5 cm. wide; rachis, distally winged. Largest pinnules, contracted at base to about half their maximum width, about 10 mm. long by 4 mm. wide, rather abruptly contracted to an acute apex, obliquely and marginally lobed, with 4 to 8 obtuse lobes that end in abrupt acute points that are commonly buried in rock matrix; midvein, pronounced, running to apex, very slightly zigzag, giving off to each lobe an oblique lateral, which is once or twice divided in the largest lobes, simple in the smaller, distal lobes. Remaining pinnules, non-contracted at base, slightly decurrent on, and united by narrow wing of parent rachis, marginally toothed, the teeth commonly inconspicuous; laterals running to marginal teeth, once divided or the majority simple, commonly slightly curved towards pinnule apex.

Remarks. Although G.S.C. specimen No. 5969 (Pl. XII, fig. 1) is readily distinguishable from No. 5842 of *C. alberta* (Pl. XII, fig. 4), by its pinnatifidly lobed pinnules, specimen No. 6652 (Pl. XIII, fig. 4) represents an associated primary pinna with stout rachis and inconspicuously toothed pinnules similar to pinnules on No. 5842 of *C. alberta*. This specimen suggests that *C. alberta* may actually belong to *C. oerstedi*, but until specimens of *C. alberta* come to hand, showing lower primary pinnae provided with pronouncedly lobate pinnules, it is preferable to retain Dawson's species.

Occurrence. Kingsvale group, British Columbia, locality 3449.

Types. Hypotypes, G.S.C. Nos. 5969, 6652.

Cladophlebis parva Fontaine

Plate XI, figures 3, 5; Plate XII, figure 3; Plate XIII, figures 1, 2; Plate XIV, figure 3; Plate XV, figure 3

Cladophlebis parva Berry, Nat. Mus., Canada, Bull. 58, p. 40 (1929).

Description. Frond, at least tripinnate, rachis up to 2.5 mm. or more wide, obscurely ridged longitudinally. Primary pinnae, elongate-lanceolate, acutely pointed, up to 15 cm. or more long by 5 cm. or more wide, alternate, attached about 45 degrees to parent rachis, commonly touching one another, straight or curved; rachis, like parent rachis, up to 2 mm. or more broad. Secondary or ultimate pinnae, linear-lanceolate, alternate, acutely pointed, up to 3 cm. long by 0.5 cm. broad, commonly asymmetric, those holding a superior, basal, adaxial position nearly normal to parent rachis, whereas inferior basal pinnae and those nearer apex are oblique, commonly more or less falcate; length of pinnae variable, those occupying proximal parts of primary pinnae shorter than those situated more distally; rachis, winged. Secondary pinnae on primaries near apex of frond in form of long, apically pointed pinnules. Pinnules, small, alternate, up to 5 mm. long by 2.5 mm. broad, pecopteroid, more or less decurrent, triangular to elliptical, connate by wing of rachis and progressively more united to apex, commonly somewhat falcate, bluntly or more sharply pointed at apex; inferior, basal pinnule, commonly attached to base of pinna close to its insertion, and not uncommonly possessing a posterior, marginal lobe, or rarely three-lobed. Veins, moderately strong; midrib, commonly flexuous or slightly falcate; laterals, in largest pinnules two to four pairs, simple or basal ones once divided, strongly ascending and commonly curved towards apex of pinnule.

Fertile pinnules, like sterile; generally they appear as pinnatifid pinnules that in distal parts of a frond take the place of pinnae of a lower order; in these a row of subcircular sori occurs on each side of the midrib, about midway to margin, one sorus to each lobe segment. Scattered fertile pinnules may occur in other parts of frond on normal pinnules, with commonly one sorus on a lateral vein in the anterior half of the pinnule. The sori generally are about 0.75 mm. diameter, and contain a group of sporangia, each seemingly possessing an annulus.

Remarks. The specimens included here differ in venation from the type specimens of *C. parva* Fontaine in that simple and not divided laterals greatly predominate. Such variation in species of *Cladophlebis* is not generally of specific significance. What may be a more significant difference is the form of the sori, providing the fertile specimen described by Berry (1911, p. 251, Pl. 31, figs. 1-3) actually belongs to *C. parva*, and that the sori are correctly described as reniform. The sori in the Canadian specimens are precisely similar in gross characters at least to those of *Polypodium oregonense* Fontaine (1905, Pl. 10, figs. 1-7) from so-called Jurassic beds of Oregon. The species are believed to be specifically distinct mainly owing to differences in dissection of the frond when corresponding parts are compared. The ultimate degree of dissection in *P. oregonense* is a pinnatifid pinnule. The exceptions may be deceiving, for they apparently concern pinnules from near the apex of a frond, which are interpreted by the writer to represent pinnatifid secondary pinnae. Specimen G.S.C. No. 4047 (Pl. XV, fig. 3 of this report) is believed to represent a part of a primary pinna from a position on a frond corresponding to that held by Pl. 9, fig 3, Fontaine (op. cit.) of *Polypodium oregonense.* Where the dissection of secondary pinnae of *P. oregonense* is greatest, as in Pl. 9, fig. 7, and Pl. 8, fig. 12, of Fontaine, the pinnule-like segments have only one pair of lateral veins in contrast to several pairs in corresponding Canadian specimens. Yet, *C. parva* as defined in this report is, apparently, very close specifically to *P. oregonense.* In venation the species resembles *Dryopteris montanense* (Fontaine) Knowlton (Fontaine, 1893, Pl. 82, figs. 1-3; Pl. 83, figs. 2-3), but the pinnules of the latter are non-falcate, are relatively much more elongate, and the fructifications different. *Aspidium monocarpum* Fontaine in part (1893, p. 490, Pl. 84, fig. 3; Pl. 83, figs. 4, 5) is considered by the writer to be conspecific with *C. parva.*

Occurrence. Blairmore group (lower flora), Alberta, localities 1727, 3174, 4026, 4027, 4031, 4033; Luscar formation, Alberta, localities 1233, 2054, 3296, 3340, 3362, 3908; Hazelton group, British Columbia, localities 836, (?) 3029; Spence Bridge group, British Columbia, locality 3456; Uslika formation, British Columbia, locality 3839.

Types. Hypotypes, G.S.C. Nos. 4047, 4048, 4049, 4050, 4052, 5744, 6569.

Cladophlebis impressa n. sp.

Plate XII, figure 2; Plate XIII, figure 3; Plate XIV, figure 2;
Plate XV, figure 1; Plate XVI, figure 4

Description. Frond, apparently quadripinnatifid. Penultimate (primary) pinnae, deltoid-acuminate at apex, of unknown length, but rachis about 5 mm. wide in a low position on frond. Ultimate pinnae, alternate, moderately spaced or touching or even overlapping, straight or curved, attached at very open angles, linear-lanceolate, oblong for greater part of length then acuminate to acute apex, up to 9 cm. or more long and nearly 2 cm. wide. Pinnules, coriaceous, pinnatifid where in low positions on parent pinna, alternate, contiguous or nearly so, inclined 65 to 80 degrees to rachis, sub-rectangular, apically obtuse, basally constricted to short footstalk, up to 12 mm. long by 4 mm. broad, with up to seven or eight pairs more or less deeply cut, pinnule-like, suborbicular to subovate, obtuse lobes; pinnules in more apical positions have broader base of attachment, until they become attached by whole width and basally confluent. Midveins, strong and thick; laterals, commonly marked by deep furrows both on dorsal surface and on imprints of lower surface; in largest pinnatifid pinnules the lobes have a central vein and one to four pairs strongly ascending branches, the latter once divided or simple; in the smallest the lobes may have a single or once divided vein. In entire pinnules from apical position of a pinna the lateral veins are once divided and ultimately simple. The inferior basal pinnules are commonly much shorter than the others, suborbicular, and situated in the angle between the ultimate and penultimate rachises.

Remarks. The species resembles quite closely *Coniopteris nitidula* Yokoyama (1906, p. 35, Pl. 12, fig. 4) from the Cretaceous of China, but differs in the lack of crenulae on the lobes of the pinnules, and in the more divided lateral veins. Owing to the corrugated appearance of the pinnules, *Cladophlebis impressa* is not likely to be confused with *Cladophlebis strictinervis* (Fontaine). Furthermore, the entire pinnules of the former are more obtuse and have less ascending, lateral veins, and the pinnatifid pinnules are shorter and less triangular. The ultimate pinnae of *C. impressa* are more linear than those of *C. browniana* (Dunker), the pinnules more rectangular, and the veins coarser.

Occurrence. Hazelton group, British Columbia, localities 841, 2403, 2410, 3297; Jackass Mountain group, British Columbia, locality 3515.

Types. Holotype, G.S.C. No. 5764; paratypes, G.S.C. Nos. 5739, 5762, 5763, 6577, 6647.

Cladophlebis heterophylla Fontaine

Plate XIV, figure 1; Plate XV, figure 4; Plate XVI, figure 1;
Plate XVII, figures 3, 4

Cladophlebis heterophylla Berry, Nat. Mus., Canada, Bull. 58, p. 39, Pl. 5, figs. 1-4 (1929).

Description. Frond, seemingly bipinnate; rachis, up to 1 mm. or more wide, macroscopically smooth. Ultimate pinnae, linear-lanceolate, at very open angles or more oblique to parent rachis; rachis, smooth, distally winged. Pinnules, ovate to broadly triangular to rotund, alternate, attached at wide angles up to 5 mm. long by 4 mm. wide, obtusely rounded or bluntly acute at apex, more or less constricted at base, decurrent approaching apex of pinna, entire, except for basal ones which have commonly a well marked posterior, obtuse, basal lobe, while other proximate pinnules may have a low, rounded anterior lobe. Veins, prominent; midvein, strongly ascending from origin so as to run subparallel to parent rachis, thinning rapidly and more or less zigzag-flexuous to apex of pinnule; laterals three or four alternate, oblique pairs in the largest pinnules, about as strong as midvein, the lowermost dividing close to origin and one or more of the arms may divide once or twice. Owing to strongly ascending base of the midvein, the posterior, basal lateral may appear as if directly connected to parent rachis of the pinna.

Remarks. The largest pinnae, which may have more or less falcate, triangular pinnules, come closest to *Cladophlebis parva* in general appearance, but are readily differentiated by the pinnule venation. Although it is possible that *C. heterophylla* is conspecific with the earlier described German Wealden species *Sphenopteris delicatissima* Schenk (1871, p. 211, Pl. 27, fig. 3), the type specimen of the latter, less than 1 cm. long, was far too fragmentary for foundation of a species. Moreover, *Sphenopteris delicatissima* Seward (1900b, p. 23, Pl. 3, figs. 49, 50) bears little resemblance to *C. heterophylla*, nor does *Dichopteris delicatula* Seward (1913, p. 98, Pl. 11, fig. 6) from the English Wealden. There is little doubt, however, that *C. holttumi* Seward (1927, p. 88, Pl. 8, fig. 57) from Upernivik, Greenland, belongs to *C. heterophylla*.

Occurrence. C. heterophylla is common in the Kootenay formation, but is lacking or very rare in the younger Luscar or equivalent formations. Kootenay formation, Alberta, localities 2310, 4039, 4041, 4046, 4051, 4411; ? Luscar formation, Alberta, locality 1233.

Types. Hypotypes, G.S.C. Nos. 4060, 4061, 4062, 4064, 4066, 5001 (Berry, op. cit., above).

Onychiopsis psilotoides (Stokes and Webb) Ward

Plate XXIV, figure 1; Plate XXVI, figure 3

Glyptostrobus groenlandicus Dawson (non Heer). Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 9, Pl. 3, fig. 8 (1886).

Description. Frond, tripinnate; rachis, smooth, up to 5 mm. wide. Primary pinnae, alternate to subopposite, elongate-lanceolate, up to 11 cm. or more long; rachis, smooth, with central cord and bordering flat wing-like margins, up to 1.5 mm. wide. Secondary pinnae, alternate, more rarely subopposite, elongate-lanceolate, obliquely attached at angle of about 35 degrees, up to 3 cm. or more long; rachis, smaller, but otherwise like parent rachis. Pinnules, alternate, oblique, lanceolate-acuminate, the largest up to 7 mm. or more long and pinnatifid, with three or four pairs of alternate, pinnule-like lobes; intermediate pinnules, slightly lobed or serrate, and distal ones, entire. Apices of pinnules, sharply pointed. A single vein in each pinnule gives off a simple branch to each lobe or segment.

Fertile pinnules, ovate, abruptly pointed at apex, about 2.5 mm. long by 1 mm. wide.

Remarks. This species, so common in the Wealden of Europe, is rather rare in Lower Cretaceous deposits of Western Canada. *Glyptostrobus groenlandicus* Dawson (non Heer), G.S.C. No. 4833, was very inadequately figured. The specimen actually shows fragments of two primary pinnae that undoubtedly belong either to *Onychiopsis psilotoides* or to *O. elongata* (Geyler). As Seward (1903, p. 5) has stated that pinnules of *elongata* form may be found on parts of fronds of *O. psilotoides*, there is no reason for assigning this particular specimen to *O. elongata.*

While most of the pinnules, some of which are 1 cm. long, are entire, several show forwardly directed low teeth, each supplied by a simple vein that strongly ascends from the midvein of the pinnule. The veins in most of the pinnules are not preserved.

Occurrence. Kootenay formation, Alberta, locality 4046; Nikanassin formation, Alberta, locality 3161; Luscar formation, Alberta, localities 2052, 2138, 2152, 3332; Bullhead group, British Columbia, localities 1997, 4016; Pasayten group, British Columbia, localities 3127, 3128, 3129; Blairmore group, Alberta, locality 257.

Types. Hypotypes, G.S.C. Nos. 1029, 4833 (*Glyptostrobus groenlandicus* Dawson).

Dictyophyllum fuchsiforme n. sp.

Plate XXXV; Plate XXXVI, figure 4

Description. Primary pinnae, very long; rachis, up to 4 mm. wide, with narrow wing 1 mm. wide. Pinnules, at right angles or nearly so to rachis, elongate-rectangular, with parallel, entire borders and rounded, obtuse apex, up to 11 cm. or more long by 9 mm. wide, of equal width for most of length, but slightly expanded at base where they are confluent by the wing of the rachis, and separated by a rounded sinus; opposite to subopposite, and 12 to 15 mm. apart. Median nerve, well defined. Secondary veins, at very open angles to a right angle to median nerve, straight to flexuous, dominantly simple, although it is possible that a few bifurcate, running to borders or nearly so, averaging about 2 mm. apart; tertiary network, obscurely preserved, but apparently a fine reticulum, enclosing about equidimensional spaces.

Remarks. The differences from *Dictyophyllum fuchsi* Zeiller (1902, p. 98, Pl. 18, figs. 1, 2) from Rhaetic beds of Indo-China are so slight as almost to warrant inclusion with that species. The Canadian species is somewhat more robust, and the secondary veins are somewhat closer together. *D. fuchsiforme* may also be compared with *Nathorstia alata* Halle (1913, p. 20, Pl. 1, figs. 1-9), although the absence of fertile pinnae precludes any discussion of close affinity.

Occurrence. Hazelton group, British Columbia, locality 2374.

Types. Holotype, G.S.C. No. 5796; paratype, G.S.C. No. 5797.

Phlebopteris ? elongata n. sp.

Plate XXII, figure 3; Plate XXVI, figure 1; Plate LXXXV, figure 6

Description. Habit of frond, unknown. Pinnules, alternate to subopposite, coriaceous, long, linear, bluntly pointed at apex, attached by whole base which is slightly expanded to narrow wing of rachis by which they are united, up to 6 cm. or more long by 3 mm. broad. Margins of pinnules, entire or having distally short, asymmetric, oblique, narrowly rounded crenae. Midvein, well defined; laterals, generally immersed, and, where seen, obscure, but they make very acute angles to midvein, dividing several times in course to margin, the first division close to midvein and sending an anterior branch nearly parallel with it, seemingly united by rare anastomoses. Fructifications, unknown.

Remarks. The venation resembles that of *Phlebopteris brauni* (Göppert) Hirmer and Hörhammer (1936, p. 32, text-fig. 5, 1A-1D), although the linear form of the pinnules is like that of *Phlebopteris muensteri* (Schenk) Hirmer and Hörhammer (op. cit., Pl. 4, fig. 1).

Occurrence. Hazelton group, British Columbia, locality 1801; Nikanassin formation, Alberta, locality 346.

Types. Holotype, G.S.C. No. 5798; paratype, G.S.C. No. 429.

Gleichenites giesekianus (Heer) emend. Seward

Plate XVII, figures 1, 2; Plate XVIII, figure 5

Description. Ultimate pinnae, alternate to opposite, linear, acutely pointed, normal or at open angles to rachis, straight or curved, commonly asymmetric; rachis, narrowly winged. Pinnules, alternate to subopposite, normal or openly inclined to rachis, subrectangular with obtuse apices to subtriangular with pointed apices, commonly recurved backwards, narrow and small to more robust, and 4 or 5 mm. long by 2 or 2.5 cm. wide. Veins, poorly preserved; midvein, running to or near apex; laterals, where observed, relatively few, commonly not more than three or four pairs, which divide once, except posterior basal one may divide twice.

Remarks. The above is only a partial description, being based on several poorly preserved sterile fragments. Their assignment to this species is based on the common occurrence of recurved pinnules, the union of the pinnules by a narrow wing of the rachis, and by relatively few lateral veins.

Occurrence. Blairmore group (lower flora), locality 3773; Uslika formation, British Columbia, locality 3839; Spence Bridge group, British Columbia, locality 3456; Pasayten group, British Columbia, localities 3126, 3127, 3129, 3137; Kingsvale group, British Columbia, localities 3020, 3125.

Types. Hypotypes, G.S.C. Nos. 6572, 6573, 6575.

Gleichenites nordenskiöldi (Heer) emend. Seward

Plate XV, figure 2; Plate XVI, figure 3; Plate XVIII, figures 1, 3, 7; Plate XIX, figure 7; Plate XX

Gleichenia gilbert-thompsoni Penhallow, Roy. Soc. Canada, Trans. 1907, Ser. 3, vol. 1, sec. 4, p. 302, Pl. 9 (1907); Geol. Surv., Canada, Mem. 38, Appendix B, p. 813, Pl. 9 (1912).

Description. Penultimate pinnae, very large, commonly asymmetric, with pinnae on one side normal to rachis, and those on other side openly oblique; rachis, up to 6 or 7 mm. wide, smooth. Ultimate pinnae, at very open angles or normal to parent rachis, up to 19 cm. long by 1 cm. broad, flexuous or straight, of almost equal breadth for about three-quarters of length, then tapering to acute apex, commonly asymmetric, with pinnules on one side longer or more obliquely set than those on other; rachis, relatively slender, canaliculate on upper surface. Pinnules, at wide angles or normal to rachis, most commonly directed a little forwards, up to 7 mm. long by 3 or 3.5 mm. wide, generally parallel-sided and obtuse, although varying to bluntly acute, the proximal ones free and more or less constricted at base, with rounded basal corners, the posterior one being lobe-like and commonly overlapping onto rachis; pinnules in distal part of frond, connate at base by a narrow lamina that forms a wing to rachis, and attached by whole base. Median nerve, generally straight, continuous to apex or bifurcated close to it; laterals, up to seven or eight pairs in largest pinnules, once or twice divided at rather open angles, curving to meet margin at open angles. The vein supplying the posterior corner or lobe arises at base of midvein close to rachis, and may divide a third time.

Fertile pinnules, like sterile, with a single row of sori on each side of midvein, each sorus located on upper branch of a lateral close to the vein division. Sori, subcircular, commonly from 6 to 10 per pinnule, occupying, when mature, nearly the whole breadth of lamina between midvein and margin.

Remarks. Gleichenia nordenskiöldi Heer as emended by Seward (1927, p. 74) included part of Heer's species *G. longipennis*, the remainder being assigned to *G. giesekianus*. Seward's main criterion for recognition of *G. nordenskiöldi* was the separate attachment of pinnules, some of which had asymmetrical lobed bases. In addition, the number of lateral veins in *G. nordenskiöldi* was considered to be greater than in *G. giesekianus*, backwards recurving of the pinnules presumably much less common, the number of sori per pinnule greater, but the number of sporangia per sorus fewer. These criteria, with the possible exception of the last mentioned, may not singly be applicable, but by combining as many as possible, one may recognize in the Canadian material to hand the one species or the other. In *G. nordenskiöldi* there is a general rarity of pinnules recurved backwards. Apparently *Gleichenia gilbert-thompsoni* Fontaine (in Ward 1905, p. 232, Pl. 66, fig. 10) is conspecific with *G. nordenskiöldi;* the figured specimen shows the bases of some of the pinnules overlapping upon the rachis in the manner of some pinnules of *G. nordenskiöldi.*

Occurrence. Hazelton group, British Columbia, localities 836, 3299, 3303, 3304, 3305, 3306; Pasayten group, British Columbia, localities 3320, 3321; Spence Bridge group, British Columbia, locality 3173; Jackass Mountain group, British Columbia, locality 3716; Luscar formation, Alberta, localities 1233, 2134.

Types. Hypotypes, G.S.C. Nos. 5733, 5734, 5768, 5769, 5773, 5774, 5808 (type of *G. gilbert-thompsoni* Penhallow).

Cladophlebis (*Gleichenites*) *porsildi* Seward

Plate XIV, figure 4; Plate XIX, figure 4; Plate XXI, figures 2, 3

Description. Primary (?) pinna, deltoid, apically acute; rachis, up to 1.5 mm. or more broad. Ultimate pinnae, alternate to subopposite, lanceolate, acutely pointed, attached at open angles or normal to parent rachis. Pinnules, pecopteroid, subrectangular or oblong-lanceolate, broadly to narrowly rounded at apex, attached by whole base or slightly constricted and with rounded basal corners, at open angles or nearly normal to parent rachis, free or confluent only by a very narrow wing of rachis, nearly straight or slightly curved towards apex of pinna, the largest about 1 cm. long by 2 or 3 mm. broad. Midvein, strong and straight in lower part of pinnule, thin in apical part; laterals, commonly six to eight pairs, oblique, divided once, or basal ones divided again.

Remarks. Seward (1927, p. 76, Pl. 6, figs. 18A, 30A, 27A) illustrates specimens in which the lateral veins are moderately oblique or rather highly ascending. In the Canadian material the veins are mostly similar in habit to those in Seward's figures 18A and 30A. The relation of this species to *Cladophlebis angustifolia* Newberry (1891, p. 200, Pl. 14, fig. 8) is doubtful. Newberry figured only a small fragment of a pinnae, which differs from *porsildi* in that the pinnules are more noticeably falcate, and are basally united by a more marked wing of the rachis.

Occurrence. Blairmore group (lower flora), Alberta, locality 4025; Uslika formation, British Columbia, localities 3519, 3839; Spence Bridge group, British Columbia, locality 3456.

Types. Hypotypes, G.S.C. Nos. 4046, 6576, 6658, 6659.

Cladophlebis (*Gleichenites* ?) *waltoni* Seward

Plate XVIII, figure 6; Plate XIX, figures 2, 3

Description. Ultimate pinnae, alternate, inserted at right angles or open angles to penultimate rachis, those on one side being commonly at more open angle than those on other side, linear-lanceolate, tapering to acute apex, straight or forwardly curved, up to 5 cm. or more long; rachis, stout, canaliculate above. Pinnules, pecopteroid, sub-oblong, entire, very obtuse, the largest slightly contracted at base and free, inserted at right angles or nearly so to axis.

Remarks. The specimens are all contained in sandstone and the veins, except for the midrib in some instances, are not preserved; otherwise they agree perfectly with Seward's type specimen (Seward, A. C., 1927, p. 74, text-fig. 3).

Occurrence. Leckie group, British Columbia, localities 4401, 4305.

Types. Hypotypes, G.S.C. Nos. 5930, 5931, 5932.

Cladophlebis (*Gleichenites* ?) *munda* (Dawson, pars) n. comb.

Plate XI, figure 1

Dicksonia munda Dawson, pars, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 11, Pl. 3, fig. 5 (non fig. 5a) (1886).
Gleichenia gracilis Dawson (non Heer), ibid., p. 11, Pl. 3, fig. 4 (1886).

Remarks. The two fragments figured by Dawson, G.S.C. Nos. 5103a and 5102, apparently are apical parts of a single fertile pinna, and they are so figured in this report (Pl. XI, fig. 1). The longest ultimate pinna is about 2.5 cm., and the rachis is narrowly winged. Pinnules, coriaceous, alternate to subopposite, confluent only by the narrow wing of the rachis, attached at very open angles to a right angle, triangular-ovate, up to 3.5 mm. long by 1.5 mm. wide; the margins are obscurely lobed to entire, and the apices obtuse or bluntly pointed. A few pinnules show the midrib, but otherwise the veins are obscure. The larger pinnules have on each side of midrib about three circular elevations, believed to indicate sori; they lie about midway between margin and midrib. The number of sporangia could not be determined megascopically.

The species resembles somewhat some specimens assigned by Seward (1927, Pl. 5, figs. 2-4, 11, 12) to *Gleichenites giesekianus* (Heer), but the ultimate pinna are attached at more acute angles to the parent rachis, and the pinnules are not recurved.

Occurrence. Blairmore group (upper flora), Alberta, locality 1815.

Types. Lectotype, G.S.C. No. 5103a (*Dicksonia munda* Dawson and No. 5102, *Gleichenites gracilis* Dawson that belong to same pinna as 5103a).

Sphenopteris (*Gleichenites* ?) *erecta* n. sp.

Plate XIX, figure 6; Plate XXII, figures 1, 7

Description. Frond, at least bipinnate; rachis of penultimate pinnae, slender, smooth, slightly flexuous, about 1 mm. broad. Ultimate pinnae, lanceolate, straight or slightly curved forwards, attached about 70 to 80 degrees to parent rachis, somewhat over 3 cm. long by 1.5 cm. broad; rachis, smooth, canaliculate above, distally with narrow wing. Pinnules at right angles or nearly so to parent rachis, opposite to alternate, up to 8 mm. long by 3 mm. wide, rectangular-ovate, the largest constricted at base to short, stout footstalk, and furnished with four or five pairs of obtuse lobes normal to axis of pinnule; towards the apex of pinna the pinnules become less constricted at base, and are finally pecopteroid, entire, and slightly decurrent on wing of rachis. Midrib, flat and relatively inconspicuous or immersed, slightly decurrent. Lateral veins, obscured by occurrence of a row of four or five circular sori, about 1 mm. diameter, one to each marginal lobe, about halfway to margin. Each sorus is marked by obscure elevations, probably representing sporangia, but details not known.

Remarks. The species bears superficial resemblances to some species of *Oligocarpia.* Macroscopically the sori are like those of *Gleichenia.*

Occurrence. Luscar formation (?), locality 347; Blairmore formation (upper flora), Alberta, locality 1250.

Types. Holotype, G.S.C. No. 5736.

Cladophlebis (*Gleichenites* ?) sp.

Plate XVIII, figures 2, 4; Plate XIX, figure 1

Remarks. A fragment of the largest ultimate pinna (G.S.C. No. 5972, Pl. XVIII, fig. 2) has crowded pinnules, about 8 mm. long by 2.5 mm. wide, but varying slightly in length, pecopteroid, with rounded obtuse or blunt apices, slightly curved towards apex of pinna, inserted at very open angles; the pinnules are coriaceous and, except for the midrib, the veins are obscure, although some of the laterals are once divided. Specimen 5973 (Pl. XIX, fig. 1) shows a part of a penultimate pinna, with rachis about 1.5 mm. wide. The ultimate pinnae are lanceolate-acuminate and attached almost at right angles; the pinnules, except for their smaller size and union at base, are like those of specimen 5972; the basal ones are upright or reflected backwards, and have a pronounced posterior basal lobe, which may overlap upon the penultimate rachis; the lateral veins are again obscure, but several are seen to be once divided. A third specimen, No. 5974 (Pl. XVIII, fig. 4) shows a basal fragment of an ultimate pinna with pinnules intermediate in size between those of the other two specimens; of the basal pinnules only the inferior is preserved, and shows a pronounced posterior lobe; the lateral veins on this specimen, again obscure, appear to be simple; a few pinnules show circular elevations that may be sori, a row of about five on each side of the midrib.

Although the species is distinct otherwise from *Gleichenites giesekianus* (Heer) Seward, the possession of lobed basal pinnules is a feature common to both. It is possible that the coriaceous fragments described belong to *Gleichenites ? munda* (Dawson), representing parts of pinnae from lower positions in a frond than the type of that species.

Occurrence. Kingsvale group, British Columbia, locality 3449.

Types. G.S.C. specimens 5972, 5973, 5974.

Klukia canadensis n. sp.

Plate XIX, figures 5, 8; Plate XXI, figures 1, 4; Plate XXII, figure 5

Cladophlebis ungeri Berry pars (non Dunker), Nat. Mus., Canada, Bull. 58, p. 42.
Cladophlebis (Klukia) dunkeri Radforth and Woods, Can. Jour. Research, C. 28, pp. 780-787, Pl. 1 (1950).

Description. The fragments of pinnae to hand are not sufficiently large for reliable reconstruction of a frond. Ultimate pinnae, deltoid-lanceolate, short, up to 3 cm. long, normal or at open angles to parent rachis; rachis, distally winged, relatively stout, up to 1 mm. or more broad. Pinnules, suboval to subrectangular, normal or at open angles to parent rachis, pecopteroid, obtuse, more or less broadly rounded, 1.5 to 3 times as long as broad, up to 6 mm. long by 3 mm. wide, the largest with symmetrical, obtuse crenae or marginal lobes and slightly constricted at base. Veins, not generally conspicuous; laterals, all simple and straight, except in largest lobate pinnules where a lateral supplying a lobe may be bifurcated at an open angle or in the largest basal lobes be twice divided.

Fertile pinnules, like sterile, commonly crenate; sporangia very closely spaced, as if covering all of under surface of pinnule, seemingly a row on each side of laterals, single, ovate, about 0.4 cm. long by 0.25 mm. wide, with prominent annulus forming a complete ring close to apical end.

Remarks. *Pecopteris polymorpha* Dunker = *Pecopteris dunkeri* Schimper (Dunker, 1846, p. 6, Pl. 7, fig. 5) was too poorly figured and fragmentary to know whether it is specifically separable from *Pecopteris ungeri* Dunker (op. cit., p. 6, Pl. 9, fig. 10), and Schenk (1871, p. 214). Later Seward (1913, p. 95) not only united these two species, but considered them to be conspecific with *Pecopteris browniana* Dunker (1846, p. 5, Pl. 8, fig. 7). The Canadian specimens are differentiated from all these forms by the more deltoid form of the ultimate pinnae, and the more robust, obtuse pinnules which generally have simple lateral veins. Berry's conception and synonomy of both *Cladophlebis ungeri* and *C. browniana* (Berry, 1911a, pp. 243, 255) is still more widely at variance with characters shown by our specimens. A possible exception is *C. ungeri* Fontaine in Ward (1905, Pl. 65, figs. 15, 16) from the Shasta group; the figures show obtuse, symmetrically crenate pinnules, much like those of *Klukia canadensis*, but the material is far too fragmentary for adequate comparison.

Occurrence. Blairmore group (lower flora), Alberta, localities 1242, 1627, 2156, 3063, 4025, 4033, 4035, 4037; Luscar formation, Alberta, localities 1610, 2054, 3058, 3163, 3180, 3296, 3332, 3532; Hazelton group, British Columbia, localities 1557, 2420.

Types. Holotype, G.S.C. No. 5383; paratypes, G.S.C. Nos. 4045, 5382, 5385, 5386, 5387.

Sphenopteris (*Ruffordia*) *göpperti* (Dunker) Seward

Plate XXII, figures 2, 8; Plate XXIII, figures 1, 4

Asplenium dicksonianum Dawson (non Heer) pars, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 5, Pl. 3, fig. 1 (1886).

Remarks. The material is too fragmentary to add to Seward's description of the species (Seward, 1894, p. 76). Specimen G.S.C. No. 5780 (Pl. XXIII, fig. 4) shows parts of what are believed to be two primary pinnae; the upper one is presumably attached to axis A of a frond, and lies opposite attachment of another pinna. The largest attached secondary pinnae are pinnatifid. Specimen G.S.C. No. 5370 (Pl. XXII, fig. 8) may represent either an apical part of a primary pinna or of a large secondary pinna. The largest tertiary pinnae are short, up to 1.3 cm. long by 0.5 cm. wide, elliptical-lanceolate, with three or four pairs of alternating, oblique pinnules. Largest pinnules, subrhomboidal to cuneate-elliptical, about 4 mm. long and more or less deeply cut, having one to four lateral, strongly ascending, acutely pointed lobes in addition to the terminal one; each lobe has a single vein.

Specimen G.S.C. No. 5372 (Pl. XXII, fig. 2) comprises parts of two branching rhizomes, with rugose surfaces. They resemble that figured by Seward (loc. cit., p. 52, Fig. 6) as a rhizome of *Onychiopsis psilotoides*, but the same bed shows fragments of *S. göpperti*. Seward (loc. cit., p. 83, Pl. 10, fig. 2) mentions similar rhizomes associated with *R. göpperti* which show bases of attached petioles.

The habit of frond of *S. göpperti* is quite different from that of *Onychiopsis psilotoides*, although the pinnules may be superficially similar. The rachises of *S. göpperti* are proportionally more slender, the pinnules more lax and more deeply dissected, and the veins more prominent.

Occurrence. Blairmore group (lower flora), Alberta, localities 1242, 1727, 3063, 4025, 4037; Luscar formation, Alberta, localities 3181, 3183; Hazelton group, British Columbia, localities 3299, 3304.

Types. Hypotypes, G.S.C. Nos. 5370, 5372, 5767, 5780.

Sphenopteris acrodentata Fontaine

Plate XXII, figures 4, 6; Plate XXIII, figure 2

Original description of types. "Frond tripinnatifid, secondary pinnae opposite, very short, terminating in a round-lobed segment, which is cuneate at base; ultimate pinnae or pinnules subopposite, the lower ones cut obliquely in broadly elliptical lobes and pinnules nearly down to the midrib, lobes and pinnules narrowed towards their bases, the upper ones reduced to pinnules which are first lobed and then simple; pinnules and lobes at their summits rounded, very obtuse, and furnished with minute teeth; nerves of the rounded lower pinnules and of the lobes, several times forked and diverging flabellately, the ultimate branches ending in teeth" (Fontaine, 1889, p. 90).

Remarks. The material to hand is too fragmentary to add much to the above description. The writer is of the opinion, however, that Fontaine's type specimen was a deltoid primary of a tripinnate frond rather than a secondary pinna. G.S.C. No. 6564 (Pl. XXIII, fig. 2) shows part of what is interpreted to be a primary pinna that occupied a low position on a frond, and G.S.C. No. 6578 (Pl. XXII, fig. 6) is thought to show parts of two primary pinnae from an upper part of a frond, although they may represent apical parts of two primary pinnae from a low position. Under a hand lens the rachis and lower surface of the pinnules may be seen to be provided with stiff hairs about 0.5 mm. long.

Occurrence. Hazelton group, British Columbia, localities 2401, 2413; Blairmore or Bullhead group, Alberta, locality 4311.

Types. Hypotypes, G.S.C. Nos. 5360, 6564, 6578.

Acrostichopteris foliosa (Fontaine) Berry

Plate XXV, figures 1, 3; Plate XXVIII, figure 9

Description. Largest pinnae, broadly deltoid. Pinnae of lower order, subopposite, openly oblique or spreading, semi-orbicular, deltoid or obovate-cuneate in outline, with commonly two lateral, subopposite, pinnatifidly dissected, lanceolate branches, in addition to a terminal group of segments, all subordinate branches being more or less deeply divided into lobes to an axial lamina; final lobes, linear, bluntly or acutely pointed, and commonly with one or more blunt or more sharply pointed, apical teeth. Veins, thin, but distinct, single veins of major sections dividing by successive dichotomies so as to provide a simple vein to each ultimate segment or tooth.

Remarks. The Canadian material differs somewhat from Fontaine's types in the more open appearance and more deeply laciniate dissection of the pinnae, but this is doubtfully of specific importance. It departs widely from *Acrostichopteris longipennis* Fontaine (1889, p. 107, Pl. 170, fig. 10; Pl. 171, figs. 1, 5, 7), and Berry's (1911a, p. 223) union of these two species is questionable, although a high range of variability in leaves of this nature might be expected. *A. foliosa* may be compared with *Jeanpaulia borealis* Heer (1874, p. 57, Pl. 2, fig. 15), but the latter species is based on a fragment that is too incomplete to permit even a generic assignment.

Associated with specimen G.S.C. No. 5375 (Pl. XXV, fig. 1), although not in organic connection with it, is a large, seed-like ovate sporangium (?), 3.5 mm. long by 2.5 mm. wide. The outer coat is coalized and roughened by ridges that form a recticulum of cells which are polygonal except at apex and along a part of the sides where there is a row of elongated cells, several cells in width, which may represent an annulus. These bodies resemble those figured by Fontaine (1889, Pl. 171, fig. 7). Associated with specimen No. 5378 are dichotomously branched, ribbon-like laminae, similar to *Thallites blairmorensis* (Berry); they are about 6 mm. wide and have a central strand about 1 mm. wide (Pl. XXV, fig. 3). Possibly they are creeping stems or rhizomes belonging to *A. foliosa.*

Occurrence. Luscar formation, Alberta, locality 1233.

Type. Hypotypes, G.S.C. Nos. 5375, 5376, 5378.

Sphenopteris latiloba Fontaine

Plate XXVIII, figure 3; Plate XXIX, figures 1, 2; Plate XXX, figures 1, 3, 4

[*Onychiopsis göpperti* Berry pars, Nat. Mus., Canada, Bull. 58, p. 38 (1929).

Description. Frond, large, quadripinnate; rachis, up to 4 mm. broad, obscurely and finely ridged longitudinally. Primary pinnae, spreading to oblique, alternate to opposite, deltoid, contracting abruptly near apex, up to 16 cm. wide and of unknown length; rachis, commonly about 1 or 1.5 mm. wide, and generally appearing canaliculate or with pronounced central cord, according to preservation, distally winged, obscurely and finely ridged. Secondary pinnae, lanceolate, rather openly attached at angles 40 to 65 degrees or more, alternate to subopposite, touching or overlapping or more distant, up to 10 cm. or more long by 4 cm. or more broad; rachis, like that of its parent. Tertiary or ultimate pinnae, elliptical, alternate, short, up to 3 cm. long by 2 cm. broad, commonly attached 40 to 50 degrees to rachis; rachis, distally winged. Pinnules, obovate-cuneate to subquadrate to elliptical, up to 1.5 cm. long by 0.8 or more cm. wide, proximal ones at open angles to rachis, constricted at base to short, stout footstalk, and more or less deeply divided into obtuse lobes; distal ones marginally lobed or crenate or entire, decurrent and united by wing of rachis. A single, stout vein enters each pinnule, and by successive dichotomous divisions results in a flabelliform pattern, the arms of each division running subparallel. Rare specimens, under a hand lens, show scattered hairs on the pinnules, about 0.25 mm. long.

Remarks. The only good specimen of the material to hand that shows attachment of a primary pinnae is G.S.C. No. 6565 (Pl. XXX, fig. 1), which seemingly held a position on a frond close to the apex; in habit it is suggestive of *Ruffordia.* A large primary pinna is shown by G.S.C. No. 4042 (Pl. XXIX, fig. 2); it was probably attached to a nearby broad rachis shown at A in the figure, which is comparable in size to one illustrated by Fontaine (1889, Pl. 36, fig. 6).

The species resembles fairly closely *Sphenopteris naktongensis* Yabe (1905, p. 38, Pl. 4, figs. 10, 11), believed to be of Jurassic age. Although Seward (1927, p. 85) united *Sphenopteris latiloba* Fontaine to *Kirchnera dentata* Velenovsky (1888, p. 18, Pl. 2, figs. 1, 2), there seems little justification for this, because the manner of dissection of the frond in the two species is quite different when corresponding parts are compared.

Occurrence. Kootenay formation, Alberta, localities 2311, 4048, 4051; Kootenay formation, British Columbia, localities 1222, 2093, 3755; Blairmore group (lower flora), Alberta, localities 3057, 3065, 3608b, 4026, 4027, 4036; Luscar formation, Alberta, localities 1626, 2053, 2054, 2249, 2492, 3908; Bullhead group, British Columbia, locality 2299; Uslika formation, British Columbia, locality 3839; Spence Bridge group, British Columbia, locality 3456.

Types. Hypotypes, G.S.C. Nos. 4027, 4042, 4043, 4044, 6565, 6579.

Sphenopteris bidens n. sp.

Plate XXXII, figure 2; Plate XXXIII, figure 5

Description. Frond, at least bipinnate and probably tripinnate. Penultimate rachis, long, stout, about 2 mm. diameter, obscurely ribbed longitudinally. Ultimate pinnae, alternate to subopposite, contiguous, linear-acuminate, inserted at open angles to parent rachis, of about equal breadth for more than half their length, then narrowing gradually to a very acute termination, up to 7 cm. or more long and 1 cm. broad; rachis, winged. Pinnules, oblique to rachis, alternate to subopposite, decurrent on wing of rachis, closely set, obovate-cuneate to subrectangular, generally bifid or obtusely bidentate or emarginate at broad anterior end; the largest are occasionally trifid by emargination or division of the anterior lobe. A single, oblique vein enters each pinnule, gives off a posterior branch where pinnule connects with wing of rachis, whereas the anterior branch generally bifurcates a short distance beyond; the posterior branch of the main vein is generally single, terminating in a posterior, bluntly pointed lobe of the pinnule, or in largest pinnules divides once to enter the two segments of a bifid lobe. The anterior, once-divided branch of the main vein supplies the anterior distal lobe of the pinnule, which may have a subordinate marginal lobe at the end of the forward vein. The pinnules approaching the apex of a pinna are subrectangular, emarginate or bifid at their extremities, each segment provided with a single branch of the main vein.

Fertile pinnae, unknown.

Remarks. The species in its form of pinnules and venation is comparable to some species of *Scleropteris*, e.g. *S. zeilleri* Saporta (1891, p. 430, Pl. 288, fig. 1) from the Upper Jurassic. The pinnules, however, are not coriaceous, are lobate, and the veins are not immersed. Comparison may also be made with *Asplenium nauckhoffiianum* Heer (1880, p. 3, Pl. 1, figs. 9-12) from the lowermost Cretaceous of Pattorfiik in west Greenland. In Heer's species, however, the ultimate pinnae are short and suboblong, and the bidentate pinnules are united for a greater part of their length, so that the pinnae may be appropriately regarded as lobed pinnules.

Occurrence. Blairmore group (lower flora), Alberta, locality 4033.

Types. Holotype, G.S.C. No. 4025; paratype, G.S.C. No. 4024.

Sphenopteris brulensis n. sp.

Plate XXXI, figures 3, 4

Description. Frond, seemingly tripinnate, elongate-triangular, contracting gradually to acute apex; rachis, rather slender, somewhat flexuous, provided with microscopic elevations or apiculae. Primary (?) pinnae, alternate, triangular-lanceolate, apically acute, up to 6 cm. or more long by 3 cm. or more broad, attached at 50 to 80 degrees to parent rachis; rachis, similar to parent rachis. Ultimate pinnae, alternate, mostly about 45 degrees to parent rachis, but superior or adaxial, basal one more spreading than the others, the largest pinnae with six pairs or more of alternate, oblique pinnules; rachis, winged and microscopically apiculate in central part. Pinnules, elliptical, bluntly pointed, the largest constricted at base and with one to three pairs marginal, oblique lobes of which the basal one is the largest and more spreading; the remaining pinnules, mostly entire, decurrent, becoming progressively less constricted at base, and more confluent towards the apical end of the pinna. Midvein, oblique, flexuous, continuous to apex, with three pairs to none, strongly ascending, simple or once divided lateral branches.

Fertile organs, unknown.

Remarks. The species is named after the Brûlé coalfield from which the type specimens were collected. It resembles in some respects *Sphenopteris recurrens* Saporta (1894, p. 162, Pl. 29, fig. 15) from early Albian beds of Portugal, but the rachises are marked with small elevations, which seemingly represent the bases of minute stiff hairs, and the lateral veins of entire pinnules are mainly simple and not bifurcated.

Occurrence. Luscar formation, Alberta, localities 1233, 3058; Blairmore group (lower flora), Alberta, locality 1727.

Types. Holotype, G.S.C. No. 5349; paratype, G.S.C. No. 5350.

Sphenopteris newberryi n. sp.

Plate XXVII, figures 1, 2

Description. Penultimate pinnae, deltoid; rachis about 1 mm. wide. Ultimate pinnae, opposite or subopposite, spreading at very open angles or more obliquely from parent rachis, lanceolate; rachis, about as strong as parent rachis, distally winged. Pinnules, coriaceous, alternate to subopposite, asymmetric, variable in outline, although commonly subrectangular, those in lower part of a pinna constricted at base, those near apex little if at all constricted, and decurrent on wing of rachis, provided generally with one or more bluntly pointed, forwardly directed lobes or obtuse teeth, these being irregularly distributed, and one margin may be entire. Midvein, commonly strongly preserved for at least a part of its length, giving off an oblique branch to the lobes, although these not always seen; most commonly the midvein lies closer to the anterior, than to the posterior margin of a pinnule.

Remarks. Three at least of the specimens figured by Newberry (1895, Pl. 1, figs. 6, 7; Pl. 2, fig. 7) as *Asplenium dicksonianum* are considered by the writer to belong to *S. newberryi*, as well as his specimens figured as *Asplenium foersteri* (op. cit., Pl. 4, figs. 1-11).

Occurrence. Pasayten group, British Columbia, localities 3126, 3127.

Types. Holotype, G.S.C. No. 5837; paratype, G.S.C. No. 572.

Sphenopteris mclearni n. sp.

Plate XXIII, figure 3; Plate XXIV, figure 2; Plate XXVII, figure 3

Asplenium dicksonianum Dawson pars, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 5, Pl. 3, fig. 1 (1886).
Asplenium dicksonianum Berry, Nat. Mus., Canada, Bull. 58, p. 57 (1929).

Description. Frond, probably tripinnate. Penepenultimate pinnae, deltoid; rachis, relatively slender, with central chord and wing-like margins. Penultimate pinnae, lanceolate, alternate to opposite, up to 6 cm. or more long, 3 cm. or more wide; rachis, like parent rachis, distally winged. Ultimate pinnae, lanceolate, alternate, inserted 30 to 40 degrees to rachis or lower ones more spreading, up to 2.5 cm. or more long; rachis, winged. Pinnules, highly ascending, alternate, elongate-elliptical, contracted to relatively broad base and acute apex, decurrent, the largest with one or two pairs of forwardly directed teeth, entire towards apical end of pinna. A single vein enters each pinnule, and gives off highly ascending, simple laterals.

Remarks. Specimen G.S.C. No. 5834 (Pl. XXIV, fig. 2) is believed to be an apical part of a frond where elongate toothed pinnules take the place of ultimate pinnae such as represented in specimen G.S.C. No. 4815 (Pl. XXIII, fig. 3). The veins are particularly well shown in the former specimen and are thin. The leaf substance seems to be thin but firm, not coriaceous as in *Sphenopteris newberryi*. Seward (1927, p. 82) removed *Asplenium dicksonianum* Heer and part of Heer's *Dicksonia johnstrupi* to *Sphenopteris* (*Onychiopsis*) *psilotoides* (Stokes and Webb). The type specimen of *D. johnstrupi* bears little resemblance to *S. mclearni*. *Asplenium foersteri* Heer (1874, Pl. 27, fig. 1) is too fragmentary for identification with *S. mclearni;* its reference to *S. psilotoides* by Seward seems very doubtful. Both *Asplenium foersteri* Debey and Ettingshausen and *Asplenium brongniarti* D. and E. (1859, p. 193, Pl. 2, figs. 4-7, 11; p. 193, Pl. 2, figs. 1-3) from the Upper Cretaceous were based on too fragmentary material for proper specific diagnosis and for recognition outside of the type locality. Of the material referred by Dawson to *Asplenium dicksonianum* only that from the Blairmore group belongs to *S. mclearni.*

The species is named in honour of Dr. F. H. McLearn whose careful collections from Lower Cretaceous beds of the Blairmore group made possible the sequence of its fossil plants.

Occurrence. Blairmore group (upper flora), localities 257, 1264, 3065, 4022; Pasayten group, British Columbia, localities 3126, 3127, 3137.

Types. Holotype, G.S.C. No. 5834; paratype, G.S.C. No. 4815 (type of *A. dicksonianum* Dawson).

Sphenopteris cordai (Dunker) Schenk

Plate XXVIII, figure 1

Description. Frond, seemingly tripinnatifid; rachis, slender, smooth, with central cord. Penultimate pinnae, attached normal or at open angles to rachis, lanceolate, 5 cm. or more long by 1.5 cm. broad; rachis, smooth, canaliculate. Ultimate pinnae, pinnatifid, short, deltoid, a little less than 10 mm. long and about 3 mm. broad, alternate, attached normal or at open angles to parent rachis, the largest with seven or eight pairs of spreading, ovate, deeply cut segments or pinnules that are united by wing of rachis; largest segments with marginal obtuse crenae or lobes. Substance of pinnules thick, and veins semi-immersed, but midrib flexuous and laterals oblique and simple.

Remarks. The specimens agree so closely with those figured by Schenk (1871, Pl. 27, figs. 1, 2, 2a) that their correct identification is not in doubt.

Occurrence. Kootenay formation, Alberta, 50 feet above base at horizon of Holt coal seam, Highwood River.

Types. Hypotype, G.S.C. No. 6667.

Sphenopteris sp. A

Plate XVI, figure 2; Plate XXV, figure 2; Plate XXVI, figure 2

Description. Frond, apparently tripinnate; rachis, delicate, not much over 1 mm. broad. Penultimate (primary ?) pinnae, inserted at about 45 degrees to main rachis, alternate to subopposite, lanceolate; rachis slender, straight or slightly flexuous. Ultimate pinnae, alternate, lanceolate to deltoid, short, up to 1.5 cm. long by about 5 mm. wide, apically acute. Pinnules, about eight pairs, minute, alternate to subopposite, inserted at very open angles, sub-elliptical, narrow rounded at apex, about 3 mm. long by 1 to 1.5 mm. wide, the largest contracted at base to short footstalk and provided with one or two pair marginal, obtuse lobes, the remainder entire. Veins not preserved or obscure.

Occurrence. Blairmore group (upper flora), Alberta, locality 1581.

Types. G.S.C. Nos. 5139, 6638.

Sphenopteris sp. B

Plate XXVIII, figures 2, 4

Remarks. The material is too fragmentary for specific diagnosis. The ultimate pinnae are lanceolate, inserted alternately at acute angles. Pinnules, rectangular-elliptical, bluntly acute at apex, those in lower parts of parent pinnae constricted at base to a short footstalk, the more distal ones little constricted or not at all, and decurrent. The largest pinnules, which are 1.5 cm. or more long by 5 mm. wide, are asymmetrically and obliquely lobed in their basal half, crenulately lobed nearer the apex, the lobes being obtuse or bluntly pointed. Near the apex of a pinna the pinnules are more crowded and have entire margins. Midvein is strong, and gives off a branch to each lobe, which in turn gives off several pairs of strongly ascending, once divided or simple laterals.

The species resembles most closely some forms that have been assigned either to *Aneimia* or *Asplenium*, e.g. *Aneimia stricta* Newberry (1895, p. 38, Pl. 3, figs. 1, 2).

Occurrence. Kingsvale group, British Columbia, locality 3020; Blairmore group (upper flora), Alberta, locality 4023.

Types. G.S.C. Nos. 5839, 5840.

Taeniopteris canmorensis (Dawson) n. comb.

Plate XXXIII, figure 1

Angiopteridium canmorense Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 83, fig. 2 (1893).

Remarks. The pinnae are opposite, about 9 mm. wide by more than 4 cm. long. The apical ends are all missing, the base cuneate to obtusely rounded, and petiole only about 1 mm. long. Leaf substance is coriaceous, the midrib stout, but the veins are immersed and obscure. Where seen, veins are about normal to the midrib both at point of origin and at margin and are about $\frac{1}{3}$ mm. apart. They cannot be followed far enough to learn whether they are simple or forked.

Occurrence. Kootenay formation, Alberta, locality 3235.

Types. Holotype, G.S.C. No. 4839.

Phyllites asplenioides ? Berry

Plate XXXII, figure 4

Remarks. Original description of *Phyllites asplenioides* was as follows: "Fronds large in size, lax in habit but apparently of a thinly coriaceous texture. Apparently entire or with only a shallowly lobate margin. Reniform or broadly obovate in outline. Minimum length and width, over 15 centimetres. Midrib consisting of a wide, flat mass of veins formed by the approximation and subparallel proximal course of all the veins of the frond. These veins are numerous, diverge at acute angles and fork dichotomously two or three times, most of the dichotomies being near the point of their divergence. Henceforth they are mostly subparallel, here and there coalescing to form a much-elongated netted venation" (Berry, 1919, p. 140).

Berry considered that the species was an asplenioid fern, and that the frond commonly appeared as flabellate segments owing to splitting. The Canadian material consists of only a fragment which shows obscurely a small fragment of an axis and parts of three segments which occur on different levels in the rock, and which overlap; splitting of a frond prior to burial could explain such a disposition. The veins are 0.75 to 1 mm. apart, and hence closer than in Berry's species, but this is perhaps of doubtful specific importance; they bifurcate rarely and anastomose sparingly.

Occurrence. Kingsvale group, British Columbia, locality 3125.

Types. Hypotype (?), G.S.C. No. 5910.

Equisetites lyelli (Mantell) Unger

Plate XXVIII, figures 5-8; Plate LVIII, figures 2, 3

Equisetum lyelli Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 83, text-fig. 1. (1893).

Description. Aerial shoots, articulated, up to 2 cm. broad. Internodes, short, 1 to 2 cm. long, generally smooth or only microscopically striated; when partly decorticated, lightly ribbed. Leaves, in form of narrow sheaths with free, appressed acicular, acuminate teeth, about $\frac{1}{4}$ mm. wide at base and tapering to delicate, sharp apices, generally 1 to 1.3 mm. apart and 5 mm. or more long. Nodal diaphragms, commonly displaced, about two-fifths as wide as accompanying stems, commonly with sixteen to twenty-five radial rays and a narrow, central, depressed area.

Tuber-bearing rhizomes, apparently belonging to the species, are seemingly conspecific with those identified by authors as *Equisites burchardti.* They are slender stems, 2 to 5 mm. wide, with strongly ribbed internodes, 5 to 15 mm. long; attached at the nodes are whorls (two to four per whorl) of short tuber-bearing branches. Tubers, oval or ovate or globose, up to 1 cm. long, their surfaces generally wrinkled.

Remarks. The type specimen of *E. burchardti* Dunker consists of aerial shoots bearing leaves having lanceolate rather than acuminate teeth, and which slightly spread away from the stem axis. Yet the tuber-bearing rhizomes here united with *E. lyelli* have no diagnostic characters that would distinguish them from those assigned by Schenk to *E. burchardti* (Schenk, 1871, Pl. 22, fig. 1). The question accordingly arises whether the rhizomes called *E. burchardti* actually were attached to aerial stems of *E. burchardti* or to those of *E. lyelli*, whether the rhizomes of both species cannot be differentiated satisfactorily, or finally whether both these species are represented in Canadian material. In this connection it is interesting to note that Seward (1894, Pl. 1, fig. 6) figured a rhizome which he assigned to *E. burchardti* showing part of a tuber and leaves that are much more like those of *E. lyelli* than of *E. burchardti*.

Although the teeth of *Equisetum virginicum* Fontaine (1889, Pl. 2, figs. 1-3, 6, 7, 9) are more bluntly pointed than those normal to *E. lyelli*, they too are relatively long and appressed to the stem. They are associated with normal *E. lyelli* in Potomac deposits, and with rare tuber-bearing rhizomes (op. cit., Pl. 170, fig. 8) like those in the Canadian deposits.

Occurrence. (a) Aerial stems; Kootenay formation, Alberta, localities 1574, 2378, 3147; Kootenay formation, British Columbia, locality 3763; Hazelton group, British Columbia, locality 2406.

(b) Tuber-bearing rhizomes: Kootenay formation, Alberta, localities 322, 3710; Kootenay formation, British Columbia, locality 276; Nikanassin formation, Alberta, localities 1808, 3161; Nikanassin (?) formation, Alberta, locality 3333; Hazelton group, British Columbia, localities 390, 391, 392, 2325, 2406; Blairmore group (lower flora), Alberta, locality 3063; Blairmore group (upper flora), Alberta, locality 257; Luscar formation, Alberta, localities 1627, 2052, 2151, 2168; ? Kingsvale group, British Columbia, locality 3125.

Types. Aerial stems—hypotypes, G.S.C. Nos. 4838 (Dawson's type), 5748, 5749; tuber-bearing rhizomes, G.S.C. Nos. 5751, 5800, 5801.

Selaginellites sp.

Plate XXXI, figure 5

Description. Slender, linear strobili, 3.5 to 4 mm. wide; length, unknown, but over 2 cm.; axis, about 1 mm. wide. Sporophylls, sickle-shaped, bending downward about 1 mm. from axis, then rapidly ascending nearly parallel to axis so as almost to touch the sporophyll above. Sporangia, stalked, suboval, 1 to 2 mm. long, inserted on upper surface of each sporophyll near cone axis or in angle between axis and sporophyll; details of contents unknown, but several sporangia in lower part of one specimen show obscure elevations, about 0.5 mm. long, suggesting a small number of megaspores.

Occurrence. Luscar formation, Alberta, locality 324.

Types. G.S.C. specimen No. 5746.

Selaginellites ? sp.

Plate LXXVI, figure 3

Sphenolepidium pachyphyllum ? Dawson (non Fontaine), Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 89, text-fig. 12 (1893).

Remarks. The single specimen on which Dawson based his identification is now broken down into smaller fragments. The preservation is altogether too poor for specific recognition, and Dawson's figure is misleading in showing the leaves connate at base. The leaves are ovate, sessile and free at the base, and may be opposite, although this could not be confirmed. They are not more than 2 mm. long by 1 mm. broad, and are thus considerably smaller than those of *Sphenolepidium pachyphyllum* Fontaine. Moreover, they appear to be membranous, and only rarely show a faint midrib. The larger axes, about 2 mm. broad, are preserved naked of leaves, and the lateral leafy branches go off from it at very open angles. One of these sends off two shoots only 2 mm. apart, which are seemingly barren of leaves and which might be rhizophores; distally this same branch dichotomises at a wide angle. This type of branching suggests a scrambling habit, not incompatible with some species of living *Selaginella*.

Occurrence. Kootenay formation, Alberta, locality 1574.

Types. G.S.C. No. 4856.

Isoetites horridus (Dawson) Brown

Plate L, figures 1, 3

Carpolithes horridus Dawson, Roy. Soc. Canada, Trans. 1882-83, vol. 1, sec. 4, p. 21, Pl. 1, figs. 3, 3a (1883).

Original description. "Fruit globose, 3 centimetres in diameter. Surface polished and shining, with dense thin outer coat, marked by pores or dots, from which are given off in a radiating manner numerous flat linear processes 4 to 5 centimetres in length, and 3 millimetres wide, and minutely dentate at their edges. I can only conjecture that this remarkable object is a compound fruit perhaps of some cycadeous plant, covered with bracts or rudimentary leaves".

Remarks. The type specimens came from the Dunvegan formation (Cenomanian), and only a fragment of one of the 'rays' was noted in a collection from an upper part of the Blairmore group.

In the type specimen a circlet of crowded, flattened rays radiates from a central boss 3 cm. diameter, which has a depressed rim about 4 mm. wide. Some coalized tissue remains in this central area, that on the rim roughened by crowded, irregular, rhombic depressions, in contrast to the almost smooth, shining surface of that still preserved on the central protuberance. The roughened surface of the rim is evidently the "coat, marked by pores or dots" mentioned in Dawson's description. The rays are poorly preserved as imprints, and no details are preserved for a few millimetres surrounding the central area; beyond, the rays are characterized by two longitudinal rows, one row on each side of a central groove, of transverse, rectangular elevations that occupy most of the distance to the margins, which are seemingly entire. These elevations, those in one row alternating or opposite those in the other, are evidently what Dawson interpreted as dentations on the margins. The ends of the rays, some of which may be traced 6 cm. from the central organ, are not preserved. Throughout most of their length many are marked by the double row of elevations; others, however, show only several well marked longitudinal elevated striae. Notwithstanding a resemblance to the 'synangia'-bearing leaves of *Williamsonia* cf. *setosa* Nathorst as figured by A. C. Seward (1917, p. 44, fig. 557B), the similarity of *Carpolithes horridus* to specimens of *Isoetites* described and illustrated by R. W. Brown is so close as to win acceptance of Brown's allocation of Dawson's species to the Isoetales (Brown, R. W., 1939b, p. 264). The preservation of the type of *Isoetites horridus*, however, is not sufficiently good to be certain that *Isoetites horridus* Brown from the Paleocene is actually conspecific.

Occurrence. Blairmore group (upper flora), Alberta, locality 4112.

Types. Hypotype, G.S.C. No. 4824.

Caytonia canadensis (Berry) n. comb.

Plate XXX, figure 2; Plate XXXII, figure 1

Stenorachis canadensis Berry, Nat. Mus., Canada, Bull. 58, p. 45, Pl. 7, figs. 8-11 (1929).

Original description. "They show a stout axis from 1.5 to 2.5 mm. in diameter, generally somewhat curved and preserved for maximum lengths of 6 cm. At intervals of about 1 to 1.5 cms. these axes give off branches alternately. These branches are slender, about 1 mm. in diameter, much curved, and about 1 cm. in length. They appear to be invariably simple and not forked. At their tips they expand into pendant oval bodies of considerable consistency, which bodies are from 1 to 1.5 cm. in maximum and 8 to 11 mms. in minimum diameter. They have a fluted appearance, not that of a seed, and are suggestive of from 4 to 8 large sporangia" (op. cit., p. 45).

Remarks. The species resembles closely the genotype *Caytonia sewardi* Thomas (1925, pp. 315-326, Pl. 12, figs. 14-16, 17), but the pedicels of the fruits are longer, and the fruits themselves are oval and of larger size, being 8-9 mm. wide and 10-12 mm. long. The pedicels in specimens to hand are about 5 mm. long and 1 mm. wide, and the central axes of the infructescence are 2 to 2.5 mm. diameter. The position of the stigma is not known. The collection of plants from the particular locality from which the fruits were found did not furnish any specimens of *Sagenopteris.*

Occurrence. Blairmore group (lower flora), Alberta, locality 4033.

Types. Syntypes, G.S.C. Nos. 4992, 4993 (Berry, 1929, Pl. 7, figs. 8, 11).

Sagenopteris williamsii (Newberry) n. comb.

Plate XXXI, figure 2; Plate XXXIII, figure 4; Plate XXXIV, figures 1-3; Plate XXXVI, figure 1

Description. Leaflets, up to four or more, palmately arranged, long-petiolate, ovate to obovate, symmetrical or asymmetrical. Blades of leaflets up to 10 cm. long and 10 cm. wide, the base broadly rounded, or truncate or rarely cordate, or rounded cuneate; apex, generally broadly rounded to more elongate-obtuse; margin, entire, smoothly curved to undulating. Petiole, up to 4 mm. broad and 3.5 cm. or more long. Midvein, broad in basal quarter or half of leaf, dividing well above middle. Lateral veins, well defined, strongly ascending, divided by successive dichotomies, and anastomosing moderately to sparingly; mean maximum distance between nerves in central parts of a leaflet, about 1 mm. but variable from 0.75 to 1.5 mm.

Remarks. The species was originally described as *Chiropteris williamsii* by Newberry (1891, p. 198, Pl. 14, figs. 10, 11). In G.S.C. No. 5337 (Pl. XXXIV, fig. 2) the petiole of a leaflet may be followed downwards to junction with at least two and apparently three other leaflets at top of a stout axis. Two Jurassic species, *S. grandifolia* Fontaine (in Ward, 1905, Pl. 15, figs. 4, 5) and *S. alaskense* Fontaine (1905, op. cit., Pl. 38, fig. 21) resemble *S. williamsii.* The former is based on a single specimen insufficient for specific diagnosis and *S. alaskense* has a more triangular summit and seemingly denser venation. It is not known whether either of these Jurassic species is petiolate.

Occurrence. Blairmore group (lower flora), Alberta, localities 1255, 1257, 2198, 3064; Luscar formation, Alberta, localities 1203, 1233, 1560, 1626, 1689, 2053, 2058, 2138, 2153, 2234, 2235, 2277, 3154, 3168, 3180, 3181, 3339, 3530, 3532, 3750; Bullhead group, British Columbia, localities 1997, 3208; Hazelton group, British Columbia, locality 2415.

Types. Hypotypes, G.S.C. Nos. 5337, 5339, 5342, 5344, 5348, 6583.

Sagenopteris mclearni Berry

Plate XXIX, figures 3-5; Plate XXXII, figure 3

Sagenopteris mclearni Berry, Nat. Mus., Canada, Bull. 58, p. 36, Pl. 4, fig. 3; Pl. 5, figs. 8, 9 (1929).

Original description. "Peduncle stout, terminated by five reticulate veined, digitately arranged leaflets. Leaflets lanceolate or obovate in outline, sessile, from 6 to 9 cm. in length and from 1.5 to 3 cms. in maximum width. Divided into numerous, rounded, pinnately arranged divisions, separated by acute sinuses. Texture sub-coriaceous. Venation prominent. A conspicuous double midrib persists three-fourths of the distance or all the way to the tip, becoming thin distad. The tip may be broadly rounded or narrowly extended. The laterals diverge from the midrib at acute angles, curving outward, abundantly anastomosing and terminating in the entire margins. The base is narrowly cuneate, the lobing being most pronounced medianly and diminishing toward both the base and the tip."

Remarks. Berry added to the above description that the species is distinguished from all others by its invariably pinnatifid character. But *Sagenopteris undulata* Nathorst (1878, p. 11, Pl. 2, fig. 3) from the Rhaetic of Sweden has both entire and marginally lobed pinnules, and T. M. Harris (1932, p. 11) described another Rhaetic species, *S. serrata*, which possesses irregularly crenate, foliar margins. Additional material of *Sagenopteris mclearni* shows a commingling of entire and lobed leaflets, with many intergradations. Variation also occurs in the number of leaflets, varying in material to hand from four to nine. A leaflet rapidly contracts at the base almost to the midrib at its point of attachment, although none has shown as yet a distinct petiole. The breadth varies up to 2.5 cm. and is most commonly about 1 cm. The extent of anastomosing of the veins is quite variable, from sparingly to fairly plentiful; it is never sufficiently pronounced to mask the course of the main veins, which divide several times. In specimen G.S.C. No. 5004, which is one of Berry's syntypes (op. cit. above, Pl. 4, fig. 3), connections between the veins are much fewer than figured by Berry. The cells of the vein network may vary at least from five to twelve times as long as broad. A marked character of the species is the strong midrib, $\frac{3}{4}$ to 1 mm. wide, in the lower half of a leaflet; it is obscurely costated longitudinally, and thins rapidly only in the apical third of its length; in certain states of preservation there may be a false appearance of a double rib.

The species differs from the Rhaetic species *Sagenopteris serrata* Harris in its smaller and commonly deeply lobate leaflets, which are not clearly petiolate, in its more robust character, and in the more ascending and more closely spaced veins.

Occurrence. Blairmore group (lower flora), Alberta, localities 1256, 1257, 1727, 3067, 4025, 4027, 4036; Luscar formation, Alberta, localities 347, 1233, 1626, 1689, 2053, 3181, 3296, 3723.

Types. Syntypes, G.S.C. Nos. 5004 (Berry, 1929, Pl. 4, fig. 3), 4995 (Berry, 1929, Pl. 5, fig. 9); hypotypes, G.S.C. Nos. 5333, 5334, 5335, 5336.

Sagenopteris elliptica Fontaine

Plate XXXIII, figure 6; Plate XXXVI, figure 5

Salix perplexa ? Penhallow (non Knowlton), Roy. Soc. Canada, Trans. 1907, (new series) vol. 1, sec. 4, p. 309 (1907); Geol. Surv., Canada, Mem. 38, pt. 2, Appendix B, p. 819 (1912).

Sagenopteris elliptica Berry, Nat. Mus., Canada, Bull. 58, p. 35, Pl. 4, figs. 4, 5 (1929).

? *Sagenopteris mantelli* Berry, Nat. Mus., Canada, Bull. 58, p. 37, Pl. 5, fig. 7 (1929).

Remarks. Most of the specimens included here are poorly preserved. The greatest breadth of the leaflets is most commonly above the middle, agreeing in this character with *S. oregonensis* Fontaine (in Ward, 1905, p. 235, Pl. 65, figs. 36-38). *S. oregonensis* is otherwise differentiated from *S. elliptica* by the fact that its midrib disappears about midlength of the leaflet, but that this is of specific importance is doubtful; in the specimens here referred to *S. elliptica* the midvein may be traced readily throughout three-fourths or more the length of a leaflet.

The status of *S. mantelli* Berry is doubtful. A specimen with two leaflets from Western Canada, assigned to Dunker's species by Berry (op. cit. above), may belong either to *S. elliptica* or to *S. williamsonii* (Newberry) depending on whether or not they were sessile or petiolate. When more is known of variation in leaf form of both these species the specific importance of the occurrence of a petiole may be evaluated.

The smallest leaflets of forms included here in S. *elliptica* are scarcely distinguishable, if at all, from entire leaflets of S. *mclearni* Berry.

Occurrence. Blairmore group (lower flora), Alberta, localities 2157, 2198, 3064, 4025, 4027, 4028, 4030; Luscar formation, Alberta, locality

1233; Pasayten group, British Columbia, locality 3320; Kingsvale group, British Columbia, locality 3125.

Types. Hypotypes, G.S.C. Nos. 5002 and 5345 (hypotypes designated by Berry), 500 (*S. mantelli* Berry), 5347, 5872.

Hydropterangium canadense (Berry) n. comb.

Plate XXXI, figure 1

Sagenopteris canadensis Berry, Bot. Gazette, vol. 74, pp. 329-331, fig. 1 (1922); Nat. Mus., Canada, Bull. 58, p. 35 (1929).

Original description. "Sporocarp hard and resistant; stalked; bean shaped; gibbose; slightly flattened at the sides; more recurved and slightly more narrowly rounded at one end; about 5 mm. in length and about 3 mm. in height; with 15 or 16 transverse encircling veins, which are impressed, and appear as sulcae in the material, retaining more carbonaceous matter because thicker, and appearing blacker than the balance of the sporocarp wall; bands between these impressed veins lighter in colour, and with a thin central line more or less developed" (Berry, 1922, p. 330; 1929, p. 35).

Remarks. Only one of the syntypes figured by Berry is now in G.S.C. collections. It is a cast of an internal wall of the capsule, which is partly coated by a carbonaceous layer, representing apparently tissue of the inner wall; this layer has been stripped off from most, but not all, the elevated areas, and the fact that it is preserved in the sulci between the ribs has no significance in relation to any differences in wall thickness. No traces of veins were found in the specimen. While one or two of the ribs were marked in part of their course by an obscure depressed line, the majority appear smooth. The dorsal or basal part of the capsule has a depressed, smooth area, about 1 mm. high, from which the transverse ribs radiate, and this area was evidently the seat of attachment of the capsule, although evidence of a pedicel is obscure.

Hydropterangium has been redefined by Lundblad (1950, p. 71) as a form-genus. In part at least the Rhaetic material from Sweden was considered to be probably a Mesozoic pteridosperm. Whether the genus is a male fructification has not been proven.

Occurrence. Blairmore group (lower flora), Alberta, locality 4025.

Types. Syntype, G.S.C. No. 5003.

Baiera cf. *furcata* (Lindley and Hutton) Braun

Plate XXXIII, figure 3; Plate XXXVII, figure 1

Description. Leaf, long-petiolate; petiole, 1 to 1.5 mm. broad, slightly expanded at proximal end. Blade, in outline forming about one-third of a circle, up to 7 cm. long from first fork to tip of segments, divided deeply into long, narrow, linear segments by four or five successive dichotomies at acute angles. Segments, slender, about 1 mm. wide in basal region, tapering gradually to acute apex. Veins, obscure, seemingly three or four to one or two in ultimate segments.

Remarks. *Czekanowskia nervosa* Fontaine (non Heer) (in Ward, 1899, p. 685, Pl. 169, figs. 1, 2) from the Lower Cretaceous of the Black Hills, is apparently conspecific with this species, as suggested previously by Seward (1919, p. 67).

Occurrence. Nikanassin (?) formation, Alberta, locality 1192; Kootenay formation, Alberta, localities 3710, 4410; Hazelton group, British Columbia, locality 2392.

Types. G.S.C. Nos. 5328, 5329.

Baiera cf. *gracilis* (Bean) Bunbury

Plate XXXVIII, figures 4, 7

Description. Leaf, long-petiolate; petiole, about 2 mm. broad; lamina, sub-hemispherical in outline, deeply dissected fanwise by three or four successive dichotomies into linear-lanceolate segments, up to 5 cm. and more long from first bifurcation to apex of segments. Segments, about 2 to 3 mm. broad, commonly broadest below third dichotomy where they may be 4 to 5 mm., seemingly with sub-acute apices. Veins, moderately distinct, parallel, about four in broadest parts of ultimate segments.

Remarks. In form and mode of division the leaf resembles specimens of *B. gracilis* from the Jurassic of Yorkshire figured by Seward (1900a, Pl. 9, figs. 3, 5); its unknown cuticular characters, however, preclude further comparison.

Occurrence. Hazelton group, British Columbia, locality 3027; Kootenay formation, Alberta, locality 1630; Bullhead group, British Columbia, locality 1997.

Types. G.S.C. Nos. 5325, 5331.

Ginkgo pluripartita (Schimper) Heer

Plate XXXVI, figures 2, 3; Plate XXXVII, figures 2, 3; Plate XXXVIII, figure 1

Ginkgo arctica Berry (non Heer) pars, Nat. Mus., Canada, Bull. 58, p. 48 (1929).

Description. Leaf, petiolate; petiole, up to 2.5 cm. or more long by 1.5 mm. wide, obscurely striated longitudinally; blade, up to 3.5 cm. long by 6 cm. broad, more or less hemispherical, the base generally truncate, but narrowly cuneate on petiole, divided more or less deeply from summit to lower half of blade or beyond into four primary segments, one or more of which may be divided again into two to four secondary segments. Ultimate segments, all obtusely rounded to rounded-truncate. Veins, strong, subparallel in mid-region, the outermost in broader segments slightly convergent, fifteen to twenty per centimetre, dichotomising generally once within segmented area, although an arm resulting from this dichotomy may divide again.

Remarks. Ginkgo pluripartita is diagnosed by its cuticular as well as its morphological characters. But the morphological resemblance of the Canadian material to the original types is so strong that little doubt exists as to the identification. Heer pointed out the resemblance between *G. pluripartita* and *Ginkgo arctica* stating, however, that the former is differentiated by possession of stouter veins and more broadly rounded segments; such characters are variable, and rarely of specific importance.

Ginkgo sibirica Knowlton (1908, Pl. 13, figs. 1-4; Pl. 14, figs. 1, 2) from Great Falls, Montana, is apparently conspecific with the species here under consideration.

Occurrence. Kootenay formation, Alberta, localities 4042, 4046, 4051; Nikanassin formation, Alberta, locality 346; Blairmore group (lower flora), Alberta, localities 1265, 1727, 2198, 3064, 3174; Luscar formation, Alberta, localities 324, 1233, 1560, 1626, 1689, 2053, 2056, 2493, 3058, 3153, 3193, 3194, 3748; Bullhead group, British Columbia, locality 4016; Hazelton group, British Columbia, localities 2136, 2389, 2394, 2416, 2419, 3008.

Types. Hypotypes, G.S.C. Nos. 575, 5317, 5318, 6587, 6588.

Ginkgo nana Dawson

Plate XXXIII, figure 2; Plate XXXVII, figure 4;
Plate XXXVIII, figures 2, 8; Plate LXXII, figure 3 (in part)

Salisburia (Ginkgo) sibirica Dawson (non Heer), Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 8, Pl. 2, fig. 1 (1886).
? *Salisburia (Ginkgo) lepida* Dawson (non Heer), ibid., p. 8, Pl. 2, fig. 2 (1886).
Salisburia (Ginkgo) nana Dawson, ibid., p. 8, Pl. 2, fig. 3 (1886).
? *Baiera longifolia* Dawson (non Heer), ibid., p. 9, Pl. 2, fig. 5 (1886).
Ginkgo arctica Berry pars, Nat. Mus., Canada, Bull. 58, p. 49, Pl. 7, fig. 6 (1929).

Description. Leaf, petiolate; petiole, about 2 cm. long by 1 to 1.5 mm. wide; blade, up to 3 cm. long from first dichotomy, hemispherical to subtriangular in outline, dissected fanwise to or near base into four primary lobes which may remain simple or divide by secondary dichotomy once or more rarely twice, the ultimate divisions having obtuse terminations. Veins, fairly prominent, three to eight in ultimate segments, converging at apex.

Remarks. The type specimen is a mere fragment of an abnormal leaf. It has four and five veins to a segment; and may be compared to specimen No. 6586 (a) in Pl. XXXVIII, fig. 8 of this report. Exclusive of cuticular characters, which have not been determined, the species is very like *Ginkgoites* cf. *australis* Halle (1913, Pl. 5, figs. 1 to 4) from Lower Cretaceous beds of Patagonia. It resembles, too, *Baiera brauniana* (Dunker) Brongniart from the German Wealden. Until cuticular structure is available, it is considered advisable to retain Dawson's species. In form and venation all three of these species are much like *Ginkgoites sibirica* (Heer) Seward (Heer, 1876b, Pl. 7, fig. 6; Pl. 9, fig. 5f; Pl. 11), although they are of smaller size than normal with that species.

Salisburia lepida Dawson (non Heer) and *Baiera longifolia* Dawson (non Heer), cited in above synonomy, seemingly belong to a single species, which is doubtfully *G. nana.* The apices of their segments are not preserved, although they were seemingly more acute than those of *G. nana;* the veins are obscure, and, although seemingly about eight to a segment, are separated by longitudinally striated spaces, a condition not observed in undoubted specimens of *G. nana.*

Occurrence. Kootenay formation, British Columbia, localities 274, 276, 3753, 3754; Kootenay formation, Alberta, localities 3158, 3221, 4042; Hazelton group, British Columbia, localities 387, 389, 390, 391, 394, 395, 396, 1800, 2389, 2392, 2405, 2417; Nikanassin formation, Alberta, localities 346, 3333; Blairmore group (lower flora), Alberta, locality 3063.

Types. Holotype, G.S.C. No. 4826; hypotypes, G.S.C. Nos. 4818 (*Salisburia sibirica* Dawson), ? 4825 (*Salisburia lepida* Dawson), 5321, 5323, 6586 (A, B, C).

Ginkgo cf. *lepida* Heer

Plate XXXVII, figure 5

Description. Flabelliform, petiolate leaves, with blade deeply dissected by two to four dichotomies into elongate segments that taper distally to rounded or obtusely pointed apices; ultimate segments commonly 4 to 6 mm. broad. Veins, subparallel, forking a few times, about 0.5 mm. apart near summit of leaf. Length of blade from first dichotomy is up to 7 cm.

Remarks. Specimen G.S.C. No. 5327 (Pl. XXXVII, fig. 5) is the blade of a large leaf having the typical form of *G. lepida* Heer (1876b, Pl. 7, fig. 7; Pl. 12). The outline of blade forms the third of a circle; it is deeply dissected by four successive dichotomies, of which the second and third lie not more than a centimetre from the first, and the fourth from 2 to 4 cm.; the total length of the blade from the first dichotomy is about 7 cm. The veins, although coarse where seen, are poorly preserved; seemingly about eight occur in an ultimate segment.

Occurrence. Kootenay formation, Alberta, localities 3807, 3808; Kootenay formation, British Columbia, locality 2309, 3847; Bullhead group, British Columbia, localities 3520, 3522.

Types. G.S.C. No. 5327.

Carpites (*Ginkgo* ?) sp. Dawson

Plate XXXVIII, figure 6

Carpolites sp. Dawson pars, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 90, text-fig. 15 (except specimen lower left) (1893).

Remarks. Seeds suborbicular to obovate with sclerotesta 9 to 12 mm. long by 7 or 8 mm. wide. Sclerotesta, smooth, somewhat flattened laterally and at rounded apical end, or apparent flattening due to plane of deshisence, bluntly pointed at chalazal end. Surface of inside kernel or nucellus, minutely roughened by anastomosing longitudinal ridges. The specimens closely resemble *Carpolithes* (*Ginkgo* ?) *fultoni* Bell (1949, p. 44, Pl. 12, figs. 4, 7; Pl. 13, figs. 1, 2) from beds of late Cretaceous age.

Occurrence. Kootenay formation, Alberta, locality 3235.

Types. G.S.C. No. 4859b (Dawson's types in part).

Stenorachis striolatus (Heer, pars) Nathorst

Plate XXXVII, figure 6

Description. Spike-like inflorescence, more than 7 cm. long and 1.5 to 2 cm. broad, consisting of a rachis and short lateral branches that divide into two divergent arms at their extremities, each arm bearing a seed-like body. Rachis, irregularly striated, about 2 mm. broad. Lateral branches, subopposite to alternate, at right or very open angles to parent axis, commonly about 5 mm. apart on each side, 0.5 to 1 mm. broad, and 0.5 to 1 cm. long to terminal fork. Arms commonly not much more than 1 mm. long, each bearing on side away from the fork an ovate, seed-like, coriaceous or woody organ, 4.5 to 5.5 mm. long by 3 to 3.5 mm. broad. The imprint of the inner side of wall or lamina of this organ is irregularly striated.

Remarks. Except for its somewhat smaller size the Canadian specimens, of which there are two, and Heer's original *Carpolithus striolatus* (Heer, 1876a, p. 47, Pl. 9, fig. 17) are indistinguishable in any important gross characters from *Zamiostrobus scanicus* Nathorst (=*Stenorachis scanicus*) (Nathorst, 1875, p. 31, Pl. 13, figs. 1, 2; 1902, pp. 16-17, Pl. 1, figs. 16, 17). The material to hand is not sufficiently well preserved to solve the problem of whether the seed-like organs are seeds or microsporophylls. The occurrence of the species in Lower Cretaceous beds is of interest in view of the great stratigraphic range of *Podozamites lanceolatus*, and of Nathorst's suggestion that *Stenorachis* may be male fruiting organs of *Podozamites* (Nathorst, 1902, p. 17).

Occurrence. Bullhead group or Blairmore (?) group, Alberta, locality 4309.

Types. Hypotype, G.S.C. No. 6598.

Stenorachis sp.

Plate XXXVIII, figure 3

Description. A minute, elongated inflorescence, comprising an axis, 1 mm. broad, from which are given off at right angles short branches, 1 mm. or more long, each of which bears on its distal end two obliquely spreading sessile, ovate appendages (sporophylls ?), each about 1.75 mm. long by 1 mm. broad. Surface of appendages marked by microscopic longitudinal lines.

Remarks. The species resembles the relatively much larger *Stenorachis striolatus*, except that the terminal appendages are sessile and obliquely standing.

Occurrence. Luscar formation, Alberta, locality 324.

Types. G.S.C. specimen No. 6625.

Stenorachis ? sp.

Plate LXXXV, figures 2, 3, 4

Remarks. The material consists only of 3 isolated fragments, each consisting of a forked, coriaceous sporophyll or seed-like body at the terminal end of a short pedicle or shoot. They resemble somewhat the lateral organs of the main axes of *Stenorachis scanicus*, but the terminal bodies, which are elliptical and 5 to 7 mm. long, are obliquely upright and connate at the base. In both these characters they bear some resemblance to *Stenorachis solmsi* Nathorst (1902, p. 17, Pl. 1, figs. 18-21), but are not elongate and curved. Because they are detached from a main axis, their assignment to *Stenorachis* is doubtful.

Occurrence. Nikanassin formation, Alberta, locality 346.

Types. G.S.C. Nos. 576, 578, 6599.

Czekanowskia cf. *rigida* Heer

Plate XXXVIII, figure 5; Plate XXXIX, figures 2, 4; Plate XLIII, figure 1

Pinus susquaensis Dawson pars, Geol. Surv., Canada, Rept. Prog. 1885, vol. 1, pp. 133B, 162B (1886).

? *Leptostrobus longifolius* Dawson (non Fontaine), Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 88, fig. 8 (1893).

Czekanowskia sp. Berry, Nat. Mus., Canada, Bull. 58, p. 47, Pl. 8, figs. 1-3 (1929).

Description. Fascicles of occasionally dichotomosing, filiform leaves, generally about 1 mm. broad, of unknown length, but up to 11 cm. or more, attached to short basal shoots provided with scale-leaves, which seem to be subcircular and up to 2 mm. broad; apparently about ten leaves in a fascicle. Veins, obscure, seemingly two or four.

Remarks. The leaves vary from 0.75 to 2 mm. broad, although 1 mm. is about the usual width. Dichotomy is at variable and rather distant intervals, more common distally where some leaves may divide twice or even three times. True veins are difficult to distinguish from a longitudinal striation. A longitudinal central ridge may or may not occur, and is apparently due to compression of a rigid, thick, pine-like leaf. The leaves contract rather abruptly to an acute tip. Specimen G.S.C. No. 5308 (Pl. XLIII, fig. 1) shows a number of leafy shoots apparently attached almost at right angles or slightly pendant to a stout axis, which is about 4 cm. broad. The details are obscure, for no traces of carbonaceous matter remain. A second specimen, G.S.C. No. 6590 (Pl. XXXIX, fig. 2), shows two leafy shoots apparently attached in like manner to a slender shoot.

Pinus susquaensis Dawson (1883, p. 23, Pl. 3, fig. 36) was founded on an Upper Cretaceous specimen of doubtful taxonomic position, and there is nothing to indicate any close relationship to the present species from the Kootenay and equivalent formations.

Dawson's *Leptostrobus longifolius* probably belongs to the species under consideration. None of the leaves, however, shows its base, and some doubt must consequently remain as to their attribution to *Czekanowskia* rather than to *Baiera*. The leaves are about 1 mm. broad, some of them forked more than once, with long intervals without division; they seem to have been more than 10 cm. long.

Occurrence. Kootenay formation, British Columbia, localities 276, 1222, 1579, 1819, 2093, 2309, 3754, (?) 3757, 3758, 3760; Kootenay formation, Alberta, localities 864, 1574, 1630, 3157, 3221, 3710, 4045, 4046, 4047, 4050, 4051, 4410; Nikanassin formation, Alberta, 346, 2139, 3161; Hazelton group, British Columbia, localities 387, 388, 390, 391, 392, 393, 396, 1801, 2401, 2416, 3008.

Types. G.S.C. Nos. 1045, 5306, 5308, 6590.

Phoenicopsis angustifolia Heer forma *media* Krasser

Plate XXXIX, figure 1; Plate XL, figures 1, 3, 5

Description. Fascicles of five or six narrow, ribbon-like leaves, each 3 to 8 mm. broad by 9 cm. or more long, obtuse at apex, tapering to about $\frac{1}{2}$ mm. wide at base to locus of attachment to a short shoot that is provided with scale-like leaves. Veins, subparallel, bifurcating rarely, six to twelve near summit of a leaf. No traces of vein-like striae occur between veins, but surface marked by a microscopic longitudinal lineation.

Remarks. F. Krasser (1901, p. 139) created the species *P. media* for leaves 6 to 8 mm. broad and bearing up to eleven veins. Other authors, e.g. Nathorst (1906, p. 6), taking into consideration normal variation in breadth of leaves and number of veins, united such forms as *P. media* to *P. angustifolia* Heer. This procedure is more reasonable in view of the variation shown in Canadian material by specimens derived from a single bed.

Occurrence. Bullhead group or Blairmore group, Alberta, localities 4309, 4310; Bullhead group, British Columbia, localities 3208, 3521.

Types. Hypotypes, G.S.C. Nos. 5309, 5310, 6589.

Phoenicopsis arctica (Heer)

Plate XXXIX, figure 3

Description. Linear, grass-like leaves, deciduous, or attached in clusters of at least 6 to a short shoot. Leaves, 1.5 to 4.5 mm. wide, the lower surface marked by a central groove and with five to seven delicate veins.

Remarks. G.S.C. No. 5294 is precisely like *Cyparacites arcticus* Heer (1874, p. 86, Pl. 12, fig. 4b), having a central rounded groove (represented by a keel on imprints) on each side of which are three delicate raised veins, parallel with the margins of the leaf. A single specimen with smaller leaves of the same character shows the leaves convergent, as if attached to a short shoot; the shoot itself, however, is not preserved.

The main difference from other described leaves of *Phoenicopsis* lies in the presence of a median groove.

Occurrence. Blairmore group (lower flora), Alberta, locality 4033; Luscar formation, Alberta, locality 1611; Hazelton group, British Columbia, locality 3300.

Types. Hypotype, G.S.C. No. 5294.

Ptilophyllum (*Anomozamites*) *montanense* (Fontaine) n. comb.

Plate XL, figure 2; Plate XLI, figures 1-3; Plate XLVII, figure 1

Pterophyllum acutipennis Berry pars, (? non Heer), Nat. Mus., Canada, Bull. 58, p. 43 (1929).

Description. Leaf, petiolate, pinnate, elongate, obtuse at base and apex, symmetric or asymmetric; rachis, stout, up to 3.5 mm. wide, rather commonly transversely wrinkled. Pinnae, normal or openly oblique to rachis, alternate to subopposite, linear, straight or slightly falcate, from 1 to 3 mm. wide and up to 4 cm. long, acutely or bluntly pointed at apex, attached to upper surface of rachis, but leaving one-fifth or much more of the breadth of the rachis uncovered, attached by whole width of base very slightly rounded to line of attachment, or lower base somewhat expanded and decurrent, generally free, but more or less connate at base in apical region of leaf. Veins, parallel, usually four, commonly separated by conspicuous upfold of intervening surface, but in some specimens not seen.

Remarks. In the insertion of the pinnae the species is intermediate between *Ptilophyllum* and *Pterophyllum*, revealing the artificial nature of these genera. Although the basal union of some pinnae, together with a common lack of any marked rounding of the upper base, favours an assignment to *Pterophyllum*, the species otherwise strongly resembles *Zamites speciosus* Heer (1874, p. 64, Pl. 14, figs. 1-12; Pl. 16, fig. 4) and its probable conspecific associates *Z. borealis* Heer (1874, op. cit., Pl. 14, figs. 13, 14; Pl. 15, figs. 1, 2) and *Z. acutipennis* Heer (1874, op. cit., Pl. 15, figs. 3, 4, 5a; Pl. 16, fig. 10). *Zamites montanensis* Fontaine (= *Pterophyllum montanense* Knowlton) was stated by Knowlton (1908, p. 123) to have laterally attached pinnae, yet some of the pinnae in Knowlton's fig. 3, Pl. 14 (1908, op. cit.) seem to be attached within the margin of the rachis. Admittedly a false appearance of attachment of pinnae to the upper surface of a rachis may result from compaction, but this does not apply to all the Canadian specimens. The lines of attachment, however, are parallel to the borders of the rachis and are either straight or have very slight re-entrants. The folding of the lamina between the veins seems to be a common character of the species, and the folds might be mistaken readily for the veins themselves; where such folds are lacking the veins are commonly not apparent.

Occurrence. Kootenay formation, Alberta, locality 4039; Blairmore group (lower flora), Alberta, localities 2491, 3142, 3164, 3175; Luscar formation, Alberta, localities 384, 1233, 1610, 1611, 1688, 1810, 2052, 2053, 2056, 2058, 2235, 3154, 3163, 3168, 3181, 3184, 3532, 3748, 3750, 3767, 3828; Hazelton group, British Columbia, localities 836, 2413, 2415, 2417, 2418, 2419, 3299, 3300; Bullhead group, British Columbia, localities 1997, 3208; Jackass Mountain group, British Columbia, locality 3718.

Types. Hypotypes, G.S.C. Nos. 5228, 5249, 5250, 5251, 6592.

Pterophyllum rectangulare n. sp.

Plate XLII, figures 3, 4, 6

Description. Leaf, petiolate, pinnate, with elongate, rectangular-elliptical blade, which is truncate at base and summit; rachis, up to 2 mm. wide, smooth or transversely wrinkled. Pinnae, attached at right angles or nearly so, except near summit where obliquely ascending, and at base where lowest pair is slightly descending; upper margin of base, straight or nearly so, the lower, straight or slightly expanded; alternate to subopposite, free except near apex of leaf where basally connate, decreasing very gradually in length and almost equally to base and summit of leaf, up to 1.8 cm. long by 2.5 mm. broad, abruptly and obtusely rounded at apex. Veins, inconspicuous, or moderately defined, and rarely not seen, parallel, usually four to six, rarely forked.

Remarks. The species resembles most closely *Pterophyllum concinnum* Heer (1874, p. 68, Pl. 14, figs. 15-20; Pl. 15, figs. 5b, 11), but differs in the basal character of the leaf blade which in *P. concinnum* is acute on account of the rapid, progressive decrease in length of the pinnae.

Occurrence. Luscar formation, Alberta, localities 1233, 1610, 1883, 2052, 3162, 3332; Bullhead group, British Columbia, localities 3095, 3208, 3211, 3279, 3288, 4016, 4019; Hazelton group, British Columbia, locality 2419; Jackass Mountain group, British Columbia, locality 3718.

Types. Holotype, G.S.C. No. 5254; paratypes, G.S.C. Nos. 5256, 5257.

Pterophyllum plicatum n. sp.

Plate XL, figure 4; Plate XLII, figures 1, 5; Plate XLIII, figures 2, 5

Description. Leaf, petiolate, pinnate, relatively slender for the genus; rachis, up to 1.5 mm. broad. Pinnae, subrectangular, with broadly rounded, obtuse apices, attached by whole bases to side of rachis at right angles or nearly so throughout most of leaf, the higher ones moderately oblique to rachis, free except those at summit, which are connate at base, up to 1.5 cm. long and 2 to 5 mm. wide, commonly varying somewhat in width on same frond, about equal in length except for gradual shortening to base and summit of leaf, and for lowermost pair which are much smaller than the pair immediately above and which are commonly slightly deflected downwards. Veins, coarse, generally three to five, most commonly four, parallel, occasionally forked near apex and rarely at point of origin. Space between veins, marked by a fold that gives a conspicuous, plicated appearance.

Remarks. The outline of the leaf is much like that of *P. rectangulare*, as is the downward deflection of the basal pair of pinnae. The pinnae, however, are differentiated from that species by their plication and by their somewhat commonly variable width. They are, moreover, relatively broader in proportion to their length, being only two to five times as long as broad. The species resembles superficially *P. lepidum* Heer (1874, p. 68, Pl. 16, figs. 1-3), but the pinnae are mostly free to the rachis, are less distantly spaced as a rule, the basal pair are differentiated by their short length and downward deflection, and the veins are much coarser. The plications are in some instances at least imprints of dorsal surface that overlie the veins.

Occurrence. Bullhead group, British Columbia, locality 3091; Luscar formation, Alberta, locality 2234.

Types. Holotype, G.S.C. No. 5259; paratypes, G.S.C. Nos. 5258, 5261, 5262, 5263.

Pterophyllum validum ? Hollick

Plate XLV, figure 5

Remarks. A single specimen may represent Hollick's species, regardless of its older age. However, like the type specimens only a part of a single leaf is preserved, and the apices of the pinnae are missing. The rachis is about 8 mm. wide at lower end, smooth, except for obscure, longitudinal costae. Pinnae, elongate, ribbon-like about 3 mm. wide and at least 4 cm. long, attached to side of rachis at open angles, their bases being united and slightly expanded. Veins are obscure, parallel, apparently six to eight. The pinnae in the preserved lower part of the leaf are curved backwards, in the upper part, slightly forwards.

Occurrence. Commotion formation, British Columbia, locality 3202.

Types. Hypotype ? G.S.C. No. 5871.

Pterophyllum sp.

Anomozamites acutilobus ? Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 7, Pl. 1, fig. 7 (1886).

Remarks. The material comprises only the single specimen G.S.C. No. 4823, figured by Dawson, which is much too fragmentary for specific diagnosis. Dawson compared it both to *Anomozamites acutilobus* Heer and *A. schmidtii* Heer (1876, pp. 100-103, Pl. 23, fig. 1a; Pl. 24, figs. 1-3; Pl. 25, fig. 9; Pl. 28, fig. 36; Pl. 23, figs. 2, 3; Pl. 24, figs. 4-7). The difference between these two, judging from Heer's figures, does not appear to be of specific rank, and *A. schmidtii* being the first and more fully described species should have the preference. The largest pinna on the Canadian specimen is 13 mm. broad, the smallest 6 mm. The apices are seemingly obtuse to rounded-truncate as in *A. schmidtii*, and the veins about thirty per centimetre.

Occurrence. Kootenay formation, Alberta, locality 260.

Types. G.S.C. specimen No. 4823.

Ptilophyllum arcticum (Göppert) Seward

Plate XLIII, figure 3; Plate XLIV, figure 3

Zamites montana Dawson, ibid., p. 7, Pl. 1, figs. 6, 6a (1886).
Zamites acutipennis Dawson (non Heer), ibid., p. 7, Pl. 1, fig. 5 (1886).
Pterophyllum acutipennis Berry pars, Nat. Mus., Canada, Bull. 58, p. 43 (1929).

Description. Leaf, petiolate, pinnate, up to 15 cm. long by 3 cm. broad; rachis, up to 2 mm. wide, commonly transversely wrinkled. Pinnae, attached at right or openly oblique angles to upper surface of rachis, leaving a central strip of rachis up to one-third of its total breadth uncovered, those on either side contiguous or slightly separated, alternate to subopposite, linear-oblong, up to nine times as long as wide, commonly about 1.5 mm. wide, with obtusely rounded or truncate-rounded apices, and contracted very slightly at base by rounding of basal corners, straight or slightly falcate, decreasing gradually in length to the petiole, and rather rapidly at summit to rounded apex of leaf. Substance of lamina, thick, and veins commonly not visible, but, when visible, parallel, commonly four but up to six, rarely bifurcated.

Remarks. Although the material is abundant, the writer found no transitional forms between this species and *Ptilophyllum* (*Anomozamites*) *montanense* (Fontaine), the latter species having apically pointed pinnae, and in most states of preservation more strongly marked veins. Generically, the species falls within the *Subzamites* group of *Zamites* as used by Halle (1916, p. 53), which the writer, until the generic value of a decurrent base of the pinnae has been clarified, prefers to include in *Ptilophyllum* (*see* Seward, 1917, pp. 512-527, and T. M. Harris, 1942, p. 572).

Zamites brevipennis Fontaine (in Ward, 1899, p. 665, Pl. 162, figs. 10-13) and *Z. borealis* Fontaine (ibid., p. 666, Pl. 162, fig. 14) are both considered by the writer to be conspecific with the Canadian material, and possibly also *Pterophyllum contiguum* Fontaine (in Ward, 1905, p. 99, Pl. 19, figs. 7-11) from the Oregon Jurassic.

Occurrence. Kootenay formation, Alberta, localities 1248, 1574, 1648, 3221, 3709, 3804, 3809, 4039, 4040, 4044, 4047, 4048; Kootenay formation, British Columbia, localities 104, 864, 1222, 2093, 3752, 3759, 3762, 3764, 3765, 3848; Luscar formation, Alberta, localities 2052, 2053, 3748; Blairmore group (lower flora), Alberta, localities 1628, 1668; Hazelton group, British Columbia, localities 2137, 2280, 2325, 2388, 2413, 2415, 2418, 3027, 3319; Bullhead group, British Columbia, localities 3280, 3281, 4016.

Types. Hypotypes, G.S.C. Nos. 5266, 5269.

Ptilophyllum robustum n. sp.

Plate LXXXV, figure 7

Zamites sp. Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 7, Pl. 1, fig. 4 (1886).

Description. Pinnae like *Ptilophyllum arcticum* (Göppert), but much more robust, being up to 1 cm. long by 3.5 to 4.5 mm. wide, and veins about ten to twelve per pinna. The pinnae are attached to upper surface of rachis, which is up to 3 mm. wide, leaving an uncovered space about 0.5 mm. wide. The base is symmetrical, and both upper and lower corners well rounded. The apices of the pinnules are rounded-truncate.

Remarks. *Zamites arcticus* Fontaine (non Heer) (in Ward, 1905, Pl. 68, fig. 1) from the Shasta group is considered by the writer to be conspecific with the species under consideration. Some of the specimens from the Kootanie formation of Montana, such as that of Pl. 73, fig. 1 of the above reference, are more doubtfully referable to *P. robustum.* They agree closely with the smaller forms of the latter species, and are stated to have about ten veins per pinna.

Occurrence. Kootenay formation, Alberta, locality 278.

Types. Holotype, G.S.C. No. 4821.

Ptilophyllum columbianum n. sp.

Plate XLIV, figure 4; Plate XLV, figure 6; Plate XLIX, figure 7

Description. Leaf, petiolate, pinnate, linear, up to 15 cm. or more long and up to 6 cm. or more wide, contracting gradually to summit, which is abruptly rounded-truncate; rachis, stout, up to 3.5 mm. wide. Pinnae, attached to upper part of rachis, leaving up to 0.75 mm. of surface of rachis uncovered, having their upper and lower basal corners slightly rounded to lines of attachment that are parallel with the borders of rachis, spreading at right angles or nearly so to rachis, of nearly equal breadth on a single leaf, 2.5 to 5 mm. wide and up to 2.5 cm. long, contracting abruptly to obtusely rounded apices. Veins, parallel, inconspicuous, usually six to eight, simple or rarely bifurcated.

Remarks. The species bears a close resemblance to *Pterophyllum aequale* Fontaine (in Ward, 1905, Pl. 20) (non Brongniart), which judging from Fontaine's figures, seems to be a *Ptilophyllum,* and, if so, Fontaine's species would have priority. *P. columbianum* differs mainly in having fewer veins, a feature of doubtful specific value. The smallest leaves of *P. columbianum* resemble a very robust *P. arcticum,* but otherwise the form is well characterized.

Occurrence. Hazelton group, British Columbia, locality 3297.

Types. Holotype, G.S.C. No. 5803; paratypes, G.S.C. Nos. 5759, 5760.

Ptilophyllum hirtum n. sp.

Plate XLII, figures 2, 7; Plate XLIII, figure 4

Description. Leaf, pinnate, linear-rectangular; rachis stout, up to 1.5 mm. wide. Pinnae, sub-coriaceous, linear-oblong, up to 1.8 cm. long by 2.5 mm. wide, attached at right angles or nearly so to upper surface of rachis, leaving a part (about one-third) of rachis uncovered; apex obtuse, broadly rounded; upper and lower basal corners slightly rounded to line of attachment, which is parallel to margin of rachis. Veins, coarse, obscure in compressions, but well marked on imprints of upper surface as impressions of dorsal furrows that overlie the veins, which are usually four, the outer pair simple, the two inner commonly forked once at variable distances from the base. Surfaces of pinnae marked by abundant, microscopic, linear hairs, about 0.75 mm. long, seemingly arranged in regular rows.

Remarks. The species most resembles *P. arcticum*, but the pinnae are longer, the veins coarser, the inner veins forked and the surface of the pinnules marked by abundant hairs. The occurrence of abundant hairs in some species of *Ptilophyllum*, as recorded in cuticle preparations, was noted by H. H. Thomas (Thomas, H. H., and Bancroft, N., 1913, p. 184).

Occurrence. Hazelton group, British Columbia, locality 3029.

Types. Holotype, G.S.C. No. 5788; paratype, G.S.C. No. 5789.

Pseudocycas dunkeriana (Göppert) Florin

Plate XLIII, figure 6; Plate XLVII, figures 2, 6

Dioonites buchianus abietinus Berry (non Göppert), Nat. Mus., Canada, Bull. 58, p. 44 (1929).

Description. Leaf, large, simply pinnate, rectangular-elongate, up to more than 30 cm. long and 12 cm. wide, gradually contracting to base and probably more abruptly to apex; rachis, up to 7 mm. or more broad, in some specimens transversely wrinkled. Pinnae, free, entire, linear-acuminate, coriaceous, dorsally strongly convex, occasionally triangular-convex, with revolute margins, closely spaced, although not generally touching beyond the rachis, attached to upper side of rachis, commonly at angles of about 70 degrees or more in midregion of leaf, leaving an uncovered space of 1 mm. or so, the base commonly slightly expanded or swollen, and upper and lower corners may be bluntly rounded, so that lines of attachment on rachis are slightly zigzag; pinnae are straight or more or less curved upwards, the latter particularly near apex of leaf, up to 8 cm. long and 1 to 1.5 mm. broad. No veins observed, but imprints of lower surface in some specimens show a narrow medial rib, representing by inference a stomato-bearing groove.

Remarks. Without cuticular analysis the differentiation of some species of *Pseudocycas*, e.g. *P. saportae* (Seward) Holden (Seward, 1895, pp. 29-35, Pl. 3, fig. 7; Pl. 6, fig. 5; Pl. 8, fig. 2), from *P. dunkeriana*. is unreliable, and it must be confessed that the Canadian material on the megascopic characters described above could just as appropriately be identified with Seward's species from the Wealden. The attachment of the pinnae throughout most of the frond resembles that in *Ptilophyllum*. But in G.S.C. No. 6593 (Pl. XLVII, fig. 2), which apparently represents an apical part of a leaf, the pinnae appear to be confluent at base as in *Pterophyllum*, so that on the whole the insertion of the pinnae is analogous to that of *Ptilophyllum* (*Anomozamites*) *montanense*, described elsewhere in this report.

Occurrence. Blairmore group (lower flora), Alberta, localities 1246, 4025, 4032; Luscar formation, Alberta, localities 1560, 1907, 3307; Bullhead group, British Columbia, locality 3636; Hazelton group, British Columbia, localities 3027, 3297, 3305.

Types. Hypotypes, G.S.C. Nos. 5270, 5299, 6593.

Pseudocycas sp. A cf. *P. unjiga* (Dawson)

Plate XLIV, figure 2; Plate XLV, figure 3; Plate XLVI, figure 2, Plate XLVII, figure 4

Pseudocycas unjiga Berry (? non Dawson), Nat. Mus., Canada, Bull. 58, p. 59 (1929).

Remarks. The pinnae, 2 to 2.5 mm. broad, and up to 9 or 10 cm. long, are well separated to closely spaced, inclined 45 to 70 degrees to rachis, straight, or only slightly curved toward leaf apex, attached to upper surface of stout rachis (up to 1 cm. broad), as in *Ptilophyllum*, leaving a space of about 1 mm. broad uncovered; character of apex unknown; stomatal groove on lower surface, narrow, about 0.25 mm. broad; dorsal surface only slightly arched.

The species may be conspecific with *Pseudocycas unjiga* Dawson (1883, p. 20, Pl. 1, figs. 2, 2a) from the Dunvegan formation, differing only in megascopic character, as far as known, by the somewhat narrower pinnae, which in *P. unjiga* are 2.5 to 3.5 mm. broad. The apices in *unjiga* are very sharp, elongated and thorn-like, but unfortunately were not seen in the specimens here considered. The species also resembles closely *Pseudocycas insignis* Nathorst (1907, p. 4, Pl. 1, figs. 1-5; Pl. 2, figs. 1-9; Pl. 3, fig. 1). It is quite evident it would be useless to designate the material specifically until comparisons of cuticular characters can be made.

Occurrence. Blairmore group (upper flora), Alberta, localities 1250, 4020, 4021, 4022; Spence Bridge group, British Columbia, locality 3456; Bullhead group, British Columbia, locality 3091; Pasayten group, British Columbia, localities 3126, 3321.

Types. G.S.C. Nos. 5271, 5300, 5301, 6665.

Pseudocycas sp. B cf. *P. unjiga* (Dawson)

Plate XLIV, figure 1

Remarks. Material comprises only two small imprints of fragments of a *Pseudocycas* having well spaced pinnae, 4 to 4.5 mm. broad. The imprint of stomatal groove appears as a pronounced raised narrow costa, resembling a midrib. The pinnae curve slightly towards apex of leaf, and show slight arching in cross-section. They resemble those of *Pseudocycas* sp. A and *P. unjiga* Dawson, but have a greater breadth.

Occurrence. Pasayten group, British Columbia, locality 3129.

Types. G.S.C. No. 6660.

Zamites tenuinervis Fontaine

Plate XLVIII, figure 4

Original description. "Leaflets very long, attaining a length of 20.5 cm. and a width of 24 mm., at base abruptly subcordate, in shape ensiform, sometimes curved, acute; nerves very numerous and closely spaced, fine but distinct, forked at base or simple, occasionally forked a little higher, parallel after forking" (Fontaine, 1889, p. 171).

Remarks. Of the few Canadian specimens to hand the best leaflet is 11.5 cm. long by 2 cm. wide. The base is abruptly rounded with a medial, re-entrant scar of attachment, about 2 mm. broad. The extreme apex is missing, but the lamina has narrowed to about 3 mm. One side of the leaflet, except for curvature near base, is nearly straight, the other margin forming a gentle curve. Parts of the leaf substance is preserved as a coalized film, and shows very fine, parallel veins averaging about 0.5 to 0.6 mm. apart; between them are two or four parallel microscopic striae, in places appearing almost as strong as the veins. This type of venation and striation is very similar to that in *Podozamites*, and *Podozamites nervosa* (Newberry, 1891, p. 200, Pl. 14, fig. 6) is considered by the writer to be probably conspecific. If one of the specimens figured by Fontaine (op. cit. Pl. 76, fig. 7) belongs to the species, and there is no reason to think it does not, it is possible that this species is conspecific with *Podozamites tenuinervis* Heer (1882, p. 44, Pl. 16, fig. 9). Although the writer retains the species in *Zamites*, where Fontaine placed it, he considers it might be assigned more appropriately to *Podozamites tenuinervis* ? Heer.

Occurrence. Blairmore group (upper flora), Alberta, locality 3065.

Types. Hypotype, G.S.C. No. 5865.

Zamites ? sp. (Dawson) n. comb.

Plate XLV, figure 1

Pagiophyllum sp. Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 90, fig. 14 (1893).

Remarks. The material comprises only the counterparts of the single pinna that was figured by Dawson, and of a subsequently collected isolated pinna from the younger Luscar formation. The first is 3.7 cm. long by about 1 cm. wide. The anterior margin is nearly straight, the posterior subparallel with the anterior in its lower half, then curving, gradually at first and finally more rapidly, to an acute apex. In its outline the pinna is very like that of *P. hirsutum* Thomas and Bancroft from the Jurassic of Yorkshire (Harris, T. M., 1949, p. 293, fig. 7D). What is preserved of the base indicates no contraction. The leaf substance was evidently thick, and the veins are not shown.

The specimen from the Luscar is likewise a detached pinna and is mostly preserved, except the extreme tip. It is about 3.2 cm. long, and contraction of width towards apex is fairly rapid, from 9 mm. to 3 mm., the outline being much the same as that of the first specimen. The veins are well preserved and rather coarse, about 0.6 mm. apart in lower part of pinna, the outermost slightly spreading from the base and running to the lateral margins. Some of the veins fork once or twice.

Occurrence. Kootenay formation, Alberta, locality 1574; Luscar formation, Alberta, locality 1907.

Types. G.S.C. Nos. 4858 (Dawson's *Pagiophyllum* sp.), 6591.

Zamites ? sp.

Plate XLV, figure 2

Remarks. A single fragment of a pinnae, the base broken off, and method of attachment to rachis consequently unknown. The veins, about 0.3 mm. apart in lower part of pinnae, well marked, dichotomise in places from base to near apex, diverge slightly, and the outermost terminate at the lateral margins. The exposed length is 6 cm. and the decrease in width towards apex is gentle from 5.5 mm. to 3 mm.

Occurrence. Blairmore group (lower flora), Alberta, locality 4031.

Types. G.S.C. No. 5296.

Williamsonia ? recentior Dawson

Plate XLVI, figure 1; Plate L, figure 2; Plate LI, figure 6

Williamsonia recentior Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 12, Pl. 4, fig. 1 (1886).

Remarks. The specimen shows a whorl of about twenty incurved coriaceous, acutely pointed appendages or bracts, each about 1.5 mm. wide, attached to a globose end of an otherwise downwardly expanded, carbonized, cone-like receptacle or disc that shows no definite surface markings. Each segment or appendage tapers towards an incurved apex after spreading outwards, the basal ones being first down curved almost parallel with the cone-shaped base of the specimen. One or two remnants of axial tissue occur below the margin of the expanded base as if in continuity. Some of the appendages have a central, keel-like elevation on the ventral surface, which is convex. The upper, bractiferous part of the specimen resembles some species of *Williamsonia*, e.g. *W. blandfordi* Feistmantel (Seward, 1917, p. 446, fig. 558), but, if actually a *Williamsonia,* it would appear to be a male strobilus, or, if part of an ovulate strobilus, to have been attached to the upper end of a receptacle.

Specimen No. 6645 (Pl. LI, fig. 6) is interpreted to be a part of a branching peduncle, possibly of this species, and at right at "f" is a small male flower. One of the branches has a scar at "s", which may represent the attachment of another flower.

Occurrence. Blairmore group (upper flora), Alberta, localities 1815, 3066.

Types. Holotype, G.S.C. No. 5105; hypotype (?), G.S.C. Nos. 6636, 6645.

Cycadolepis sp. Berry

Plate XLV, figure 4

Cycadolepis sp. Berry, Nat. Mus., Canada, Bull. 58, p. 44, Pl. 7, fig. 7 (1929).

Original description. "An unsymmetrical obovate scale of considerable consistency and about 2.75 cms. in length by about 1 cm. in maximum width appears to represent a carpellary or antheriferous scale of some species of cycadophyte."

Remarks. The scale bears some resemblance to those occurring in *Williamsonia ? recentior* Dawson.

Occurrence. Kootenay formation, Alberta, locality 4044.

Types. G.S.C. specimen No. 5297.

Cycadolepis sp.

Plate LI, figure 1

Remarks. The single specimen observed is a lanceolate-acuminate scale or bract similar to the hairy bracts in some species of *Williamsonia.* The hair-like appendages strongly ascend from the two sides of the bract, are crowded and up to 1 cm. or more long. The lamina of the bract has an acute apex, is slightly contracted to the base, and is 4.8 cm. long by 4.5 mm. wide. It is obscurely ridged longitudinally.

Occurrence. Luscar formation, Alberta, locality 3750.

Type. G.S.C. No. 6597.

Cycadospadix sp.

Plate XLVIII, figure 2

Description. A subcircular, coriaceous scale, about 5 cm. diameter, with fimbriate borders, slightly funnel-shaped in centre; petiole, if one existed, not preserved.

Remarks. The specimen is worthy of note, because it is associated with *Pseudocycas dunkeriana* at locality 3636. It differs from *Cycadospadix* ? sp. Cockerell (1916, p. 110, fig. 1) from the Lower Cretaceous beds in Colorado in its subcircular shape and fimbriated rather than laciniated borders.

Occurrence. Bullhead group, British Columbia, locality 3636.

Types. G.S.C. No. 6594.

Nilssonia schaumburgensis (Dunker) Nathorst

Plate XLVIII, figure 1; Plate XLIX, figure 5; Plate LI, figure 5

Nilssonia pasaytensis Penhallow, Roy. Soc. Canada, Trans. 1907, Ser. 3, vol. 1, sec. 4, p. 307, text-fig. 3 (1907).
Nilssonia schaumburgensis Berry, Nat. Mus., Canada, Bull. 58, p. 47, Pl. 7, fig. 5 (1929).

Description. Frond, linear, up to 15 cm. long by 3.5 cm. wide, short-petiolate. Blade, dissected up to rachis into segments of variable width, inserted on upper surface of rachis. Segments, sub-rhomboidal to sub-triangular, their distal or upper margins nearly straight or slightly concave and normal or at wide angles to rachis, their proximal or lower margins openly oblique to rachis, nearly straight or curving upwards to truncated or rounded outer margin, the lower outer edge is broadly rounded and upper one narrowly rounded to sub-angular. Veins, about thirty per centimetre, parallel, simple, departing about normal to midrib of rachis.

Remarks. Specimens, conform closely to types of the species, e.g. G.S.C. No. 5833 (Pl. XLIX, fig. 5) are associated with others having segments with more rounded outer margins, e.g. G.S.C. No. 5285 (Pl. XLVIII, fig. 1).

Occurrence. Kootenay formation, Alberta, localities 864, 3221, 3712, 4051; Kootenay formation, British Columbia, locality 3848; Hazelton group, British Columbia, localities 2137, 2276, 2389, 2411, 3165, 3832; ? Pasayten group, British Columbia, locality 3321.

Types. Hypotypes, G.S.C. Nos. 5285, 5292, 5833.

Nilssonia nigracollensis Wieland

Plate XLVII, figure 5; Plate XLIX, figures 3, 6

Description. Leaf slender, elongate, petiolate, with obtuse or narrowly rounded tips. Lamina, up to 7 cm. or more long by 2 to 10 mm. wide, attached to upper surface of stout rachis, which may be 1 mm. wide, generally convex upwards from sharp groove over midrib of rachis, entire, or rarely in places cut almost to rachis into obtuse segments. Veins, generally very prominent, eighteen to thirty per centimetre, simple or rarely divided near point of origin, inclined 50 to 80 degrees to midrib, generally slightly curved towards apex of leaf in their course to margin.

Remarks. *Nilssonia parvula* Fontaine (non Heer), (in Ward, 1905, p. 92, Pl. 17, figs. 1-7), obviously belongs to this species.

Occurrence. Hazelton group, British Columbia, localities 387, 388, 1557, 2278, 2279, 2306, 3837; Nikanassin formation, Alberta, localities 346, 1267, 3185, 3333; Kootenay formation, Alberta, locality 3807.

Types. Hypotypes, G.S.C. Nos. 3293, 3294, 3295.

Nilssonia cf. *tenuicaulis* (Phillips) Fox-Strangways

Plate XLIX, figure 2

Description. Leaf up to 6 cm. or more wide, with axis about 2 mm. wide, dissected normal to rachis into linear, alternate to subopposite segments that are well spaced, of unequal length and breadth, up to 1 cm. wide and 3 cm. or more long, tapering distally to narrowly rounded or subacute apex, commonly expanded at base, particularly at lower margin. Veins, more or less convergent from point of origin, depending upon degree of basal expansion, about parallel for most of length, simple, seventeen to twenty per centimetre.

Remarks. The Canadian specimens seemingly do not differ materially from the Jurassic species *N. tenuicaulis* (Phillips, 1829, p. 148, Pl. 7, fig. 19), unless it is in their coarser and more distantly spaced veins.

Occurrence. Hazelton group, British Columbia, localities 2160, 2303; Tantalus formation, Yukon Territory, locality 372.

Types. G.S.C. No. 5805.

Nilssonia brongniarti (Mantell) Dunker

Plate XLVII, figure 3; Plate XLIX, figures 1, 4 (in part)

Description. Lamina, inserted on upper surface of a stout rachis, dissected into alternate or subopposite segments that are up to 2.7 cm. long and 3 to 8 mm. broad, the segments on an individual frond being slightly apart laterally and somewhat unequal in width; they are attached by their whole base normal or at wide angles to the rachis, at least in middle part of a leaf, the lateral margins subparallel, or distal margin slightly concave, and proximal one convex, contracting distally to a narrowly rounded or subacute apex. Veins, well marked, parallel simple, about twenty to twenty-five per centimetre.

Remarks. *Nilssonia california* Fontaine (in Ward, 1905, p. 252, Pl. 67, fig. 7) from the Shasta group of California may be conspecific. A segment of a Canadian frond, 3 mm. broad, has about six veins, which agrees well with the number given by Schenk (1871, p. 236, Pl. 32, fig. 2) for segments of comparable width.

Occurrence. Hazelton group, British Columbia, localities 2405, 2411; Tantalus formation, Yukon Territory, locality 372.

Types. Hypotypes, G.S.C. Nos. 547, 5289, 5291.

Nilssonia canadensis n. sp.

Plate LI, figures 2, 3, 4; Plate LII, figure 5; Plate LIV, figures 6, 8

Nilssonia densinerve Berry, Nat. Mus., Canada, Bull. 58, p. 46 (1929).

Description. Leaf, elongate, spatulate to oblong, petiolate. Blade, inserted on upper surface of a stout rachis (that may be up to 4 mm. wide), in largest leaves 3 to 5 cm. wide and more than 15 cm. long, in spatulate leaves, parallel-sided in mid-region, contracting near summit to a bluntly pointed or narrowly rounded apex, contracting very gradually to a narrowly cuneate base or more abruptly to a rounded base; base, slightly asymmetric. Veins, ten to eighteen per centimetre, mostly simple, but a few forked at point of origin or in course to margin, normal or about 80 degrees to midrib, running straight to margin or rarely slightly curved towards apex of leaf.

Remarks. The leaves are fragmentary and few show base or apex. A very small and probably immature leaf is the only one showing the entire petiole, which is expanded to a crescent shaped basal end (Pl. LI, fig. 4). The specimens differ from *N. johnstrupi* Heer (1882, Pl. 6, figs. 1-6), in that all the leaves so far observed are entire, and the prevailing form is oblong rather than elliptical. The species resembles rather closely *N. taeniopteroides* Halle (1916, p. 47, Pl. 5; Pl. 6, figs. 1-7), but differs in the generally straight course of the lateral veins. It differs also in this respect from *N. yukonensis* Hollick (1930, p. 42, Pl. 3, figs. 1-7; Pl. 7, fig. 4) and from *N. densinerve* (Fontaine) (1889, p. 115, Pl. 29, fig. 4), as well as in the lack of dissected leaves. The spacing of the veins is much greater than in *N. orientalis* Heer.

Occurrence. Kootenay group, Alberta, locality 864; Bullhead group, British Columbia, localities 1997, 3208, 3634, 3665, 4019; Hazelton group, British Columbia, locality 2393; Kingsvale group, British Columbia, localities 3020, 3125; Luscar formation, Alberta, localities 3334, 3339, 3750; Blairmore group (lower flora), Alberta, locality 4028.

Types. Holotype, G.S.C. No. 5282; paratypes, G.S.C. Nos. 5281, 5869, 6580, 6581, 6584.

Nilssonia sp.

Plate XLIX, figure 4 (in part)

Remarks. This form has apically narrowed pinnae that are obliquely truncate at the summits and narrowly obtuse at the upper corners, resembling those of an exceptionally large *Nilssonia schaumburgensis.* The number of veins is twenty-five to thirty per centimetre, and, although a frond is cut into segments of unequal breadth, they are rather closely spaced, and the contiguous ones are more regular than those of *Nilssonia tenuicaulis.*

Occurrence. Hazelton group, British Columbia, localities 2405, 2411.

Types. G.S.C. No. 5287.

Ctenis borealis (Dawson) n. comb.

Plate XLVIII, figure 3; Plate LII, figure 4; Plate LIII, figure 1; Plate LVI

Dioonites borealis Dawson, Roy. Soc. Canada, Trans. 1882-83, vol. 1, sec. 4, p. 24, Pl. 3, fig. 37 (1883).
op. cit., Trans. 1885, vol. 3, sec. 4, p. 6, Pl. 1, fig. 2 (1886).

Ctenis albertensis Warren, Roy. Soc. Canada, Trans. 1927, Ser. 3, vol. 21, sec. 4, p. 48, Pl. 1, fig. 1; Pl. 2, figs. 1, 2 (1927).

Description. Leaf, very large, pinnate; rachis, up to 2 cm. broad, obscurely ridged. Pinnae, entire, alternate to subopposite, up to 15 cm. or more long by 3 cm. broad, sub-oblong, contracting more or less rapidly well beyond mid-length to an obtuse apex, normal or nearly so to rachis in lower part of leaf inclined up to 45 degrees near summit, closely spaced, so that commonly the decurrent base of one may be on same level or almost so as the upper base of pinna below, 1.2 to 3 cm. broad, 5 to 15 cm. or more long, the upper basal margin running straight from rachis or slightly contracted, the lower basal margin slightly expanded and decurrent; terminal segment in one specimen, 2.5 mm. broad and larger than those immediately below it, the rachis disappearing as a midrib in the lower one-fifth or one-quarter of its length. Veins prominent, commonly in relief, twelve to twenty per centimetre, sub-parallel, except that basal lateral ones are somewhat convergent, and the outermost meet lateral margins of pinnae, forking freely at point of origin or within 1 cm. from base, less commonly in course towards apex; anastomoses, variable from rare to scattered, generally more plentiful in basal part of pinnae where forking of the veins is more common.

Remarks. The type specimen of *Dioonites borealis* Dawson is very fragmentary and lies in a sandstone matrix, the veins are coarse and prominent, about 1 mm. apart, but too poorly preserved for detection of anastomoses. Rare anastomoses of the veins may be observed, however, in the specimen later figured by Dawson, as well as in another specimen of the original series that was identified by Dawson. Because the degree of anastomosing of the veins is variable, the relation of *Ctenis orovillensis* Fontaine (1900, p. 357, Pl. 58, fig. 4) to Dawson's species is not certain. It may be conspecific, although Fontaine stated that in his species anastomoses of the veins were rare near the rachis and rather common at intervals in distal parts of the pinnae.

The species is differentiated from *Pseudoctenis hazeltonensis* Bell by the larger and sub-oblong pinnae, the lower basal margins of which are always decurrent and somewhat expanded.

Occurrence. Kootenay formation, British Columbia, localities 276, 3751, 3755, 3756; Kootenay formation, Alberta, localities 864, 1590, 3807, 4410.

Types. Holotype, G.S.C. No. 5136 (*Dioonites borealis* Dawson); hypotypes, G.S.C. Nos. 4817 (*Dioonites borealis* Dawson), 5723, 5728.

Ctenis sp.

Plate LII, figure 3

Remarks. A single specimen from the Luscar formation shows fragments of three pinnae, 1 to 1.4 cm. wide, with parallel veins, about 7 per centimetre, which have a few anastomoses. The species may belong to *Ctenis borealis* (Dawson), but differs in possession of more widely spaced veins. The occurrence of the genus in strata as late as that of the Luscar formation is worthy of record.

Occurrence. Luscar formation, Alberta, locality 1907.

Types. G.S.C. specimen No. 6585.

Pseudoctenis hazeltonensis n. sp.

Plate LV; Plate LVII, figure 5

Description. Leaf, pinnate, commonly asymmetric, petiolate, large, more than 30 cm. long and up to 12 cm. broad; rachis, stout, up to 9 mm. broad, obscurely ridged. Pinnae, normal or at open angles to rachis, commonly curved downwards distally in parts of frond, inserted by whole of base, which is constricted above and generally non-decurrent below, rather closely spaced, widest near or below middle, tapering acuminately beyond middle to acute or narrowly rounded apex, up to 1 cm. broad and 7 cm. long. Veins, mostly parallel, fourteen to twenty per centimetre, sparingly forked, with rare anastomoses, the outermost running to lateral margins of pinnae.

Remarks. The lowermost pinnae are about 2.5 cm. long by about 0.5 cm. broad, and there is a gradual increase of length higher in the leaf. The pinnae are smaller than those of *Ctenophyllum wardii* Fontaine (in Ward, 1900, p. 357, Pl. 59; Pl. 60; Pl. 67, fig. 5), are acuminate, their bases generally non-decurrent, and the veins have rare anastomoses. The general shape of the pinnae of *P. hazeltonensis* resembles that of *Pseudoctenis ensiformis* Halle (1916, p. 51, Pl. 6, fig. 8), except that their upper bases are constricted. The veins, too, of *P. ensiformis* are much more distant. The near apical parts of a leaf of *Ctenis borealis* (Dawson) may be distinguishable with some difficulty from *Pseudoctenis hazeltonensis*, although a general decurrence of the pinnae and common bifurcation of the veins, particularly near their origin, should prove helpful in their differentiation. The two species may be very closely allied, and the present assignment of *P. hazeltonensis* to *Pseudoctenis* rather than to *Ctenis* is an arbitrary and far from a satisfactory one.

Occurrence. Hazelton group, British Columbia, localities 397, 2410; Kootenay formation, Alberta, locality 1590.

Types. Holotype, G.S.C. No. 5316; paratype, G.S.C. No. 5787.

Ctenopteris insignis Fontaine

Plate LII, figures 1, 2

Original description. "Frond large, arborescent, bipinnate or tripinnate; principal rachis very strong, striate; ultimate pinnae with strong, rigid rachises, alternate, terminating in a lobed segment, the pinnules passing into lobes more or less united towards the ends of the ultimate pinnae; pinnules thick and leathery, those of the lower and middle portions of the pinnae, attached by the whole base, slightly decurrent, separate, cut away obliquely above, alternate to subopposite, gradually diminishing towards the summit of the pinnae in size and depth of toothing, not sensibly narrowed at the base, oblong-acute, curved slightly forward, terminating in a large ovate to sub-triangular acute tooth. The pinnules usually show two acute or spinous teeth on each side, a couple near or at the summit of the pinnule, the associated members of the couples being opposite or subopposite. Sometimes there is an additional tooth on the posterior margin below the upper one, and sometimes the terminal tooth is enlarged to an oblong lobe, which is slightly notched; nerves several, departing separately from the principal rachis along the entire width of the pinnule, the outermost ones forking and curving outwards, the inner ones forking deeply several times and slightly diverging flabellately, the ultimate branches nearly or quite parallel, long and slender" (Fontaine, 1889, p. 156).

Remarks. Only several fragments of the distal parts of ultimate pinnae were seen. One is slightly asymmetric, and has some of its pinnules, which are mainly alternate, normal to the rachis; the pinnules are basally united by a very narrow wing of a stout axis. Another specimen has basally confluent, opposite to subopposite pinnules attached at wide angles to the rachis. Two to four veins enter a pinnule, of which the longer and inner dichotomoses several times. The margins of the pinnules have a few, short, forwardly directed teeth.

Occurrence. Luscar formation, Alberta, localities 3181, 3182; Blairmore group (lower flora), Alberta, locality 3063; Hazelton group, British Columbia, locality 3319.

Types. Hypotypes, G.S.C. Nos. 5298, 5756.

Elatocladus brevifolia (Fontaine) n. comb.

Plate LIII, figure 2; Plate LIV, figures 2, 7; Plate LVII, figure 1; Plate LX, figure 7

Cephalotaxopsis magnifolia Berry, Nat. Mus., Canada, Bull. 58, p. 51 (1929).

Description. Sparingly branched shoots, with larger axes marked by spirally arranged leaf scars that are outlined by two prominent ridges parallel with the axis margins. Leaves, alternate, pseudo-distichous, linear-lanceolate, 1.5 to 2 mm. wide and up to 3 cm. or more long, rather abruptly rounded at base to a very short and stout, decurrent footstalk, contracting at summit to an acutely pointed apex. The leaves lie most commonly about 45 degrees to the axis, but may spread so as to lie almost at right angles. At the base of small branches the leaves may be very short. Midvein, broad, slightly elevated, bordered on each side on under surface of leaf by a shallow groove. Surface occasionally marked by microscopic, transverse wrinkles.

Remarks. Although most of the specimens examined fall within the size range of *Cephalotaxopsis brevifolia* Fontaine, some have leaves as long as, although much narrower than, the smaller leaves of *C. magnifolia* and many intergradations occur.

Elatocladus (*Metasequoia* ?) *smittiana* is distinguishable from the present species by its less contracted base, which is markedly decurrent, by its stouter leaf-bearing axes, and by its opposite, more flexible leaves, which commonly curve downwards and which contract more abruptly at apex.

Occurrence. Blairmore group (lower flora), Alberta, localities 1626, 3067, 3142, 4025, 4027, 4033; Luscar formation, Alberta, localities 324, 384, 2058, 2277, 2282, 3337, 3361, 3362, 3532, 3750; Kingsvale group, British Columbia, locality 3020, 3125.

Types. Hypotypes, G.S.C. Nos. 5856 (forma *lata*), 5860 (forma *lata*), 6601, 6602, 6603, 6619 (forma *lata*).

Elatocladus brevifolia forma *lata*

Plate LIX, figure 2; Plate LX, figure 7

Description. Some specimens from the Kingsvale group of British Columbia are designated forma *lata*, because they differ from those described above in the greater breadth of the leaves, which is 2.5 to 3 mm. Their length, 1.5 to 2.5 cm., still falls within the range of leaves of *C. brevifolia* Fontaine, whereas the width approaches that of specimens of *C. magnifolia*. The Kingsvale group contains also forms indistinguishable from those from the Blairmore group as described above. No gradational forms between these and forma *lata* have as yet been noted, but the number of specimens to hand from the Kingsvale group is much too few for the assumption that such gradations may not occur. At any rate, it is not considered advisable at present to assign forma *lata* to a new species. Comparison may be made with *Elatocladus* sp. Seward cf. *Cephalotaxopsis brevifolia* Fontaine (Seward, 1927, p. 111, text fig. 19) from Atanikerdluk.

Cephalotaxopsis brevifolia was not originally well differentiated from *C. magnifolia* Fontaine, and might reasonably be considered only a form of the latter species.

Taxonomically these forms may be more closely related to *Torreya* than to *Cephalotaxus*.

Occurrence. Kingsvale group, British Columbia, locality 3020.

Elatides curvifolia (Dunker) Nathorst

Plate LIV, figures 1, 3, 4, 5; Plate LVII, figures 2-4, 6; Plate LVIII, figures 1, 4; Plate LIX, figure 3; Plate LX, figure 4

Geinitzia sp. Berry, Nat. Mus., Canada, Bull. 58, p. 52 (1929).
Sphenolepis sternbergiana Berry (non Dunker), ibid., p. 52 (1929).

Description. Sparingly or moderately branched, leafy shoots, with subopposite or alternate branches. Leaves, persistent, crowded, spirally disposed, thick, tetragonal in cross-section, widened at base, uninerved, strongly falcate, averaging about 2 mm. wide near base, up to 1 cm. long. Female cones, terminal, oval or more rarely globose, the largest 3.5 cm. long by 2.3 cm. wide, but variable down to 1.5 cm. long and slightly less wide; cone scales, Araucarian in form, transversely oval, from 6 to 10 mm. wide, ending in an apical, spine-like prolongation, about 1.5 mm. long.

Remarks. The largest leafy axis to hand is 12 mm. wide; leaves about 1 cm. long, are preserved in plane of bedding, and central part of axis is marked by transverse, fusiform scars of leaf bases, about 3 mm. long by 1 mm. high.

The species, originally defined from the Wealden of Germany, has been confused commonly with *Geinitzia reichenbachii* (Geinitz) Endlicher, a species with similar falcate leaves, but with *Sequoia*-like cones. *Pachyphyllum crassifolium* Schenk (1871, p. 240, Pl. 40, fig. 8) does not appear to be specifically distinct from *Pachyphyllum curvifolium* (= *Elatides curvifolia*) of the same author. Specimens from so-called Upper Jurassic beds of Spitzbergen, referred to *E. curvifolia* by Nathorst (1897, p. 35, Pl. 1, figs. 25-27; Pl. 2, figs. 3-5), have in general narrower leaves than those of Canadian specimens, although Nathorst stated that some of his specimens had leaves up to 2 mm. broad. In the majority of specimens of this species the leaves are commonly seen more or less in side view, and thus appear narrower than they really are. Certain attached cones described by Nathorst as male strobili are of about the size of the smallest female cones in the Canadian material.

Occurrence. Blairmore group (lower flora), Alberta, localities 1254, 1256, 1624, 1626, 1727, 2126, 2249, 2452, 3063, 4026, 4027, 4033, 4034; Luscar formation, Alberta, localities 384, 1233, 1269, 1610, 1688, 1689, 1810, 1907, 1919, 2052, 2053, 2056, 2138, 2169, 2201, 2234, 3148, 3154, 3163, 3168, 3180, 3181, 3184, 3194, 3334, 3532, 3748, 3749, 3750, 3767, 3812; Bullhead group, British Columbia, localities 3091, 3167, 3208; Hazelton group, British Columbia, localities 3191, 3297; Jackass Mountain group, British Columbia, localities 3716, 3718; Spence Bridge group, localities 3451, 3455.

Types. Hypotypes, G.S.C. Nos. 5229, 5230, 5231, 5232, 5233, 5234, 6605, 6606, 6607, 6608, 6609.

Elatides splendida n. sp.

Plate LIX, figures 1, 4; Plate LX, figures 1-3, 6; Plate LXI, figures 1, 2, 4; Plate LXIII, figures 2, 3; Plate LXVI, figures 1, 4

Description. Moderately to sparingly branched, leafy shoots. Leaves, spirally attached, pseudo-distichous, linear-lanceolate, up to 4 cm. long by commonly 1.5 to 2.5 mm. wide, distally rather gradually narrowed to an acute apex, obliquely attached at angles generally 50 degrees or more, but commonly reflected close to axis to a right angle or nearly so, decurrent, not perceptibly contracted at base. Midvein, rarely noticeable, but upper surface commonly concave, and lower surface with a rounded median keel, and several obscure longitudinal grooves. Scars on largest stems, crescent-shaped at summit of a fusiform area that is outlined by bordering lines.

Female cones, terminal on short shoots, small, globose, about 1 cm. diameter, bearing Araucarian-like scales, about 5 mm. long by 3 mm. wide, which are concave or saucer-shaped above, broadly rounded distally and ending in a short, mucronate tip.

Remarks. The largest leafed forms resemble certain Upper Cretaceous species, e.g. *Cunninghamites pulchellus* Knowlton (1905, Pl. 16, fig. 1), *Cunninghamites recurvatus* ? Knowlton (ibid., Pl. 16, fig. 6) and *Araucarites longifolius* (Lesquereux) Dorf (1942, p. 130, Pl. 4, figs. 9, 12, 13; Pl. 5, figs. 1-6), but the species is differentiated by its small cones which have persistent scales. The cones are similar in size to those of *Athrotaxites berryi*, but the scales are thinner and less constricted at the base. They are much smaller than the cones of *Elatides curvifolia*, and have relatively shorter mucronate points.

Specimen G.S.C. No. 5235 (Pl. LXIII, fig. 3) with leaves about 1.5 cm. long and 3.5 to 4 mm. wide, and with bluntly pointed apex and mucronate point is included here as an aberrant form; it seems to be indistinguishable from *Torreya dicksoniana* Heer (1874, p. 70, Pl. 18, figs. 1a, 2, 4).

Occurrence. Blairmore group (lower flora), Alberta, localities 1266, 1626, 1629, 2249, 3063, 4026; Luscar formation, Alberta, localities 384, 1233, 1234, 1610, 1688, 1689, 1810, 1881, 2052, 2053, 2054, 2056, 2151, 2277, 3154, 3180, 3296, 3748, 3749, 3750, 3812, 3827, 3828; Bullhead group, British Columbia, localities 1997, 3095, 3208, 3209, 3210, 3283, 3288, 3289, 3290, 3521, 3525, 3527, 3604, 3631, 3636, 3642, 4017; Hazelton group, British Columbia, localities 3299, 3319; Jackass Mountain group, British Columbia, locality 3718.

Types. Holotype, G.S.C. No. 6631; paratypes, G.S.C. Nos. 5235, 5236, 5237, 5239, 5240, 5241, 5242, 5248, 5790, 6612, 6613.

Pityophyllum cf. *nordenskiöldi* (Heer) Krystofovich

Plate LXI, figure 3; Plate LXII, figures 1, 4, 5

Pinus (Cyclopitus) nordenskiöldii Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 88, text fig. 9 (1893).

Oleandra graminaefolium Berry (? non Knowlton), Nat. Mus., Canada, Bull. 58, p. 38, Pl. 5, fig. 5 (non-fig. 6) (1929).

Description. Detached, linear, uninerved leaves, 1.5 to 3.5 mm. and rarely 4.5 mm. wide, and up to 7 cm. or more long, straight or curved, tapering gradually to a contracted base and rather abruptly to a bluntly acute apex; upper surface with narrow medial groove, about 0.3 to 0.5 mm. wide. Surface, with microscopic longitudinal striae, and very commonly marked by close transverse wrinkles that may resemble lateral veins.

Remarks. These leaves agree closely with some specimens of *P. staratschini* figured by Nathorst (1897, Pl. 5, figs. 32-36), but Nathorst (ibid., p. 68) separates that species from *P. nordenskiöldi* (Heer) (1876a, p. 45, Pl. 9, figs. 1-6) on the basis that the former species lacks a medial dorsal groove characteristic of the latter. A groove similar to that of *P. norden-*

skiöldi is ordinarily quite marked on the Canadian specimens here under consideration, although it is occasionally lacking. If Heer was correct in his observation that the type material of his *P. nordenskiöldi* has a rounded and little contracted base, it differs from our Canadian material.

Berry (op. cit., 1929 above) mistook transverse wrinkles on Canadian specimens for lateral nerves, so that his figure 6 is baseless. The writer believes that Knowlton (1908, p. 113, Pl. 11, figs. 5, 6) may have made a similar error in the case of his *Oleandra graminaefolia* from Great Falls, Montana.

Occurrence. Kootenay formation, Alberta, localities 1574, 1589, 1590, 1591, 1630, 1968, 2378, 3146, 3158, 3221, 4039, 4041, 4044, 4046, 4050, 4051; Kootenay formation, British Columbia, localities 276, 279, 1222, 1579; Nikanassin formation, Alberta, locality 346; Hazelton group, British Columbia, localities 387, 389, 392, 396, 397, 2325, 3029, 3316, 3319; Tantalus formation, Yukon Territory, locality 372; Blairmore group (lower flora), Alberta, localities 1626, 1670, 1673, 2493, 4033; Luscar formation, Alberta, localities 384, 1234, 1610, 1688, 2052, 2058, 2151, 2153, 3154; Bullhead group, British Columbia, localities 3208, 3210, 3281, 4018.

Types. G.S.C. Nos. 549, 4852 (*Pinus nordenskiöldii* Dawson), 5311, 5312.

Pityophyllum cf. *longifolium* (Nathorst) Moeller

Plate LXVI, figure 3; Plate LXIX, figure 1

Description. Linear, uninerved leaves, attached to a short axis. Leaves, up to 9 cm. long by 2.5 to 3.5 mm. broad, gradually contracted to base and to bluntly acute summit. Midrib, commonly obscure, on some specimens having an appearance of being bordered by grooves, possibly marking rows of stomata.

Remarks. The leaves resemble *P. longifolium* (Nathorst, 1878, p. 50) in their dimensions and in the character of the short shoot, as exemplified in one specimen assigned to Nathorst's species by Seward (1919, p. 378, Fig. 775). It is difficult to form a reliable estimate of the number of leaves on a shoot. G.S.C. No. 5315 (Pl. LXVI, fig. 3) seems to have seven, whereas G.S.C. No. 5314 (Pl. LXIX, fig. 1) has about fourteen. The short shoots have low bolsters which may be persistent bases of scale-leaves or basal parts of ordinary leaves that had broken off or otherwise became detached.

Occurrence. Luscar formation, Alberta, locality 1688; Blairmore group (lower flora), Alberta, locality 1626.

Types. G.S.C. Nos. 5314, 5315.

Pityophyllum sp.

Pinus susquaensis Berry (non Dawson), Nat. Mus., Canada, Bull. 58, p. 61 (1929).

Remarks. Detached, straight, long, linear, pine-like leaves, one surface slightly convex, the other concave and with narrow medial groove. At least one obscure groove on each side of medial groove, which may mark position of stomata. The width of a leaf (1.5 to 2 mm.) is narrower than most specimens of *P. nordenskiöldii*, but a little broader than those of *Pityophyllum susquaensis* Dawson; the leaves of the type specimen of the last mentioned are in fascicles and attached to short shoots. No transverse wrinkling as in *P. nordenskiöldii* occurs in *Pityophyllum* sp.

Occurrence. Blairmore group (upper flora), Alberta, locality 4020.

Type. G.S.C. No. 6663.

Pityospermum anthraciticum (Dawson) n. comb.

Plate LXV, figure 5 (in part)

Pinus anthraciticus Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 89, fig. 10 (1893).

Description. Winged seed, 10 to 14 mm. long by 4 to 5 mm. wide. Body of seed, suboval to subcircular, 2 to 3 mm. long by about 2 mm. wide; wing, sub-rectangular, slightly expanding to subtruncate distal end, marked by microscopic striae.

Remarks. The seed resembles *Pinus maakiana* Heer (1876a, p. 76, Pl. 14, fig. 1), differing, however, in the more truncate distal end of the wing.

Occurrence. Kootenay formation, Alberta, locality 1574; Tantalus formation, Yukon Territory, locality 372.

Types. Holotype, G.S.C. No. 4855; hypotype, G.S.C. No. 5784.

Pityospermum yukonense n. sp.

Plate LXV, figures 2, 3, 4 (in part), 5 (in part)

Description. Winged seed, 10 mm. long by 4 mm. wide. Body of seed, elliptical, 3 mm. long by 1 mm. wide. Wing, almost straight along inner edge, convexly curved along outer edge to narrowly rounded distal end.

Occurrence. Tantalus formation, Yukon Territory, locality 372.

Types. Holotype, G.S.C. No. 5781; paratype, G.S.C. No. 5782.

Pityocladus sp.

Plate LXV, figure 8

Description. An axis of a branch, bearing short, spirally disposed shoots that are 1 to 1.5 cm. long; the shoots are marked with scars of leaf bases or of bracts.

Remarks. These shoots are found in association with *Pityophyllum* cf. *nordenskiöldi.*

Occurrence. Nikanassin formation, Alberta, locality 346; Hazelton group, British Columbia, locality 3029; Bullhead Mountain group, British Columbia, localities 1997, 3288; Luscar formation, Alberta, locality 347.

Types. G.S.C. No. 5795.

Athrotaxites berryi n. sp.

Plate LVIII, figure 5; Plate LX, figure 5; Plate LXI, figure 5; Plate LXII, figures 2, 3; Plate LXIII, figure 1; Plate LXIV, figures 1-5; Plate LXV, figure 7

Athrotaxopsis grandis Berry (non Fontaine), Nat. Mus., Canada, Bull. 58, p. 51, Pl. 8, figs. 4-6 (1929).

Description. Shoots, moderately to sparingly branched; branches from largest shoots, not all in one plane, and commonly at open angles, whereas the smallest shoots branch seemingly wholly or mainly in one plane and at more acute angles. Leaves, spirally disposed, adpressed, ovate-rhomboid, with low rounded keel on abaxial surface, acutely pointed.

Female cones, terminal on short shoots that are mainly curved, oval or more rarely globose, up to 15 mm. long by 10 to 12 mm. broad; scales, with stout, relatively long, basal part and expanded, seemingly thickened, distal part, up to 4 mm. wide, abruptly tapering to a small, mucronate apex. Male strobili, probably belonging to the species, elliptical, up to 1 or more cm. long by 3 or 4 mm. wide, with small upwardly curved bracts.

Remarks. G.S.C. specimen No. 5217 (Pl. LXIV, fig. 1) was the largest axis identified. It is 6 mm. wide and branches freely on one side at open angles, one branch being short, uncurved and bearing a cone. A single branch, 3 mm. wide, is given off at a more acute angle on the opposite side, and it gives off a few small secondary branches at a wide angle, including a short one bearing a cone; in addition, it has a few branch scars that indicate branching in another plane, and similar scars occur on the main axis. Curving of short cone-bearing branches is common, and is well shown by G.S.C. specimen No. 5221 (Pl. LVIII, fig. 5).

Although Berry (1929, op. cit. above, p. 521) was confident that the species was conspecific with *Athrotaxopsis grandis* Fontaine, this cannot be so if the cone scales of the latter species were correctly interpreted by him as being peltate. Notwithstanding a wide geographic separation, only minor discernible characters separate the Canadian species from *Athrotaxites ungeri* Halle (1913, pp. 40-44, Pl. 2, figs. 11-17; Pl. 3, figs. 13-21; Pl. 4, fig. 22; Pl. 5, figs. 10-13). The cones of the former are generally longer than wide, and it is possible that the cone scales are less thickened in their expanded distal part than those of the Patagonian species. Although Halle considered his species to be closely allied to *Athrotaxites lycopodioides* Unger, R. Florin (1940, pp. 34-35) stated that the leaves of the latter were decussate, and that the cones resembled those of some members of the *Cupressaceae* more than those of the *Athrotaxis*. Because Florin considered *A. ungeri* to be a true *Athrotaxis*, the Canadian fertile specimens might be assigned to the living genus with equal justification, contrary to Florin's opinion that *Athrotaxis* was always, as at present, confined to the southern hemisphere.

Occurrence. Blairmore group (lower flora), Alberta, localities 1242, 1256, 1270, 1727, 2249, 2491, 2492, 2494, 3063, 3067, 3142, 3151, 3174, 3506, 4025, 4026, 4027, 4029, 4030, 4031, 4033, 4035, 4036; Luscar formation, Alberta, localities 340, 341, 384, 1233, 1270, 1558, 1623, 1624, 1625, 1626, 1629, 1688, 1689, 1883, 2052, 2053, 2138, 2151, 2235, 3058, 3163, 3168, 3194, 3296, 3332, 3335, 3530, 3532; Bullhead group, British Columbia, localities 3091, 3092, 4016, 4019, 4308; Hazelton group, British Columbia, locality 842.

Types. Holotype, G.S.C. No. 5221; paratypes, G.S.C. Nos. 5215, 5217, 5218, 5219, 6626, 6627, 6628, 6629, 6646, 6668.

Elatocladus (*Metasequoia* ?) *smittiana* (Heer) Seward

Plate LXV, figure 6; Plate LXVI, figure 2; Plate LXVII, figures 1, 4

Sequoia smittiana Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 9, Pl. 2, fig. 7 (1886).
Sequoia smittiana Berry, Nat. Mus., Canada, Bull. 58, p. 53 (1929).

Description. Branched, leafy shoots. Axes, up to 3 mm. broad, branching moderately, marked by bases of the distichously arranged leaves, which are bordered by light furrows marking their decurrence. Branches, commonly ascending, opposite or alternate, the base commonly marked by short scale-like leaves. Leaves, opposite or subopposite, lanceolate, spirally attached, but appearing distichous, linear-lanceolate, rather abruptly constricted to an acutely pointed apex, slightly, if at all, contracted at base, decurrent, openly oblique to axes and commonly curved backwards, about 2 mm. wide and up to 2 cm. long; shorter leaves commonly on same axis as larger ones. Midvein, narrow, commonly in relief on lower surface. In some states of preservation obscure, parallel lines, probably marking stomatiferous bands, appear between midrib and margins.

Remarks. The species resembles closely *Metasequoia cuneata* Newberry from Upper Cretaceous rocks, but differs in its leaves being little, if at all, contracted at the base. The more lax habit of the leaves, and the masking of a spiral phyllotaxy by a distichous arrangement, separates the species from *Elatides splendida* or *Torreya dicksoniana.*

Caution must be used in assigning the species to a living genus. Seward (1927, p. 103) mentions Florin's opinion that the cuticular characters of the species relate it more nearly to *Sequoia* than to any other known living genus. On account of the opposite arrangement of the leaves the species now might be assigned to *Metasequoia*, although no cones have been found to justify fully such reference. Seward (op. cit., p. 104) described a single cone scale as *Protodammara arctica* that was found in such close proximity to a specimen of *E. smittiana* that the possibility of organic connection was not precluded. Curiously enough, a specimen of the apparently allied species, *Metasequoia cuneata* (Newberry) from the Upper Cretaceous of Vancouver Island has in contact with it another species of Araucarian scale, the pedicel of which rests in the axil of a branch in seeming organic connection, but lack of evidence of any traces of the cone axis makes it difficult, if not impossible, to believe that such connection is actual.

Occurrence. Blairmore group (lower flora), Alberta, localities 347, 1245, 1579, 3063, 4027; Luscar formation, Alberta, localities 347, 3750; ? Uslika formation, British Columbia, locality 3838; Jackass Mountain group, British Columbia, locality 3512; Bullhead group, British Columbia, locality 3091.

Types. Hypotypes, G.S.C. Nos. 4832 (Dawson's type), 5222, 6603, 6670.

Sequoia condita Lesquereux

Plate LXV, figure 1; Plate LXVII, figure 3; Plate LXVIII, figures 4, 7

Description. Moderately branched, slender, leafy shoots. Leaves, spirally disposed, imbricate, small, triangular, straight or more rarely falcate, up to 3 or 4 mm. long by 1 mm. broad at base, decurrent, contracting rapidly to acute apex, ascending close to stems or more rarely obliquely spreading.

Oblate cones, probably belonging to the species, up to 1.5 cm. or more in cross-section, which may show nine or ten peltate scales with slender peduncles; these scales are about 8 mm. long by 5 or 6 mm. wide at expanded distal ends.

Remarks. E. W. Berry (1922, pp. 209-211, Pl. 48, figs. 1-11) gave a comprehensive account of this species based on specimens from the Cheyenne sandstone of Kansas. The material from Western Canada is presently scanty, consisting only of several branching stems and two associated cones. One stem has small falcate leaves, precisely similar to those in a specimen figured by Berry (1922, Pl. 48, fig. 5). It would be hazardous, as pointed out by Berry, to identify sterile foliage like that of this species, but there is little doubt in this instance, as both foliage and cones occur in association, that the Canadian forms belong to the same species as that occurring in the Cheyenne formation.

Occurrence. Crowsnest formation, Alberta, localities 3134, 3135; Kingsvale group, British Columbia, localities 3125, 3449; Blairmore group (upper flora), Alberta, localities 261, 3065, 4020, 4022.

Types. Hypotypes, G.S.C. Nos. 5847, 5848, 5849, 5852.

Geinitzia ? *jenneyi* ? Ward

Plate LXIX, figure 4

Geinitzia jenneyi ? Berry, Nat. Mus., Canada, Bull. 58, p. 60 (1929).

Remarks. The specimen on which Berry based his identification is an imprint of a coniferous stem with traces of leaf bases. In a few places there are remnants of coalized tissue. The details are more obscure than in specimens of *Geinitzia jenneyi* Ward (1899, p. 676, Pl. 166, figs. 5-11; Pl. 167), but the leaf bases are rhomboid, 0.7 to 0.8 mm. wide, transverse to the stem, with a sunken scar near the base. Along the lateral margin of the stem the leaf bases form peg-like projections. The taxonomic position of such specimens is doubtful.

Occurrence. Blairmore group (upper flora), Alberta, locality 4020.

Types. Hypotype (?), G.S.C. No. 6662.

Cyparissidium ? *gracile* ? Heer

Plate LXVII, figure 2; Plate LXVIII, figures 2, 3, 6; Plate LXIX, figure 3

Description. Slender, leafy stems, branching at acute angles. Leaves, minute, appressed, spirally disposed, generally straight, rather abruptly contracted distally to relatively long, acicular apex. Midvein is obscure.

Remarks. The specimens were referred by Berry (1929, p. 55) to *Athrotaxopsis* or *Widdringtonites.* No cones similar to those of *Cyparissidium* have been found as yet in association, and the identification is consequently questionable. The vegetative shoots agree closely with *Cyparissidium gracile* Heer as described and figured by Seward and Conway (1935, p. 16, Pl. 4, fig. 19). The stems are commonly from 0.5 to 1 mm. diameter, and the leaves from 1 to 1.5 mm. long. The leaves are less elongate and less pointed than those of *Sequoia concinna*, and even their ends are appressed to the stem.

Occurrence. Blairmore group (upper flora), Alberta, localities 1247, 1249; Pasayten group, British Columbia, localities 3126, 3136; Kingsvale group, British Columbia, localities 3020, 3125.

Types. Hypotypes (?), G.S.C. Nos. 5846, 6642, 6643.

Elatocladus acifolia n. sp.

Plate LXX, figure 2; Plate LXXI, figure 4; Plate LXXIV, figure 6

Description. Leafy branches; branches, alternate to subopposite. Leaves, coriaceous, distichously arranged, needle-like, acutely pointed, decurrent, not constricted at base, 0.5 to 1.5 mm. wide and up to 2.5 cm. long, more or less triangular in cross-section, mainly straight, but some groups shorter and somewhat falcate, about 45 degrees to axis in young shoots, but commonly spreading almost at right angles in older shoots. Median nerve, rarely seen, but lower surface marked by an angular keel, and upper surface concave. Microscopic, transverse wrinkles are visible in some states of preservation.

Remarks. The species resembles closely *Sequoia rigida* Heer (1874, p. 80, Pl. 22, figs. 5g, 11a), but the leaves are more or less triangular in cross-section, and some, particularly at the base or near the insertion of branches, are somewhat falcate. Moreover, the original specimens described by Heer from the Kome of Greenland were considered by Seward (1927, p. 103) to belong to *Elatocladus smittiana* (Heer), a species to which the Canadian material bears slight resemblance.

Occurrence. Luscar formation, localities 1688, 1810, 1882, 2052, 2056, 2058, 2201, 3154, 3298, 3747, 3750, 3767.

Types. Holotype, G.S.C. No. 5244; paratypes, G.S.C. Nos. 5245, 6616.

Pagiophyllum magnifolium n. sp.

Plate LXX, figure 5; Plate LXXI, figure 1

Description. Sterile twigs, sparingly branched, with relatively stout axes. Leaves crowded, obliquely ascending, spirally disposed, very thick, elongate-triangular, decurrent, 15 to 20 mm. long by 6 to 9 mm. wide across expanded basal part, rapidly decreasing to an acuminate apex that may be somewhat falcate, provided with a rounded keel on lower surfaces, and marked commonly for some distance from the base by more or less well defined, longitudinal elevated lines; where leaves had broken off the leaf bases leave a rhomboid scar on the rachis.

Remarks. The species is believed to be conspecific with *Pachyphyllum crassifolium* Saporta (non Schenk) from Upper Jurassic rocks of France (Saporta, G. de, 1884, p. 655, Pl. 226, fig. 1). *Pachyphyllum crassifolium* Schenk (=*Pagiophyllum crassifolium*) (Schenk, 1871, p. 240, Pl. 40, fig. 8) is considered by the writer to be conspecific with *Elatides curvifolia* (Dunker) Nathorst. The latter species occurs abundantly in the Luscar formation of Alberta, but no gradational forms between it and the present species have been found. It is possible, however, that when cones are found, *Pagiophyllum magnifolium* may properly be assigned to *Elatides.*

Occurrence. Luscar formation, Alberta, locality 3335.

Types. Holotype, G.S.C. No. 6656; paratype, No. 6657.

Pagiophyllum sp. cf. *Sphenolepidium sternbergianum* (Dunker) Heer

Plate LXXI, figure 5

Remarks. A few branching slender shoots have leaves that differentiate them from *Athrotaxites berryi* or *Elatides curvifolia.* The leaves are spirally disposed, acutely pointed, about 2 or 3 mm. long by 0.5 to 1.5 mm. wide at base, decurrent, straight or slightly falcate, keeled on abaxial surface, mainly strongly ascending, although on the larger stems they may spread almost normal to the axis. In appearance the species closely resembles *Sphenolepidium sternbergianum,* but, as no attached cones have been found, assignment to that species is scarcely justified.

Occurrence. Blairmore group (lower flora), Alberta, locality 4027; Luscar formation, Alberta, locality 1883.

Types. G.S.C. specimen No. 5216.

Pagiophyllum ambiguum (Heer) Seward

Plate LXVIII, figure 1

Description. Branched, leafy shoots. Leaves sessile, spirally disposed, crowded, short, fleshy and stout, keeled on lower surface, acuminate, triangular, the largest 2 to 2.5 mm. at expanded base, and 3.5 to 4 mm. long, spreading nearly normal to axis, their apices narrowly pointed and commonly upturned giving a slight falcate appearance.

Remarks. The above description is based on a single, sterile specimen. It agrees closely with most of the Greenland specimens figured by Heer (1874, Pl. 21, figs. 1, 2, 3, 7, 8) and with a specimen figured by Seward (1927, Pl. 9, fig. 68), except that branching from one side of a main axis is more profuse. The leaves are smaller, shorter in proportion to the length, and less markedly falcate than those of *Pagiophyllum crassifolium* (Schenk) (1871, Pl. 40, fig. 8) from the German Wealden, which is much more like *Elatides curvifolia.*

Occurrence. Kingsvale group, British Columbia, locality 3020.

Types. Hypotype, G.S.C. No. 5854.

Pagiophyllum sp. A

Plate LXXII, figure 2; Plate LXXIV, figure 5

Description. Slender leafy shoots, sparingly to moderately branched at acute angles. Leaves spirally disposed, crowded, short and fleshy, subtriangular, slightly falcate, uninerved, with decurrent bases and acutely pointed tips, obliquely spreading, about 2.5 mm. long by 1.5 mm. at base.

Remarks. The specimens are too poorly preserved to be certain they are conspecific with *Pagiophyllum ambiguum* (Heer) (1874, p. 78, Pl. 21; Seward, 1927, p. 99, Pl. 9, fig. 68; Pl. 10, fig. 104), and the leaves are smaller than those of Heer's types.

Occurrence. Hazelton group, British Columbia, locality 3299; Kootenay formation, British Columbia, locality 3765; Nikanassin formation, Alberta, locality 3333.

Types. G.S.C. Nos. 5765, 6621.

Pagiophyllum sp. B

Plate LXX, figure 4

Remarks. A single sterile, leafy shoot from the Kingsvale group is indistinguishable from specimens commonly assigned to *Geinitzia reichenbachii* or *Sequoia reichenbachii* (Geinitz) Heer. The leaves are spirally disposed, decurrent, falcate, acutely pointed, about 9 mm. long by 1.75 mm.

broad at base. The leaves are thinner and narrower than those of *Elatides curvifolia*, and their decurrent bases form fusiform scars in contrast to the obovate-triangular, short and broad scars of *Elatides curvifolia*.

Occurrence. Kingsvale group, British Columbia, locality 3020.

Types. G.S.C. No. 5855.

Brachyphyllum crassicaule Fontaine

Plate LXXII, figure 4

Remarks. The material consists of only a single specimen and for a description and fuller illustration of the species the reader is referred to E. W. Berry (1911, p. 393, Pl. 64, figs. 1-6).

Occurrence. Blairmore group (upper flora), Alberta, locality 3065.

Types. Hypotype, G.S.C. No. 5862.

Nageiopsis striata n. sp.

Plate LXIX, figure 2; Plate LXX, figure 3

Nageiopsis sp. Berry, Nat. Mus., Canada, Bull. 58, p. 50, Pl. 8, fig. 7 (1929).

Description. Stems slender, branched. Leaves small, distichous or pseudo-distichous, sessile or with extremely short footstalk contracted to less than half maximum width at base where corners are well rounded, lanceolate, widest near base and gradually narrowing to obtuse or bluntly pointed apex, up to 14 mm. long by 2.5-3 mm. wide. Veins, six to eight, not forked except at base, subparallel, the outermost reaching lateral margins, the central ones reaching apex where they are only slightly convergent. Surface of pinnules, at least dorsal surface, marked by close, parallel striae, almost appearing as strong as the veins in some states of preservation.

Remarks. The form is much like *N. zamioides* Fontaine, emend. Berry (1911, p. 386, Pl. 62, figs. 1-2; Pl. 63), but not acuminate or sharply pointed at apex, and with striated lamina (cf. *Podozamites lanceolatus* Feistmantel in Seward, 1919, p. 453, fig. 813).

Occurrence. Blairmore group (lower flora), Alberta, localities 4027, 4033; Luscar formation, Alberta, locality 3296.

Types. Holotype, G.S.C. No. 5295; paratype, G.S.C. No. 4998 (figured specimen of Berry, 1929).

Podozamites lanceolatus (Lindley and Hutton) Schimper

Plate LXXII, figure 3; Plate LXXIII, figure 2; Plate LXXIV, figure 1

Podozamites lanceolatus Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 6, Pl. 1, fig. 3 (1886).
Podozamites lanceolatus Berry, Nat. Mus., Canada, Bull. 58, p. 45, Pl. 6 (1929).
Nageiopsis zamioides Berry (non Fontaine), op. cit., p. 49 (1929).
? *Podozamites latipennis* Berry (non Heer), op. cit., p. 59 (1929).

Description. Leafy shoots with pseudo-distichous, alternate, deciduous leaves. Leaves entire, attached spirally, but twisted onto one plane, up to 8 cm. or more long, 6 to 16 mm. wide, lanceolate, contracted more or less rapidly at base to 1-1.5 mm. at point of attachment, and more gradually or acuminately to narrowly obtuse or bluntly pointed apex. Veins, sub-parallel, crowded and forked in basal end of leaf, from 0.3 to 0.5 mm. apart in middle part. Surface of leaves and rachis marked by microscopic striae.

Remarks. The species is represented mostly as detached leaves. The largest axis seen with attached leaves was 5 mm. wide, others 2 to 2.5 mm. In no instance was the base of an axis observed with certainty, but one specimen, No. 577 (Pl. LXXIV, fig. 1 br.) shows obscurely an expanded basal end in close proximity to which, though not attached, is a small scale-like, subovate bract, about 5 mm. by 3 mm. Similar scales, microscopically striated, occur rarely elsewhere in association with detached leaves.

The specimens which Berry identified as *Podozamites latipennis* Heer (= *Pseudoctenis latipennis* Seward, 1925, p. 239), do not show the character of basal attachment of the pinnae, nor any anastomoses of the veins. Moreover, the pinnae are marked by microscopic striae parallel to the veins precisely as in *Podozamites lanceolatus*.

Occurrence. Kootenay formation, Alberta, localities 255, 256, 323, 1248, 2122, 2158, 3146, 3170, 3221, 4044, 4045, 4046, 4048; Kootenay formation, British Columbia, localities 274, 276, 1819, 2106, 3172; Nikanassin formation, Alberta, locality 1808; Luscar formation, Alberta, localities 384, 1233, 1688, 2151, 2153, 2277, 3296, 3332, 3334; Bullhead group, British Columbia, localities 1997, 3280, 3281, 3283, 3289, 3527; Blairmore group (lower flora), localities 1623, 1668; ? Blairmore group (upper flora), Alberta, locality 4020; Hazelton group, British Columbia, localities 3171, 3316.

Types. Hypotypes, G.S.C. Nos. 577, 6596 (Dawson's type specimen), 5278 (Berry's type specimen), 5279.

Podozamites corbinensis n. sp.

Plate LXXIV, figure 4; Plate LXXV

Description. Leafy shoots, so far as known, unbranched; axis slender, 2 or 3 mm. wide, obscurely ridged longitudinally, and microscopically striated. Leaves spirally attached, but twisted into one plane so as to appear distichous, inclined 25 to 60 degrees to main axis, 3 to 5 mm. broad and up to 9 cm. long, linear, almost parallel-sided, but gradually tapered distally to a bluntly acute apex, and contracting more rapidly to a width of about 1 mm. at locus of attachment. Veins subparallel, about 0.5 mm. apart, bifurcated near base of leaf. Surface of leaf, microscopically striated.

Remarks. The leaves are like those of *Nageiopsis angustifolia* Fontaine (1889, p. 202, Pl. 86, figs. 8, 9; Pl. 87, figs. 2-6; Pl. 88, figs. 1, 3, 4, 6-8; Pl. 89, fig. 2), but occur on apparently unbranched shoots. They differ in gross characters from *Podozamites lanceolatus* only in their more narrow, ribbon-like form. Superficially the species also resembles *Zamiophyllum buchianum* (Ettingshausen) Nathorst (Nathorst, 1890, Pl. 2, figs. 1-2; Pl. 3; Pl. 5, fig. 2), but are not semi-clasping to the axes. Detached leaves, owing to their resemblance to the last mentioned species, as well as to some species of *Phoenocopsis*, would be difficult of reliable classification.

Occurrence. Kootenay formation, Alberta, localities 1574, 1585; Kootenay formation, British Columbia, locality 1222.

Types. Holotype, G.S.C. No. 5277; paratype, G.S.C. No. 5274.

Desmiophyllum (*Podozamites* ?) sp.

Plate LXXII, figure 1; Plate LXXIII, figure 1

Remarks. Elongate, ribbon-like leaves, averaging about 5 cm. long by 3 to 6 mm. wide, constricted at base to short footstalk, almost parallel-sided for greater part of length, then gradually contracted to narrowly rounded apex. Veins simple, parallel, 0.3 to 0.5 mm. apart, with close, finer, interstitial striae. In one specimen (Pl. LXXIII, fig. 1) the leaves are disposed as if attached spirally to a common axis.

Occurrence. Blairmore formation (upper flora), localities 3065, 4114.

Types. G.S.C. Nos. 4829, 5863.

Podozamites ? stenopus ? Lesquereux

Plate LXVIII, figure 5

Podozamites stenopus Berry, Nat. Mus., Canada, Bull. 58, Pl. 10, fig. 3, 1929.

Remarks. The single specimen, which was identified by Berry as *Podozamites stenopus* Lesquereux, is actually too poorly preserved for even generic identification. It is 3.3 cm. long by 1.2 cm. broad below the middle of the leaf. It apparently had a narrow basal stalk of attachment. The veins, although parallel, are obscure.

Occurrence. Blairmore group (upper flora), Alberta, locality 1250.

Types. Hypotype (?), G.S.C. No. 6661.

Salix inaequalis ? Newberry

Plate LXXVI, figure 1

Remarks. A single, saliciform, entire leaf has a venation similar to that of *Salix inaequalis* Newberry (1895, p. 67, Pl. 16, fig. 1). Unfortunately, the tip of the blade is missing, and it is unknown whether it was acuminate. The midrib is relatively slender and somewhat flexuous. The petiole is also slender, although only a length of 3 mm. is preserved. The secondary veins are only faintly preserved, but ascend strongly subparallel with the margins.

Occurrence. Jackass Mountain group, British Columbia, locality 3517.

Types. Hypotype (?), G.S.C. No. 6648.

Populites dawsoni n. sp.

Plate LXXVII, figure 3; Plate LXXIX, figure 4; Plate LXXX, figure 5

Platanus affinis Dawson (non Lesquereux), Roy. Soc. Canada, Trans. 1885, sec. 4, p. 12, Pl. 4, fig. 2 (1886).

Description. Leaf, ovate to obovate, entire, petiolate. Petiole, where entire on one specimen, is 1.5 cm. long by 1 mm. wide. Apex of blade, broadly or obtusely rounded; base rounded to truncate and slightly cuneate on petiole. Venation, trinerved-pinnate. Median nerve, moderately strong, commonly slightly curved. Secondaries, rather evenly spaced, about 5 pairs, subopposite, the basal pair appearing as suprabasal, primary laterals, although not much thicker than succeeding pair; the secondaries are all craspedodromous, subparallel, and are inserted about 35 degrees to midrib; the primary laterals give off six or seven branches from the lower side, which may be mostly marginally camptodromous, or distal ones may run to margin. Tertiary veins, where preserved, platanoid. A pair of short basal veins may occur below the primary laterals.

Remarks. The form genus *Populites* was first used by Viviani (1833, p. 133, Pl. 10, fig. 2) for a crenulated margined leaf with palmate venation resembling a *Grewia*. Nevertheless, it was named after its resemblance to a poplar of the region, and the genus *Populites* was created on that account. Lesquereux (1874, p. 58) made use of the form genus for "leaves related by form and nervation to the genus *Populus*, from which, however, they differ by the generally entire, obtuse leaves, narrowed to the petiole, abruptly curving to it from a truncate or cordate base, or passing to it by a longer slightly decurring base; and especially by the more distinctly craspedodrome nervation, the lateral nerves and their essential divisions evidently running to the borders". The form genus thus used is convenient for differentiating certain forms of leaves from apparently related forms of *Platanophyllum* or *Platanus*. The Canadian leaf here under consideration rather closely resembles *Populites lancastriensis* Lesquereux (op. cit., p. 58, Pl. 3, fig. 1), which, however, is more orbicular and has more spreading secondaries, as well as undulating margins. The writer could find no basis for Dawson's statement that the margin of his specimens was distally dentate, and, although it is somewhat undulating, the margin has no definite crenae.

Occurrence. Blairmore group (upper flora), Alberta, localities 261, 1581, 4112.

Types. Holotype, G.S.C. No. 5109 (type of *Platanus affinis* Dawson, non Lesquereux); paratypes, G.S.C. Nos. 5108, 5118.

Ficus ovatifolia Berry

Ficus ovatifolia ? Berry, Nat. Mus., Canada, Bull. 58, p. 61, Pl. 9, figs. 1-5 (1929).

Remarks. The Canadian material consists of five imperfect specimens. All show suprabasal, primary laterals that have upwardly curved, camptodromous branches on their abaxial sides. The most complete specimen, G.S.C. No. 5882, shows several secondaries in upper half of leaf. Those tertiaries preserved are mainly percurrent, and agree well with those of *Ficus ovata* Newberry (= *F. ovatifolia* Berry) (Newberry, 1895, p. 70, Pl. 24, figs. 1-3). The base of all specimens is slightly decurrent on the petiole, while remaining part of base is truncate to rounded cuneate. Two specimens, G.S.C. Nos. 5882 and 5876, show imprints of abundant hairs, each about 2 mm. long.

Occurrence. Blairmore group (upper flora), localities 1250, 4022.

Types. Hypotypes, G.S.C. Nos. 5882 (Berry, 1929, Pl. 9, fig. 2), 5888 (ibid., fig. 3), 5884 (ibid., fig. 4), 5885 (ibid., fig. 5), missing (ibid., fig. 1).

Ficus fontainii ? Berry

Plate LXXIX, figure 2

Remarks. The material is inadequate for satisfactory identification. The secondary veins are more spreading than in the type specimen (Berry, 1919, p. 82, Pl. 11, fig. 3), but the inequilateral form and sub-lobed outline is comparable and quite distinctive. The venation resembles that of *Cordia apiculata* (Hollick) Berry.

Occurrence. Commotion formation, British Columbia, locality 3203.

Types. Hypotype (?), G.S.C. No. 6637.

Trochodendroides (*Cercidiphyllum* ?) *potomacensis* (Ward) n. comb.

Plate LXXI, figure 2; Plate LXXIV, figures 2, 3

Remarks. Berry's description of this species from the Patapsco formation was as follows: "Leaves of small size, orbicular to ovate in general outline, with an obtusely pointed apex and a broad, deeply cordate base, 2 cm. to 5.5 cm. in length by 2.2 cm. to 4 cm. in greatest width, which is in basal half of the leaf. Margin crenulate, entire in the basal sinus. Petiole stout. Midrib of medium calibre. Primaries 2 to 7 in number decreasing in calibre outward, inserted at the apex of the petiole, curving upward, camptodrome" (Berry, 1911a, p. 458).

Only two specimens are to hand from the Lower Cretaceous of Canada, one from the Kingsvale group and one from an upper part of the Blairmore group. The Kingsvale specimen, G.S.C. No. 5908 (Pl. LXXI, fig. 2), is evidently a small immature leaf; it has 7 primaries, a rather flatly cordate base, and a slightly pointed summit. The Blairmore specimen, G.S.C. No. 5904 (Pl. LXXIV, fig. 2), has only the lower half of the leaf preserved; there are 5 primaries, and the base is truncate. Six specimens of the species from the Cenomanian Dunvegan formation are contained in Survey collections, of which four have a definitely cordate base, one doubtful, although seemingly truncate, and one (G.S.C. No. 1085, Pl. LXXIV, fig. 3) definitely a truncate base like the Blairmore specimen. The normal outline for all these Canadian leaves is ovate-deltoid to orbicular like the Patapsco material. There is apparently no justification for considering them to belong to a separate species. They differ in form from *Cercidiphyllum ellipticum*, but resemble some variants of uppermost Cretaceous forms assigned to *Trochodendroides arctica* (Bell, 1949, Pl. 4, fig. 2; Pl. 9, fig. 4), as well as certain variants of the living *Cercidiphyllum japonicum* (Brown, R.W., 1939a, Pl. 51; two small leaves in centre).

Occurrence. Blairmore group (upper flora), Alberta, locality 3065; Kingsvale group, British Columbia, locality 3125.

Types. Hypotypes, G.S.C. Nos. 5904, 5908, 1085 (from Dunvegan formation).

Menispermites reniformis Dawson

Plate LXXVII, figure 4; Plate LXXVIII, figure 1

Menispermites reniformis Dawson, Roy. Soc. Canada, Trans. 1882-83, vol. 1, sec. 4, p. 23, Pl. 41, fig. 12 (1883).

Original description. "leaf broad, reniform, 11 centimetres broad and 7 centimetres in length, margins undulate. Five veined, but with two accessory veins, making seven in all".

Emended description. Leaf, semi-orbicular to semi-elliptical. Posterior margin, commonly cuneate at area of attachment, elsewhere nearly straight or broadly curved; upper margin, entire, slightly undulate. Veins, palmate from rounded top of petiole, generally seven primaries of nearly equal strength. Median primary, scarcely differentiated from the rest, nearly straight or more or less flexuous owing to deflection at junction with two or more (?) secondaries, appearing then as if dichotomously divided, running to, or almost to margin, perhaps dichotomously divided close to margin or curving there; the first secondary branches off slightly below, or well above the middle of leaf, dichotomosing distally. The two pair of primaries next to the median nerve, divide at least once by dichotomy or are deflected where giving off one or two abaxial branches. Lowest primaries, more or less parallel with lower margin of leaf or more oblique. Basal area of leaf at top of petiole is more or less infundibuliform. Petiole, of unknown length, leaf substance, thin, but firm.

Remarks. Dawson's type specimen, No. 5134 (Pl. LXXVII, fig. 4), which came from the Dunvegan formation, is slightly abnormal, being asymmetric, having four primaries on one side of median one and only two on other side; otherwise the type of venation agrees with other specimens. *Menispermites potomacensis* Berry differs in few essential features from *M. reniformis;* the primary veins of the larger figured specimen are less divided and less spreading than the type of *M. reniformis*, and the number of primaries in some of the Maryland leaves is greater.

Menispermites reniformis Hollick, pars (1930, p. 78, Pl. 42, fig. 6, non Pl. 43, fig. 1), *Castaliites flabelliformis* Hollick (1930, op. cit., Pl. 41, fig. 5) and *Castaliites ordinarius* Hollick (1930, op. cit., Pl. 41, fig. 7) are considered by the writer to be conspecific with *M. reniformis* Dawson. But the specimen illustrated by Hollick on Pl. 43, fig. 1 and assigned to *M. reniformis* is apparently conspecific with *Castaliites cordatus* Hollick, which is seemingly separable from *M. reniformis. Menispermites reniformis* ? Berry (1929, Pl. 10, figs. 1, 2) does not belong to Dawson's species.

Hedera primordialis Newberry, non Saporta (Newberry, 1895, Pl. 19, figs. 1, 9; Pl. 37, figs. 1-7) resembles *M. reniformis*, except that normally its leaves are rather deeply cordate.

Occurrence. Commotion formation, localities 3202, 3204, 3205; Pasayten group, locality 3126.

Types. Hypotype, G.S.C. No. 5889.

Menispermites potomacensis Berry

Plate LXX, figure 1; Plate LXXVII, figure 1

Description. Leaf, long-petiolate. Petiole, up to 4 cm. or more long, about 1 mm. broad. Blade, orbicular to oval, varying from wider than high to higher than wide; margin crenately undulate; apex, broadly rounded; base, very broadly cuneate, seemingly more rarely cordate. Venation, palmate, consisting of midrib and up to six lateral primaries on each side, all rather delicate, seemingly camptodromous close to margin. Finer veins, not preserved.

Remarks. The leaf agrees closely with Berry's types, except that the margins are crenate or crenulate rather than undulate. The species is rather doubtfully separable from *M. reniformis*, and mainly on the occurrence of a larger number of primary veins.

Occurrence. Kingsvale group, British Columbia, localities 3020, 3125, 3449; Commotion formation, British Columbia, locality 3204.

Types. Hypotypes, G.S.C. Nos. 5907, 6654.

Menispermites sp.

Plate LXXVI, figure 2

Remarks. A single fragment from an upper part of the Blairmore group has a deeply cordate base and seven primary palmate veins. Its veins are coarse and, so far as shown, straight.

Occurrence. Blairmore group (upper flora), Alberta, locality 3066.

Types. G.S.C. No. 550.

Menispermites ? sp.

Plate LXXVIII, figure 6

Remarks. Fragment of a large leaf which has a venation similar to that of *Menispermites.* The margin has apparently one or two low lobes. Comparison may be made with *Hedera obliqua* Newberry (1895, p. 113, Pl. 37, fig. 8; Pl. 38, fig. 5), which is perhaps only an aberrant leaf of *Hedera primordialis* Newberry, as noted by the author of the species.

Occurrence. Blairmore group (upper flora), Alberta, locality 3065.

Types. G.S.C. No. 5887.

Nelumbites sp.

Plate LXXI, figure 3

Remarks. A single fragment of a leaf is comparable to *Nelumbites tenuinervis* (Fontaine) Berry (1911a, p. 464, Pl. 82, figs. 1, 2), except that the primary veins are straighter and more numerous, being eleven in number. The finer veins are obscure although a few are seen joining the primaries almost at right angles.

Occurrence. Kingsvale group, British Columbia, locality 3449.

Types. G.S.C. No. 6655.

Magnolia ? sp.

Plate LXXX, figure 1; Plate LXXXII, figure 2

Magnolia magnifica Dawson pars, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 22, Pl. 3, fig. 11 (1886).

Remarks. A single specimen from Mill Creek, Alberta, was identified by Dawson with his *Magnolia magnifica* from the Dunvegan formation. The specimen is far too poorly preserved to justify any such identification. Obscure traces of several secondary veins occur, and these are more ascending than in the Dunvegan species; moreover, the midvein is very much thinner. About the only resemblance to *Magnolia,* therefore, is in the size and outline of the leaf. For purposes of comparison the type of *Magnolia magnifica* Dawson is reproduced in Pl. LXXIX, fig. 1, of this report.

Occurrence. Blairmore group (upper flora), Alberta, locality 1815.

Types. G.S.C. Nos. 5119, 6669.

Cinnamomoides ovalis (Dawson) n. comb.

Plate LXXVIII, figures 2, 3; Plate LXXXII, figure 3

Paliurus ovalis Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 14, Pl. 4, figs. 4, 8 (1886).
? *Paliurus montanus* Dawson, ibid., p. 14 (1886).
? *Cinnamomum canadense* Dawson, ibid., p. 13, Pl. 4, fig. 7 (1886).
? *Macclintockia cretacea* Dawson (non Heer), ibid., p. 13, Pl. 4, fig. 3 (1886).
Paliurus ovalis ? Berry, Nat. Mus., Canada, Bull. 58, p. 63 (1929).

Description. Leaf, coriaceous, elongated elliptical, the blade about 6 cm. long by 2.5 to 3.5 cm. wide, entire, petiolate, broadly or narrowly cuneate at base, and slightly decurrent on petiole; apex, seemingly obtusely pointed. Petiole, stout, 1.5 to 2 cm. long and 1.5 to 2 mm. broad. Midrib, also stout. Two opposite to subopposite, lateral primaries are given off generally well above the base, curving about parallel with margin and running well into upper half of the leaf; they are thinner than the midvein and rarely not preserved. Several camptodromous, alternate, strongly ascending secondaries may occur in upper half of leaf. Branches to primary laterals are scarcely distinguishable from tertiaries, except that they are more ascending and unite close to margin to form an apparent marginal vein. In addition, there is a pair of opposite, submarginal, basal veins. Tertiaries, at very open angles or normal to midrib and lateral primaries, divided or percurrent, forming a loose, transverse network.

Remarks. G.S.C. No. 5913 (Pl. LXXXII, fig. 3) best shows the tertiary veins. The majority divide at rather wide angles giving a somewhat irregular, transverse areolation. The midrib is strong in lower half of leaf, and longitudinally striate; the primaries are less strong, but similarly marked. G.S.C. No. 5121 (Pl. LXXVIII, fig. 2), one of Dawson's syntypes, has fewer of the veins preserved, but they are comparable to those of specimen No. 5913. *Cinnamomum canadense* Dawson and *Macclintockia cretacea* Dawson (non Heer) are too fragmentary for specific diagnosis, and the tertiary veins are not preserved. Dawson's figure 3 of the latter species is in error in showing a double pair of lateral primaries; it is reillustrated here in Pl. LXXVIII, fig. 3. These two specimens resemble *Cinnamomum newberryi* Berry (1911b, Pl. 16, fig. 3). Dawson's *Paliurus montanus* was based on a single specimen, likewise too imperfect for specific diagnosis; owing to apparent traces of secondaries lower down in the leaf than normal for *C. ovalis*, its inclusion in this species is questionable.

Occurrence. Blairmore group (upper flora), localities 255a, 1250, 1815, 3066; Kingsvale group, British Columbia, locality 3513; Crowsnest formation, Alberta, locality 3135.

Types. Syntype, G.S.C. No. 5121; hypotypes (?), G.S.C. Nos. 5111 (type of *Macclintockia cretacea* Dawson, non Heer), 5113 (type of *Cinnamomum canadense* Dawson), 5120 (type of *Paliurus montanus* Dawson), 5913.

Cinnamomoides sp.

Plate LXXXI, figure 2

Remarks. Although represented by too fragmentary material for specific designation, the species is apparently very close to if not identical with *Cinnamomum newberryi* Berry (1925, p. 75, Pl. 16, fig. 5).

Occurrence. Crowsnest formation, Alberta, locality 3135.

Types. G.S.C. No. 6640.

Capparites ? sp.

Plate LXXVIII, figure 4

Remarks. Material consists of only two specimens, both very small, apically emarginate, entire, coriaceous leaves with relatively very stout midrib. One of the specimens shows thin oblique secondaries branched distally, but whether these run to the margins or are camptodromous close to the margin could not be determined. Of described forms the species resembles most closely *Capparites cynophylloides* Berry (1919, p. 95, Pl. 22, fig. 1), which, however, is a very much larger form with distinctly camptodromous secondaries.

Occurrence. Pasayten group (upper part), British Columbia, locality 3126.

Types. G.S.C. No. 6641.

Platanus sp.

Plate LXXXI, figure 6

Platanus heeri Dawson (non Lesquereux), Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 12 (1886).

Remarks. The specimens are three lobed, and may best be compared with *Platanus latiloba* Newberry (1878, Pl. 2, fig. 4) but are too poorly preserved to be worthy of more than record of the occurrence of this form of platanoid leaves in late Lower Cretaceous floras of Western Canada.

Occurrence. Blairmore group (upper flora), Alberta, localities 255A, 1815; Pasayten group (upper part), British Columbia, locality 3127; Crowsnest formation, Alberta, locality 3134.

Types. G.S.C. No. 5106.

Celastrophyllum acutidens Fontaine

Plate LXXVIII, figure 5; Plate LXXX, figure 4;
Plate LXXXI, figure 1

Laurophyllum debile Dawson pars, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 13 (1886).

? *Myrica serrata* Penhallow, Roy. Soc. Canada, Trans. 1907, Ser. 3, vol. 1, sec. 4, p. 309, text-fig. 4 (1907); reprint in Geol. Surv., Canada, Mem. 38, Appen. B, p. 820, text-fig. 4 (1912).

? *Quercus flexuosa* ? Penhallow (non Newberry), Roy. Soc. Canada, Trans. 1907, Ser. 3, vol. 1, sec. 4, p. 309 (1907); reprint in Geol. Surv., Canada, Mem. 38, Appen. B, p. 820 (1912).

Remarks. Leaf elliptical, petiolate, having base cuneate on petiole, and apex bluntly acute to right-angled; margins more or less regularly crenodentate. Midrib, strong in lower three-fourths of blade, rapidly thinning to apex, commonly curved or somewhat flexuous; secondaries, at angle of about 45 degrees to midrib, obscure distally, but seemingly camptodromous; tertiary veins an irregular network partly oblique, partly at right angles to the secondaries. Leaf substance, firm, but not apparently coriaceous as in *Sapindopsis belviderensis*.

The type of *Laurophyllum debile* came from the Upper Cretaceous (Cenomanian) Dunvegan formation, and is an entire leaf. *Myrica serrata* Penhallow (Pl. LXXVIII, fig. 5) from the Pasayten group is too poorly preserved for specific recognition; it is seemingly a more coriaceous leaf than *Celastrophyllum acutidens*, and may belong to *Sapindopsis belviderensis*. *Quercus flexuosa* ? Penhallow (non Newberry) (Pl. LXXX, fig. 4), occurring also in the Pasayten group, is a petiolate, elliptical leaf, but too fragmentary to be assigned confidently to *C. acutidens* rather than to *Sapindopsis belviderensis*.

Occurrence. Blairmore group (upper flora), Alberta, localities 255A, 1264, 3065, 3066; Crowsnest formation, Alberta, locality, 3134; ? Pasayten group, British Columbia, locality 3321; ? Kingsvale group, British Columbia, locality 3452.

Types. Hypotypes, G.S.C. Nos. 5114, (?) 5818, (type of *Myrica serrata* Penhallow), (?) 5819, (?) 5820, (types of *Quercus flexuosa* ? Penhallow).

Rhamnites sp.

Plate LXXXIII, figures 2, 4; Plate LXXXV, figure 1

Remarks. The several specimens included here are all fragmentary, and none shows the apex. The leaves are entire, elliptical, about 2.5 cm. wide, of unknown length, although presumably about 7 cm.; base, cuneate; midrib, rather stout, prominent; secondaries, camptodromous, rather highly ascending and united by tertiaries that are mainly percurrent, although some are once divided, prominent, and oblique to the secondaries. The leaf resembles *Salix nervillosa* Heer (1867, p. 15, Pl. 1, fig. 3) from the Dakota group of Nebraska.

Occurrence. Jackass Mountain group, British Columbia, locality 3513.

Types. G.S.C. Nos. 6649, 6650, 6651.

Myrtophyllum boreale Seward and Conway

Plate LXXXII, figure 4

Remarks. The type (Seward and Conway, 1935, p. 24, Pl. 5, figs. 28, text-fig. 20) was based on a single fragment, and the material to hand comprises fragments of three leaves or leaflets that add nothing to the original description, except that the base of a leaf was cuneate. The leaves have a fairly thick midrib that gives off numerous secondaries at angles of 75 to 80 degrees, between these are subparallel segments of tertiaries that form an irregular network. The secondaries are campto-dromous close to the margins, where they are connected by a network of tertiaries rather than by defined loops; there is no indication of a marginal vein, and the venation may be compared with some fossil species referred to *Ficus*.

Occurrence. Kingsvale group, British Columbia, locality 3449.

Types. Hypotype, G.S.C. No. 6653.

Sapindopsis angusta (Heer) Seward and Conway

Plate LXXXI, figure 4; Plate LXXXIII, figure 3; Plate LXXXV, figure 5

Laurus crassinervis Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, pp. 10, 12, Pl. 3, figs. 3, 3a (1886).

Proteoides daphnogenoides Dawson (non Newberry), Roy. Soc. Canada, Trans. 1907, Ser. 3, vol. 1, sec. 4, p. 309 (1907); reprinted in Geol. Surv., Canada, Mem. 38, pt. 2, Appen. B, p. 820 (1912).

? *Quercus coriacea* Penhallow (non Newberry), Roy. Soc. Canada, Trans. 1907, Ser. 3, vol. 1, sec. 4, p. 309; reprinted in Geol. Surv., Canada, Mem. 38, pt. 2, Appen. B, p. 820 (1912).

Sapindopsis brevifolia ? Berry, Nat. Mus., Canada, Bull. 58, p. 54, Pl. 8, figs. 8, 9 (1929).

Sapindopsis magnifolia Berry, ibid., p. 64, Pl. 10, fig. 8 (1929).

Remarks. The leaves included here agree so closely with *Sapindopsis variabilis* Fontaine (1889, p. 298, Pl. 151, fig. 1; Pl. 152, figs. 1-4; Pl. 153, fig. 3; Pl. 154, figs. 2-4; Pl. 155, figs. 2-5) that there is little doubt that they are conspecific with that species. Berry (1911a, p. 474; 1922, p. 216) believed that *Sapindopsis brevifolia* Fontaine was simply a variant of *S. variabilis*, and that *S. magnifolia* Fontaine was so closely allied as to be possibly another variant (Berry, 1911a, p. 472). The writer would include all these forms in *Cassia angusta* Heer (=*Sapindopsis angusta*) (Heer, 1882, p. 101, Pl. 27, fig. 6), to which Seward and Conway had already attached *Sapindopsis variabilis*.

Berry's description of *Sapindopsis brevifolia* from the Patapsco formation applies very well to the Canadian species here under consideration; it was as follows:

"Leaves odd-pinnate, the terminal leaflet considerably larger than the lateral leaflets of which but two pairs are known. These are opposite. Leaflets somewhat crowded so that their margins often overlap, with subacute tips, varying in length from 2 cm. to 5 cm. and in width from 0.8 cm. to 1.6 cm., averaging about 3 cm. long by 1.3 cm. wide. Inequilateral toward the base and showing considerable variation in decurrence even among the few specimens known, in some the rachis is conspicuously winged while in others the leaflets are all petioled, the whole having the aspect of some member of the Leguminoseae. Midribs stout, secondaries ascending, camptodrome, seen with difficulty, since the leaf texture is coriaceous" (Berry, 1911a, p. 473).

The lateral veins in most of the Canadian material are concealed. Where revealed they are rather numerous, at wide angles to the prominent midvein, and curved abruptly upwards to union near the borders; the tertiaries where visible form an irregular network. The leaflets most commonly have short, slightly curved petioles, 2 to 8 mm. long. Specimen G.S.C. No. 5743, which was illustrated by Berry (1929, Pl. 8, fig. 9), is apparently a lobate terminal leaflet, and not two overlapping leaflets as interpreted by Berry; the specimen shows no evidence of crossed petioles as shown in Berry's drawing, and is re-illustrated on Pl. LXXXI, fig. 4, of this report.

Occurrence. Blairmore group (lower flora), Alberta, localities 2308, 4033; Blairmore group (upper flora), Alberta, localities 257, 1250, 1815, 3066; Pasayten group, British Columbia, locality 3321; Kingsvale group, British Columbia, localities 3449, 3513.

Types. Hypotypes, G.S.C. Nos. 4863 (type of *Laurus crassinervis* Dawson), 5112a (*Proteoides daphnogenoides* Dawson, non Heer), 5741 (Berry, 1929, Pl. 8, fig. 8), 5743 (Berry, 1929, Pl. 8, fig. 9), 5873 (Berry, 1929, Pl. 10, fig. 8).

Sapindopsis belviderensis Berry

Plate LXXXIV, figure 4

Sapindopsis belviderensis ? Berry, Nat. Mus., Canada, Bull. 58, p. 65, Pl. 9, fig. 6 (1929).

Remarks. The writer considers that the identification of the Canadian material with Berry's species is fully justified by the finding of another small fragment that shows the same type of dentition and particularly the characteristic venation.

Occurrence. Blairmore group (upper flora), Alberta, locality 1247.

Type. Hypotype, G.S.C. No. 5875.

Fontainea grandiflora Newberry

Plate LXXX, figure 3; Plate LXXXII, figure 1; Plate LXXXIII, figures 1, 6

Remarks. On account of the venation little doubt exists as to the correctness of the identification of the Canadian material with Newberry's species (Newberry, 1895, p. 96, Pl. 45, figs. 1-4). The only difference is the lack in the material to hand of definite dichotomous division of the terminal axis of a leaf, although the axis in G.S.C. No. 6639 (Pl. LXXXIII, fig. 1) divides almost dichotomously into two unequal divisions, that on the right carrying two leaflets, that on the left a single leaflet. Whether the division is dichotomous or lateral does not seem to be a character of specific importance. Newberry noted that on the axes that bore double terminal leaflets, single leaflets apparently existed in a lower position; this is certainly the case in G.S.C. No. 6632 (Pl. LXXXIII, fig. 6) in which a leaf-bearing axis has a bilobed terminal leaflet, whereas lower the axis shows on one side the basal parts of two single sessile leaflets. Leaflets to the extreme right on the same fragment of rock are more poorly preserved. They appear to represent a trilobate, terminal leaflet, and in a lower position on one side a single leaflet by its position is inferred to be attached to the same axis.

The midveins of the leaflets are stout, and the larger are longitudinally ridged; the midrib of the terminal leaflet may send off an oblique, lateral branch about as strong as itself. The secondaries are at very open angles to a right angle, are strong near the midrib, but are so thin close to the margin that, although they appear to curve upward, it could not be determined whether they were definitely camptodromous. The tertiaries are obscure, but appear to form a loose network similar to that figured by Newberry.

Occurrence. Blairmore group (upper flora), Alberta, localities 3065, 3066; Commotion formation, British Columbia, locality 3204; Commotion (?) formation, British Columbia, locality 3344.

Types. Hypotypes, G.S.C. Nos. 5900, 5901, 6632, 6639.

Araliaephyllum westoni (Dawson) n. comb.

Plate LXXXI, figures 3, 5; Plate LXXXIII, figure 5;
Plate LXXXIV, figures 2, 3

Aralia westoni Dawson, Roy. Soc. Canada, Trans. 1885, vol. 3, sec. 4, p. 14, Pl. 4, fig. 16 (1886).
Aralia rotundata Dawson, p. 4, Pl. 4, fig. 5 (1886).
Sterculia vetustula Dawson, ibid., p. 10, Pl. 3, fig. 2 (1886).
Liquidambar integrifolium Dawson (non Lesquereux), ibid., p. 13 (1886).

Description. Leaf, coriaceous, in external outline roughly hemispherical to a quadrant of a circle, stoutly petiolate; base, truncate, but cuneate or broadly cuneate to petiole, trilobed, with lateral lobes normally bilobate; sinuses between lobes narrowly to broadly rounded. The median lobe is commonly the largest. Midrib, stout and standing in relief; two lateral primaries about as stout as midrib, joining midrib at top of petiole or rarely suprabasal, normally dividing close to origin, and the branches running to apices of the lobes, the forward lobe generally broader and longer. Apices of all lobes, seemingly generally obtuse, although they may be subacute. Tertiary veins, at wide angles to main veins, rather closely spaced, those in lobes mostly joined close to margin giving appearance of a submarginal vein, particularly in the marginal sinuses, percurrent or divided, and united also by oblique branches giving a loose and rather irregular network. A few tertiaries are looped well within the margin, from which branches form a segment of smaller marginal loops. Owing to the coriaceous texture of the leaves, tertiaries commonly are poorly preserved, if at all.

Remarks. Dawson's figure of *A. westoni* was incorrectly drawn, for the specimen is palmately three veined and not five veined, and similar to other species of *Araliaephyllum.*

Sterculia vetustula Dawson was based apparently on a small or immature leaf; its apex was crushed, and Dawson's illustration is idealized. It is re-illustrated here on Pl. LXXXI, fig. 5. *Aralia rotundata* Dawson differs from normal leaves of the species in that all five lobes are cut into the upper third of the leaf, and do not vary greatly in size. In other leaves the lobe-dissection affects the upper half or more of the leaf.

Araliaephyllum crassinerve (Fontaine) Berry is considered by the writer to be conspecific with *A. westoni.*

Occurrence. Blairmore group (upper flora), localities 257, 1815, 3066; Pasayten group, British Columbia, locality 3137.

Types. Holotype, G.S.C. No. 5117; hypotypes, G.S.C. Nos. 4862 (*Sterculia vetustula* Dawson), 5110 (*Liquidambar integrifolium* Dawson, non Lesquereux), 5116 (*Aralia rotundata* Dawson), 5878, 5879, 5880.

Dicotylophyllum sp.

Plate LXXXIV, figure 1

Remarks. A single specimen of a coriaceous leaf, elongate elliptical, entire, 11.5 cm. long by 4 cm. wide at greatest breadth, which is about the middle. Apex, narrowly obtuse, and base, cuneate. Length of petiole, unknown. Midvein, moderately strong, but other veins immersed and not visible. The leaf in outline, dimensions and strength of midvein may be compared with *Magnolia glaucoides* Newberry (1895, p. 74, Pl. 57, figs. 1-4).

Occurrence. Blairmore group (upper flora), locality 3066.

Types. G.S.C. No. 6644.

Culmites sp. (Dawson) n. comb.

Cyperites sp. Dawson, Roy. Soc. Canada, Trans. 1892, vol. 10, sec. 4, p. 91, text-fig. 16 (1893).

Remarks. The generic name is here used, as suggested by A. C. Seward (1927, p. 114), for stems believed to be monocotyledonous. The material is restricted to the single specimen figured by Dawson. Dawson's drawing, however, is misleading, for his so-called leaves are apparently only irregularities brought about by crushing, so that convex strips overlap to some extent. The stem is marked by closely spaced, microscopic, parallel striations similar to those described by Seward for a specimen from the Kome beds of Greenland, which he called *Flabellaria* ? sp. (op. cit., p. 113, text-fig. 21). Some of the striae are considerably coarser than others, and in one place there is an appearance of an obscure nodal line.

Occurrence. Kootenay formation, Alberta, locality 1574.

Types. G.S.C. specimen No. 4831.

Phyllites sp.

Plate LXXVII, figures 2, 5

Description. Minute, leafy shoots; no branching observed. Leaves, entire, lanceolate, decurrent, seemingly spirally attached, but pseudodistichous, spreading to ascending, 2 to 4 mm. long by 1 to 1.5 mm. broad, tri-nerved, with midrib, which is continuous to apex, a little more pronounced than the laterals, which converge at base and apex. The laterals perhaps join the midrib in the decurrent part of leaf, but fade out close to apex before union.

Remarks. The material is too scanty for proper diagnosis. The bases of the leaves may even be clasping rather than simply decurrent. The substance of the stem appears to have been woody and not membranous, so that it is unlikely that the plant is a moss. At any rate, the venation suggests that of a higher plant more especially of a monocotyledon.

Occurrence. Luscar formation, Alberta, localities 4301, 4302, 4303, 4304.

Types. G.S.C. specimens Nos. 6622, 6623.

Antholithes sp. (Penhallow) n. comb.

Plate LXXX, figure 2

Dorstenia ? sp. Penhallow, Roy. Soc. Canada, Trans., Ser. 3, vol. 1, sec. 4, p. 310, text-fig. 5 (1907).

Remarks. As shown in Pl. LXXX, fig. 2, this specimen does not provide the description given by Penhallow. The peduncle is at least 12 mm. long; the truncated apex has a spine-like expansion on its right side, and the left side is broken; the surface is carbonized and rough, but no traces suggesting seeds could be observed. Its botanical relationship is unknown.

Occurrence. Pasayten group, British Columbia, locality 3321.

Types. G.S.C. No. 5829.

Antholithes sp.

Plate LXXIX, figure 3

Remarks. A single specimen consists of an axis, about 5 mm. long by 0.75 mm. broad, which at one end has a group of microsporangial-like segments arranged in a circle, and presumably forming part of a spherical cluster. Each segment is oblong, about 2.5 mm. long by 0.5 mm. broad, and is apparently a compressed cylindrical body, like pollen-sacs or small seeds. The carbonaceous surface is microscopically pustulose. The details of insertion of the segments could not be made out.

At the other end of the axis is an obscure circular cluster of elevations, about 3 mm. in diameter, which admittedly may be scales, but which otherwise may be the central part of a spherical cluster of segments like that described; if the last mentioned supposition be correct, the specimen may be compared with male fructifications of *Platanus.* It seems more probable, however, that the specimen belongs to *Sparganium.*

Occurrence. Blairmore group (upper flora), Alberta, locality 1264.

Types. G.S.C. No. 6664.

Index to Locality Numbers

Blairmore Group—Alberta
(lower flora; north to Bow River)

1242 Bragg Cr. west of Rangers station. Coll. G. S. Hume, 1927.
1245 Sec. 32, tp. 22, rge. 4, W. 5th mer. Coll. G. S. Hume, 1927.
1246 Castle R. near mouth Link Cr. Coll. F. H. McLearn, 1917.
1248 Near main entry Leitch colliery from near top of formation. Coll. F. H. McLearn, 1947.
1254 Moose Mt. area. Coll. D. D. Cairnes, 1905.
1255 Moose Mt. area. Coll. D. D. Cairnes, 1905.
1256 Moose Mt. area. Coll. D. D. Cairnes, 1905.
1257 Moose Mt. area. Coll. D. D. Cairnes, 1905.
1265 East slope Ma butte, 450 ft. above base of formation. Coll. F. H. McLearn, 1917.
2126 Moose Mt. area. Coll. D. D. Cairnes, 1905.
2156 South of Blairmore from head of small creek heading near Lyon Cr. Coll. W. W. Leach, 1912.
2157 One-half mile up Blairmore Cr. west of Blairmore. Coll. W. W. Leach, 1912.
2198 Upper part of Pincher Cr., sec. 1, tp. 5, rge. 1, W. 5th mer. Coll. J. S. Stewart.
2308 Castle R. north bank at Paint mine east of Cole ranch. Coll. F. H. McLearn, 1917.
3057 =1265.
3063 Mill Cr. area. Coll. C. O. Hage, 1940.
3064 Pincher Cr., 300 to 400 feet above base of formation. Coll. C. O. Hage, 1940.
3065 Mill Cr. area from beds above those of loc. 3063. Coll. C. O. Hage, 1940.
3067 Mill Cr., n.w. sec. 25, tp. 5, rge. 2, W. 5th mer. near centre of formation above Horne sandstone equivalent. Coll. C. O. Hage, 1940.
3175 Sheep Cr. above Maccabee Cr. Coll. G. S. Hume, 1925.
3313 Moose Mt. area. Coll. D. D. Cairnes, 1905.
3608 Borehole, Taber Province No. 1 well, l.s.d. 9, sec. 18, tp. 9, rge. 10, W. 4th mer. at depth 3125 to 3143 ft. Coll. R. T. D. Wickenden, 1946.
4025 East slope Ma butte, 1305 ft. above base of formation or 545 ft. below top. Coll. F. H. McLearn, 1917.
4026 East slope Ma butte, 1250 ft. above base of formation or 600 ft. below top. Coll. F. H. McLearn, 1917.
4027 East slope Ma butte, 1220 ft. above base of formation or 630 ft. below top. Coll. F. H. McLearn, 1917.
4028 East slope Ma butte, 720 ft. above base of formation or 1130 ft. below top. Coll. F. H. McLearn, 1917.
4029 East slope Ma butte, 690 ft. above base of formation or 1160 ft. below top. Coll. F. H. McLearn, 1917.
4030 East slope Ma butte, 450 ft. above base of formation or 1400 ft. below top. Coll. F. H. McLearn, 1917.
4031 North bank Castle R. at Paint mine east of Cole ranch, probably several hundred feet below top of formation. Coll. F. H. McLearn, 1917.
4033 North bank Castle R. east of Hell Gate canyon, and west of cable foot bridge on Carbon Hill property from approx. 800 ft. above base of formation. Coll. F. H. McLearn, 1917.
4035 York Cr., upper part, 200 ft. above base or 1650 ft. below top of formation. Coll. F. H. McLearn, 1917.
4036 Lower part York Cr. south of railway and west of Blairmore, from beds 800 ft. above base of formation. Coll. F. H. McLearn, 1917.
4037 York Cr., lower part, south of the railway and west of Blairmore. Coll. F. H. McLearn, 1917.

Blairmore Group—Alberta
(Bow R. to North Saskatchewan R.)

1623 Ram R. Coll. C. S. Evans, 1928.
1624 South Ram R. forks, north side. Coll. C. S. Evans, 1928.
1625 Ram. R. Coll. C. S. Evans, 1928.
1626 Ram R. 40 ft. below coal seam. Coll. C. S. Evans, 1928.
1627 Ram R. Coll. C. S. Evans, 1928.

1628 Ram R. below forks and east of canyon. Coll. C. S. Evans, 1928.
1629 Ram R. Coll. C. S. Evans, 1928.
1667 Panther R. at coal seam on north side. Coll. C. S. Evans, 1928.
1668 Panther R. at first coal seam. Coll. C. S. Evans, 1928.
1669 Panther R. southwest of loc. 1668. Coll. C. S. Evans, 1928.
1670 Panther R. Coll. C. S. Evans, 1928.
1673 Panther R. Coll. C. S. Evans, 1928.
1727 Red Deer R. just east of Red Deer Ranger station. Coll. C. S. Evans, 1928.
2249 Red Deer R. Coll. C. S. Evans, 1928.
2452 Borehole No. 25 Canmore, at depth 1789 to 1794 ft. Coll. R. T. D. Wickenden.
3142 Marble Mt. area, Willson Cr. trib. to James R. Coll. H. H. Beach, 1941.
3160 Ram-Panther Rivers area. Coll. C. S. Evans, 1928.
3174 Red Deer R. Coll. C. S. Evans, 1928.
3745 Clearwater R. Coll. Imperial Oil Co., 1947.
3747 Ram R. Coll. Imperial Oil Co., 1947.
3748 Ram. R. Coll. Imperial Oil Co., 1947.
3749 Ram R. Coll. Imperial Oil Co., 1947.
3767 Thornton Cr. Coll. Imperial Oil Co., 1947.
3773 Borehole, Hudson Bay-Delhi-Cessford well No. 21 at depth 3304.5 ft., l.s.d. 7, sec. 14 tp. 25, rge. 12, W. 4th mer. Coll. R. T. D. Wickenden, 1952.
3827 Joachim Cr., Grande Cache area. Coll. R. Thornsteinson, 1948.
3828 Goat Cliff, Grande Cache area. Coll. R. Thornsteinson, 1948.

Blairmore Group—Alberta
(*Luscar formation*)

324 In draw just north of Miette Mt. 1 mile south of Pocahontas. Coll. J. A. McLennan, 1915.
340 Smoky R. area. Coll. J. McVicar, 1916.
341 Smoky R. area, P. Isenburg coal claim, near 17 ft. coal seam. Coll. J. McVicar, 1916.
347 Solomon Cr. from Grigsby coal claim. Coll. J. McVicar, 1916.
384 Russell McAllister coal claim at head McLeod R. Coll. D. B. Dowling, 1909.
1203 South bank Saskatchewan R. in line with Bighorn range. Coll. D. B. Dowling, 1906.
1233 Brûlé coalfield. Coll. B. R. McKay, 1927.
1234 Jasper Park, above 1 ft. coal and 95 ft. below 15 ft. cgl. Coll. E. M. Kindle, 1927.
1266 =347.
1269 =341.
1270 =340.
1558 Jasper Park, Drummond's coal crop near Folding Mt. Coll. D. B. Dowling, 1911.
1560 Pocahontas, Jasper Park, from waste dump coal mine. Coll. E. M. Kindle, 1927.
1610 Mountain Park, about 500 ft. above cgl. Coll. B. R. McKay, 1924.
1611 East Mt. Cr. 80 ft. above Cadomin cgl. Coll. B. R. McKay, 1929.
1688 Pocahontas. Mixed lot, partly from loc. 1611, partly from fault-zone adjacent to Cadomin cgl. Coll. B. R. McKay, 1928.
1689 =1233.
1868 Junction of Cabin Cr. and Grey R. about 100 ft. west of cabin and 100 ft. above Cadomin cgl. Coll. B. R. McKay, 1928.
1881 Cadomin; about 1,500 ft. from top of cgl. along R.R. cut at Cadomin. Coll. B. R. McKay, 1924.
1882 Cadomin; about 1,000 ft. from top of cgl. Coll. B. R. McKay, 1924.
1883 Cadomin; about 100 ft. from top of cgl. Coll. B. R. McKay, 1924.
1907 About 1 mile north of Mt. Park, 200 ft. above Cadomin cgl. Coll. B. R. McKay, 1924.
2052 Brûlé coalfield; 650 ft. above Cadomin cgl. at Cadomin. Coll. B. R. McKay, 1928.
2053 Luscar mine, Brûlé coalfield. Coll. B. R. McKay, 1928.
2054 Wildhay R. Coll. B. R. McKay, 1928.
2056 =1883.
2058 Creek flowing south into McLeod R. opp. mile post 29 and 35 ft. above Cadomin cgl. Coll. B. R. McKay, 1928.
2134 Smoky R., 100 ft. above 8 ft. coal seam on Abbot Cr., east of Grande Cache. Coll. B. R. McKay.
2138 Smoky R., first creek north of Gustave Flats, 120 ft. above cgl. and 50 ft. above 7 ft. coal seam. Coll. B. R. McKay.

2151 Brûlé coalfield; 425 ft. north of Cadomin cgl. crossing R.R. Coll. B. R. McKay, 1928.
2152 Brûlé coalfield; 450 ft. above Cadomin cgl. Coll. B. R. McKay, 1928.
2153 Creek flowing southwest into McLeod R. opp. mile post 29 and 150 ft. above Cadomin cgl. Coll. B. R. McKay, 1928.
2168 Cadomin, Brûlé coalfield. Coll. B. R. McKay, 1928.
2169 McLeod R. Coll. B. R. McKay, 1928.
2201 =1868.
2234 Mt. Park, close to and probably overlying Cadomin cgl. Coll. B. R. McKay, 1919.
2235 Mt. Park, just above Cadomin cgl. Coll. B. R. McKay, 1919.
2277 Trail Cr., Bighorn basin. Coll. G. S. Malloch, 1908.
2282 North of Roche Miette and 1 mile south of Pocahontas. Coll. J. A. McLennan, 1915.
2491 Smoky R. area. Coll. J. McVicar, 1916.
2492 Smoky R. Coll. J. McVicar, 1916.
2493 Smoky R. Coll. J. McVicar, 1916.
2494 Smoky R. Coll. J. McVicar, 1916.
3058 Wawa map-area. Coll. B. R. McKay, 1940.
3148 =1882.
3152 Wildhay R. Coll. B. R. McKay, 1928.
3154 McLeod R., mile post 29. Coll. B. R. McKay, 1928.
3162 Smoky R. area; sec. 2 or 4, tp. 57, rge. 7, W. 6th mer. Coll. D. B. Dowling.
3163 =1611.
3168 =1611.
3180 Brûlé coalfield. Coll. B. R. McKay, 1929.
3181 Nordegg; Brazeau collieries, west of No. 3 coal seam. Coll. J. S. Stewart, 1916.
3182 Nordegg; west of No. 3 coal seam. Coll. J. S. Stewart, 1916.
3183 Mt. Park; R.R. creek, a short distance beyond end of R.R. track. Coll. J. S. Stewart, 1916.
3184 Mt. Park, north of Mt. Harris. Coll. J. S. Stewart, 1916.
3193 =2052.
3194 Jasper Park; Pocahontas, above spring trail to Punch bowl. Coll. E. M. Kindle, 1927.
3296 Borehole, Nordegg. Coll. J. S. Stewart, 1916.
3298 Jasper Park collieries. Coll. J. D. Dowling, 1911.
3307 Smoky R. on Grande Cache Mt. Coll. H. H. Beach, 1943.
3332 North branch, Upper Big Berland R. on Forty Foot Falls Cr. Coll. H. H. Beach, 1944.
3334 Walton Cr. from lower and middle parts of formation. Coll. H. H. Beach, 1944.
3335 Wildhay R. at Carson Cr. Coll. H. H. Beach, 1944.
3337 North branch, Upper Big Berland R., 2 miles above mouth of Forty Foot Falls Cr. Coll. H. H. Beach, 1944.
3340 Little Berland R., Moon Cr. map-area. Coll. J. Spivak, 1944.
3361 Oldhouse Cr., Brûlé coalfield, 300 ft. upstream from road to sawmill. Coll. A. H. Lang, 1944.
3495 North tributary of Lower Lynx Cr. Coll. O. A. Erdman, 1943.
3506 On ridge about 2 miles above mouth of south fork of Wildhay R. and ¾ mile to south, about 150 ft. from top of formation. Coll. C. O. Hage.
3530 Prine Cr., 1,200 ft. upstream from old Solomon coal tunnels. Coll. A. H. Lang, 1945.
3531 Solomon coal prospect, near head of Prine Cr. Coll. A. H. Lang, 1945.
3532 Abandoned coal mine, Prine Cr. Coll. A. H. Lang, 1945.
3723 Forty-one Mile Cr., Moon Cr. map-area. Coll. E. J. W. Irish, 1947.
3750 Gregg R. Coll. Imperial Oil Co., 1947.
3812 Bean Cr. A la Peche map-area. Coll. E. J. W. Irish, 1948.
3908 Adolphus Cr. Grand Cache area. Coll. R. Thornsteinson, 1949.
4301 Borehole No. 52, Brûlé coalfield, at depth 241 ft., about 3 ft. above Jewell coal seam. Coll. G. L. Kidd, 1952.
4302 Borehole No. 52, Brûlé coalfield, at depth 156.9 ft., about 24 ft. above Jewell coal. Coll. G. L. Kidd, 1952.
4303 Borehole No. 52, Brûlé coalfield at depth 160.7 ft., about 18 ft. above Jewell coal. Coll. G. L. Kidd, 1952.
4304 Borehole No. 52, Brûlé coalfield at depth 70.8 ft., about 93.5 ft. above Jewell coal seam. Coll. G. L. Kidd, 1952.

Blairmore Group—Alberta
(upper flora, Blairmore area)

255A Middle Branch, North Fork Oldman R. (=Oldman R. above Livingstone R.). Coll. G. M. Dawson, 1883.
257 North Branch, North Fork Oldman R. (=Livingstone R.). Coll. G. M. Dawson, 1883.
261 Mill Cr. Coll. G. M. Dawson, 1881.
1247 York Cr. below dam, about 260 ft. below top of formation. Coll. F. H. McLearn, 1917.
1249 York Cr. below thick sandstone at first dam on Blairmore water supply system. Coll. F. H. McLearn, 1917.
1250 York Cr. about 180 ft. below top of formation. Coll. F. H. McLearn, 1917.
1264 Ma butte, 45 ft. below top of formation. Coll. F. H. McLearn, 1917.
1581 =261.
1582 Mill Cr. Coll. T. C. Weston, 1883.
1815 =1582.
3065 Mill Cr. area. Coll. C. O. Hage, 1940.
3066 Mill Cr., 2 to 4 ft. below top of formation. Coll. C. O. Hage, 1940.
3708 Upper Highwood R. approx. sec. 15, tp. 17, rge. 6, W. 5th mer. on west bank of river just beyond west border of Mt. Head map-area from beds, 15 ft. below contact with Blackstone formation. Coll. R. J. W. Douglas, 1947.
4020 York Cr. below dam, about 175 ft. below top of formation. Coll. F. H. McLearn, 1917.
4021 Link Cr. just above confluence with Castle R., about 80 ft. below top of formation. Coll. F. H. McLearn, 1917.
4022 Ma butte, about 45 ft. below top of formation. Coll. F. H. McLearn, 1917.
4023 Link Cr. just above confluence with Castle R., about 20 ft. below top of formation. Coll. F. H. McLearn, 1917.
4112 Northwest Branch, North Fork Oldman R. (=Oldman R. above Livingstone R.). Coll. G. M. Dawson, 1883.
4114 =4112.

Bullhead Group—British Columbia
(Gething formation and other non-marine beds)

1997 South bank Peace R. canyon, above Gething Cr., from lower part of Gething formation. Coll. F. H. McLearn, 1937.
2299 Peace R. canyon, Gething formation. Coll. F. H. McLearn, 1937.
3091 Kenuseo Cr., north bank, below Honeymoon Cr., at crossing of trail from upper Muskeg Cr. to Monkman highway, about 35 miles southwest of Alta.-B.C. boundary, where it crosses Red Willow R. Coll. E. M. Speaker, 1940.
3092 Kenuseo Cr., south bank, below Honeymoon Cr. bridge, from exposure ¼ mile above that of loc. 3091, and stratigraphically below. Coll. E. M. Speaker, 1940.
3095 Stinking Cr. about ½ mile south of 16th base line at head of narrow gorge. Coll. E. M. Speaker, 1940.
3166 About 1½ miles above Gething coal mine on coal claim No. 1042. About 280 ft. above Grant coal seam. Coll. C. M. Sternberg, 1930.
3167 About ¾ mile above Gething coal mine, from roof of coal seam. Coll. C. M. Sternberg, 1930.
3208 Large cliff on Dunlevy Cr. at canyon about 6 miles above mouth. Coll. H. H. Beach, 1942.
3209 North branch of Dunlevy Cr. about 1,000 ft. above junction. Coll. H. H. Beach, 1942.
3210 Gething mine on Peace R. canyon. Coll. H. H. Beach, 1942.
3211 Middle branch of Gething Cr. west of Peace R. Coll. H. H. Beach, 1942.
3213 Monkman Pass. Coll. F. H. McLearn, 1942.
3279 South of coal occurrence No. 2 on Hasler Cr. Coll. J. Spivak, 1943.
3280 Prospect pit near Grizzly Bear Cr. Coll. J. Spivak, 1943.
3281 Foot-wall of Hasler Cr. coal mine, 34 ft. from hanging-wall of main coal seam. Coll. J. Spivak, 1943.
3283 Willow Cr. below falls. Coll. J. Spivak, 1943.
3288 South of Hasler Cr. coal mine on east side of creek. Coll. J. Spivak, 1943.
3289 Willow Cr. directly below first falls below camp. Coll. J. Spivak, 1943.

3290 North side Pine R., 2,560 ft. west of Crassier Cr. along trail at elev. 2,040 ft. Coll. J. Spivak, 1943.
3394 Eleven Mile Cr., 0.4 miles below forks. Coll. W. H. Mathews, 1944.
3520 Head of Peace R. canyon, below Peace R. coal mine. Coll. W. H. Mathews, 1945.
3522 Pine R., 1 mile west of Crassier Cr. Coll. W. H. Mathews, 1945.
3526 Beaudette Cr., 2½ miles above mouth. Coll. W. H. Mathews, 1945.
3631 In creek south of Wolverine R. and thought to be above a cobble cgl. Coll. O. A. Erdman, 1946.
3634 On ridge about 3 miles north of Wapiti L. just above cobble cgl. Coll. O. A. Erdman, 1946.
3636 Wapiti-Murray R. area; Upper Ferguson Cr. Coll. O. A. Erdman, 1946.
3642 Wapiti-Murray R. area. Coll. O. A. Erdman, 1946.
3665 Along skyline ridge leading west from Mt. Omega, 2 miles west of B.C.-Alta. boundary and 3 miles north of Narraway R. Coll. L. D. Burling, 1946.
4016 North bank of Peace R. canyon, between mouths of Gething and Johnson Creeks and probably near middle of Gething formation. Coll. F. H. McLearn, 1917.
4017 North side of valley of Peace R. canyon, possibly about halfway between Milligan pt. and Grant flat. Near middle of Gething formation. Coll. F. H. McLearn, 1917.
4018 North bank of Peace R. canyon, between Milligan pt. and Grant flat, near middle of Gething formation. Coll. F. H. McLearn, 1917.
4019 North bank of Peace R. canyon, below Milligan pt. and above middle of Gething formation. Coll. F. H. McLearn, 1917.

Bullhead or *Blairmore Group*—Alberta

3604 100 ft. above massive cgl. cliff of loc. 3605. Coll. L. D. Burling, 1945.
3605 450 ft. below massive cgl. cliff east of B.C.-Alta. boundary trail where it crosses to an east-west mountain ridge north of Kakwa R. valley. Coll. L. D. Burling, 1945.
4308 In shale series below upper Bullhead rocks in an unnamed mountain forming crest of Smoky R. valley about 8 miles west of mouth of Sheep Cr. and 4 miles east of Mt. Hammell. Coll. L. D. Burling, 1946.
4309 In a thinly-bedded series with coal seams near summit of peak at north end of Coal Ridge, 1 mile east of B.C.-Alta. boundary at about lat. 54°10′ north. Coll. L. D. Burling, 1946.
4310 Twenty feet below a coal seam which is 30 ft. below a massive cgl. in ridge connecting peak of loc. 4309 with a cgl.-capped peak to south. Coll. L. D. Burling, 1946.
4311 Coal ridge in saddle southwest of loc. 4309, and 75 ft. below massive cgl. which underlies beds of loc. 3604. Coll. L. D. Burling, 1946.

Commotion Formation—British Columbia

3202 Commotion Cr. about 150 ft. northeast of falls, about 40 ft. above cgl. Coll. R. T. D. Wickenden, 1942.
3203 Commotion Cr. about ¾ mile above falls in west bank below fault. Coll. R. T. D. Wickenden, 1942.
3204 Same as loc. 3203, but from beds 20 ft. above fault. Coll. R. T. D. Wickenden, 1942.
3205 =3202.
3344 Narraway River, about 1½ miles above mouth of Torrens River in Mt. Torrens map-area. Coll. A. J. Goodman, 1944.

Crowsnest Formation—Alberta

3134 Baker's Cr. tributary to Pincher Cr., l.s.d. 6, sec. 35, tp. 4, rge. 1, W. 5th mer. Coll. C. O. Hage, 1941.
3135 Baker's Cr. Coll. C. O. Hage, 1941.

Hazelton Group—British Columbia

26 Mountains north of McDonald Cr. Groundhog coal basin. Coll. G. S. Malloch, 1912.
31 Ridge between middle and north forks of Ross Cr., Groundhog coal basin. Coll. G. S. Malloch, 1912.
32 Head of Langlois Cr., Groundhog coal basin. Coll. G. S. Malloch, 1912.
387 New Hazelton, section A. Coll. J. J. O'Neill, 1917.
388 New Hazelton, section B. Coll. J. J. O'Neill, 1917.

389 New Hazelton, section C. Coll. J. J. O'Neill, 1917.
390 New Hazelton, section D. Coll. J. J. O'Neill, 1917.
391 Buckley R. canyon between low level and high level bridges, New Hazelton. Coll. J. J. O'Neill, 1917.
392 Upper road to Silver Standard mine, approx. 3,000 ft. north of forks of road, New Hazelton. Coll. J. J. O'Neill, 1917.
393 On upper road to Silver Standard mine, approx. 5,500 ft. north of forks of road, New Hazelton. Coll. J. J. O'Neill, 1917.
394 Same road as loc. 393, approx. 8,000 ft. north of forks of road, New Hazelton. Coll. J. J. O'Neill, 1917.
395 Near lower road to Silver Standard mine, 300 ft. east of junction with cross road from Harris Ranch road to lower Silver Standard road, New Hazelton. Coll. J. J. O'Neill, 1917.
397 From boulder on Babine trail, ½ mile east of Comel mining claims, and approx. 6 miles east of Hazelton. Coll. J. J. O'Neill, 1917.
836 Lake Kathlyn coal mine, Smithers. Coll. F. A. Kerr, 1934.
842 Goathorn Cr., Telkwa R. Coll. W. W. Leach, 1907.
1556 Groundhog coal basin, from sandstone below cgl. at top of measured section. Coll. G. S. Malloch, 1911.
1557 Skeena bridge, Yukon trail, Groundhog coal basin. Coll. G. S. Malloch, 1911.
1800 Yukon trail, Groundhog coal basin. Coll. G. S. Malloch, 1911.
1801 Twenty Mile Mt. north of Hazelton. Coll. W. W. Leach, 1910.
2136 Clappan Mt., Groundhog coal basin. Coll. G. S. Malloch, 1912.
2137 Mountain east of Kluayetz L., Groundhog coal basin. Coll. G. S. Malloch, 1912.
2160 Mountain west of Shaunec L., Groundhog coal basin. Coll. G. S. Malloch, 1912.
2276 Kluayetz L., Groundhog coal basin. Coll. G. S. Malloch, 1912.
2278 No. 4 of measured section, Groundhog coal basin. Coll. G. S. Malloch, 1911.
2279 No. 31 of measured section, Groundhog coal basin. Coll. G. S. Malloch, 1911.
2280 Beirnes Cr., Groundhog coal basin. Coll. G. S. Malloch, 1911.
2303 =26.
2304 West slope, Goat Mt., Groundhog coal basin. Coll. G. S. Malloch, 1911.
2306 Mountain at end of ridge between Beirnes Cr. and Currier Cr., Groundhog coal basin. Coll. G. S. Malloch, 1912.
2307 Ridge south of Kluayetz L., Groundhog coal basin. Coll. G. S. Malloch, 1912.
2325 Southwest side of Seven Sisters Mt., 9 miles from Cedarville at elev. 4,800 ft. Coll. E. D. Kindle, 1936.
2374 South side of Glacier gulch near Smithers, above and below coal of L. Kathlyn. Coll. E. D. Kindle, 1936.
2386 Hazelton area from Ridge L. at elev. 6,220 ft. Coll. J. G. Gray, 1938.
2387 Hazelton area. Coll. J. G. Gray, 1938.
2388 Hazelton area, from head of Salmon R. Coll. J. G. Gray, 1938.
2390 Hazelton area. Coll. J. G. Gray, 1938.
2391 =2386.
2392 Hazelton area. Canyon Cr., Skeena R. valley. Coll. J. G. Gray, 1938.
2393 =2392.
2394 =2392.
2395 =2390.
2401 Hazelton area, Buckley R. below Monceton. Coll. J. G. Gray, 1938.
2404 Suskwa R., 1½ miles below Twenty Mile Cr. Coll. J. E. Armstrong, 1938.
2405 Cirque, east face of Quad Mt. group. Coll. J. E. Armstrong, 1938.
2406 South face of Quad Mt. group. Coll. J. E. Armstrong, 1938.
2407 Suskwa R., ½ mile below Twenty Mile Cr. Coll. J. E. Armstrong, 1938.
2408 One and one-half miles up Twenty Mile Cr. Coll. J. E. Armstrong, 1938.
2409 Suskwa R., ½ mile above Twenty Mile Cr. Coll. J. E. Armstrong, 1938.
2410 Peak north of Twenty Mile Cr. between forks 7 miles to north. Coll. J. G. Gray, 1938.
2411 Ridge running east from Rup Mt. group. Coll. J. E. Armstrong, 1938.
2412 West bank Suskwa R. Coll. J. E. Armstrong, 1938.
2413 Creek flowing into Skeena R. opp. Hazelton. Coll. J. E. Armstrong, 1938.
2414 Fan Mts., Hazelton area. Coll. J. E. Armstrong, 1938.
2415 Road cut south of Juniper Cr. at Skeena Crossing. Coll. J. E. Armstrong, 1938.
2416 West bank Kispiox R. at Seventeen Mile bridge. Coll. J. E. Armstrong, 1938.
2417 West bank Skeena R., 7 miles above mouth Kispiox R. Coll. J. E. Armstrong, 1938.
2418 Two miles below Seventeen Mile bridge on Kispiox R. Coll. J. E. Armstrong, 1938.

2419 Two miles up Campbell Cr. from Kispiox R. Coll. J. E. Armstrong, 1938.
2420 Buckley R. canyon from argillite in banded tuff. Coll. J. E. Armstrong, 1938.
3008 Gramaphone Cr., 1 mile east of road, Smithers area. Coll. A. H. Lang, 1939.
3027 Mouth of Kitsgeucla R., south side. Coll. E. D. Kindle, 1939.
3165 Mountain west of Sharmes L., Groundhog coal basin. Coll. G. S. Malloch.
3169 Alex Mt., Groundhog coal basin. Coll. G. S. Malloch.
3171 =32.
3191 Creek south of Halfway House between second and third cabins. Coll. G. S. Malloch, 1911.
3297 One mile northeast of Cedarville. Coll. E. D. Kindle, 1936.
3299 =2374.
3300 Talus, 200 yds. south of Bulkley Valley collieries, Goathorn Cr., Smithers area. Probably about 200 ft. above coal seam. Coll. E. J. Lees, 1936.
3303 =3300.
3304 Glacier gulch, Hudson Bay Mt. Coll. E. J. Lees, 1936.
3305 Lake Kathlyn coal mine, Smithers area. Coll. M. Bancroft, 1936.
3306 Below Kathlyn glacier on Hudson Bay Mt. Coll. G. Hanson.
3316 =2374.
3317 Rock quarry on C.N.R., 1½ miles south of Cedarville. Coll. E. D. Kindle, 1937.
3318 =3304.
3319 Little Cedar R., Smithers area. Coll. G. Hanson, 1922.
3832 Kluakag branch of Skeena R., just north of mouth of Discovery Cr., Groundhog coal basin. Coll. A. F. Buckham, 1948.
3836 Float from Kluayetz branch of Skeena R., Groundhog coal basin. Coll. A. F. Buckham, 1948.
3837 Discovery Cr., just below upper tunnel, Groundhog coal basin. Coll. A. F. Buckham, 1948.
3893 Ridge north of Currier Cr., Groundhog coal basin. Coll. J. E. Muller, 1949.
3896 On trail near hogsback on west slope of Table Mt., Groundhog coal basin. Coll. J. E. Muller, 1949.

Jackass Mountain Group—British Columbia

3511 West side of Fraser R. valley, ½ mile north of Lytton. Coll. K. C. McTaggart, 1945.
3512 At Fraser L. level, west side of Fraser R., opp. Lytton C.N.R. station. Coll. K. C. McTaggart, 1945.
3513 Below highway, ¾ mile north of mouth of Stein R. on east side Fraser R. Coll. K. C. McTaggart, 1945.
3514 On road west side Fraser R. directly west of Lytton. Coll. K. C. McTaggart, 1945.
3515 On road, ¼ mile south of loc. 3514. Coll. K. C. McTaggart, 1945.
3517 Ferry Landing, east side Fraser R., ¾ mile north of Lytton. Coll. K. C. McTaggart, 1945.
3716 East side Fraser R., ½ mile south of C.N.R. bridge at Lytton. Coll. K. C. McTaggart, 1947.
3718 One hundred and fifty yards west of mouth of Fountain Cr., Ashcroft area. Coll. K. C. McTaggart, 1947.

Kingsvale Group—British Columbia

3020 West bank Coldwater R. opp. Kingsvale. Coll. H. M. A. Rice, 1939.
3125 Kingsvale. Coll. H. M. A. Rice, 1941.
3270 C.P.R., 1 mile east of Brookmere. Coll. H. M. A. Rice, 1943.
3449 Three miles up Shakan Cr., tributary to Nicola R. Coll. S. Duffell, 1945.
3452 Two miles north of Nuaitch Cr. on railway. Coll. S. Duffell, 1945.

Kootenay Formation—Alberta
(north to Bow River)

35 Maple Leaf coal mine, near Bellevue. Coll. W. W. Leach, 1912.
255 Middle Branch, North Fork Oldman R. (=Oldman R. above Livingstone R.), about 14 miles above mouth of Livingstone R. Coll. G. M. Dawson, 1883.
256 North Fork Oldman R. (=Oldman R. above mouth Crowsnest R.). Coll. G. M. Dawson, 1883.
1248 Above No. 1 coal seam, Byron Cr. mine at Passburg. Coll. F. H. McLearn, 1917.
1585 Moose Mt. area. Coll. D. D. Cairnes, 1905.
1589 Canmore coal mines. Coll. Dr. Hayden, 1891.

1630 Wabash oil well near Kananaskis—at depth 958 ft. Coll. C. S. Evans, 1928.
1642 =35.
1643 Hillcrest mine. Coll. W. W. Leach, 1912.
2106 Greenhill, Elk R. Coll. D. B. Dowling, 1905.
2122 Moose Mt. area. Coll. D. D. Cairnes, 1905.
2158 =35.
2311 York Cr. 15 ft. below coal seam near mine. Coll. F. H. McLearn, 1917.
3146 =2311.
3147 Pekisko Cr. area; south side Greenfield Cr., 11,000 ft. upstream from mouth of Pekisko Cr. Coll. C. O. Hage, 1939.
3153 York Cr. below coal mine, south bank and 5 ft. below ss. near base of formation. Coll. F. H. McLearn, 1915.
3170 Sheep R. canyon C. Coll. ?.
3221 Dyson Cr. area, tp. 18, rge. 5, W. 5th mer. from upper part of South Coal Cr. Coll. C. O. Hage, 1942.
3235 =1589.
3702 Cat Cr., Highwood R. Coll. W. A. Bell, 1946.
3709 Mt. Head area, approx. sec. 12, tp. 17, rge. 6, W. 5th mer. from Cat Cr., base of No. 8 (Douglas) coal seam at adit about 320 ft. above base of formation. Coll. R. J. W. Douglas, 1947.
3710 Mt. Head area, approx. sec. 33, tp. 19, rge. 5, W. 5th mer. from 'eastern band' of formation west of Highwood Range nr. eastern end of second switchback on bull-dozer cuts. Near base of formation. Coll. R. J. W. Douglas, 1947.
3711 Mt. Head area, approx. sec. 31, tp. 19, rge. 5, W. 5th mer. from Basil Cr. fault slice or western band of formation at east end of cut 7, from beds close to top of lower part of formation. Coll. R. J. W. Douglas, 1947.
3712 =3711.
3804 Sec. 28, tp. 23, rge. 9, W. 5th mer. Coll. M. M. B. Crockford, 1947.
3805 Sec. 3, tp. 23, rge. 9, W. 5th mer. Coll. M. M. B. Crockford, 1947.
3806 Sec. 28, tp. 23, rge. 9, W. 5th mer. Coll. M. M. B. Crockford, 1947.
3807 Ridges, Wind Mt. Coll. M. M. B. Crockford, 1947.
3808 Zone A, Highwood R. Coll. M. M. B. Crockford, 1947.
3809 Marsh prospect, Wind Ridge. Coll. M. M. B. Crockford, 1947.
4038 Castle R. south bank Carbon Hill property of Well's ranch. Coll. F. H. McLearn, 1917.
4039 Castle R. south bank, at lower horizon than that of 4038. Coll. F. H. McLearn, 1917.
4040 Forks of McGillivary Cr. Coll. F. H. McLearn, 1917.
4041 Hell Gate on Castle R., estimated to be 25 ft. from base of formation. Coll. F. H. McLearn, 1917.
4042 South of Blairmore and west of old Blairmore mine, from middle part of formation. Coll. F. H. McLearn, 1917.
4043 Three hundred feet below top of Hell Gate section on Castle R. near middle of formation. Coll. F. H. McLearn, 1917.
4044 McGillivray ridge from middle part of formation or about 300 ft. below top. Coll. F. H. McLearn, 1917.
4045 South of Blairmore and west of old Blairmore mine, from beds below second thick ss. and about 160 ft. below top of formation. Coll. F. H. McLearn, 1917.
4046 Nez Percé Cr. below dam, estimated 150 ft. below top of formation. Coll. F. H. McLearn, 1917.
4047 York Cr., 45 ft. below coal seam near mine, about 150 ft. below top of formation. Coll. F. H. McLearn, 1917.
4048 York Cr., 15 ft. below coal seam near mine, about 120 ft. below top of formation. Coll. F. H. McLearn, 1917.
4049 Hillside above main tunnel of Maple Leaf mine, estimated 100 ft. below top of formation. Coll. F. H. McLearn, 1917.
4050 Lyon Cr., about 2 miles south of Blairmore, and 5 ft. below top of formation. Coll. F. H. McLearn, 1917.
4051 Lyon Cr., about 2 miles south of Blairmore, and 3 ft. below top of formation. Coll. F. H. McLearn, 1917.
4052 Mill Cr. close to Link mine. Coll. C. O. Hage, 1940.
4410 Sec. 34, tp. 23, rge. 9, W. 5th mer. Tributary of Pigeon Cr. Coll. M. M. B. Crockford, 1948.
4411 Sec. 5, tp. 22, rge. 8, W. 5th mer. Coll. M. M. B. Crockford, 1948.

Kootenay formation—British Columbia

104 Flathead R., Corbin area. Coll. J. O. MacKenzie, 1914.
274 Coal Cr., Crowsnest Pass. Coll. G. M. Dawson, 1883.
276 Martin Cr., Crowsnest Pass. Coll. G. M. Dawson, 1883.
279 Branch of Elk R. Coll. G. M. Dawson, 1884.
1222 Corbin, about 15 ft. below large coal seam at No. 6 mine. Coll. B. R. McKay, 1930.
1579 =274.
1819 Michel station. Coll. G. M. D. McEvoy, 1900.
2093 Corbin, from mine dump. Coll. B. R. McKay, 1929.
2105 Elk R. at mouth of Aldridge Cr. Coll. D. B. Dowling, 1905.
2106 Greenhills, Elk R. Coll. D. B. Dowling, 1905.
2309 =2093.
2310 Corbin. Coll. B. R. McKay.
3172 Crowsnest Pass Coal Co. Roof No. 3, seam Michel. Coll. B. R. McKay, 1933.
3751 Coal Cr., Elk cgl. member, 2,602 to 2,652 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3752 No. 9 coal seam, south side of Coal Cr., 1,915 ft. above base of 'passage beds' to Jurassic. Coll. C. B. Newmarch, 1947.
3753 Coal Cr., Elk cgl. member, 3,346 to 3,351 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3754 Coal Cr., Elk cgl. member, 2,539 to 2,547 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3755 Elk cgl. member, north side of Coal Cr., 2,426 to 2,433 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3756 Coal Cr., 1535 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3757 Coal Cr., Elk cgl. member, 2,321 to 2,334 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3758 Coal Cr., 1,097 to 1,109 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3759 Coal Cr., 1,705 ft. above base of 'passage beds'. Coll. C. B. Newmarch, 1947.
3846 Corbin strip mine, Fernie. Coll. C. B. Newmarch, 1948.
3847 Baldy strip mine, Fernie. Coll. C. B. Newmarch, 1948.
3949 Above Baldy strip mine, Fernie. Coll. C. B. Newmarch, 1948.

Leckie Group—British Columbia

4305 Tyaughton R. area. Coll. C. H. Crickmay, 1939.
4401 Tyaughton R. area. Coll. C. H. Crickmay, 1939.

Nikanassin Formation—Alberta

346 North Wildhay R. from J. Errington coal claim. Coll. J. McVicar, 1915.
1267 Smoky R. Coll. J. McVicar, 1916.
1808 Thornton Cr., Mt. Park area; 3,300 ft. downstream from R.R. crossing and beneath Cadomin cgl. Coll. F. H. McLearn, 1919.
2055 Brûlé coalfield; 25 ft. below Cadomin cgl. Coll. B. R. McKay, 1928.
2139 Redmond Cr. near bend, about 3,000 ft. north of limestone contact. Coll. B. R. McKay, 1929.
3161 Creek flowing south into McLeod R. opp. mile post 29, and 65 ft. below Cadomin cgl. Coll. B. R. McKay, 1928.
3185 Mile Twenty-six Cr., McLeod R., traverse by J. S. Stewart, 1916.

Nikanassin ? Formation—Alberta

1192 Panther R., Alberta. Coll. C. S. Evans, 1928.
3310 Grande Cache Mt. north side Smoky R. Coll. H. H. Beach, 1943.
3333 Carson Cr. tributary to Wildhay R. Coll. H. H. Beach, 1944.

Pasayten Group—British Columbia

3126 North side Hope-Princeton highway, 1600 ft. west of loc. 3129 and at elev. 4,810 ft. Coll. H. M. A. Rice, 1941.
3127 Near crest of northwest spur of mountain, northeast of Chuwanten Cr., about 2 miles southeast of loc. 3129, at elev. 6,950. Coll. H. M. A. Rice, 1941.

3128 North side Hope-Princeton highway, 800 ft. northeast of loc. 3129, at elev. 4,000 ft. Coll. H. M. A. Rice, 1941.
3129 North side Hope-Princeton highway, 2 miles east of Chuwanten Cr. and just east of small creek entering Similkameen R. Coll. H. M. A. Rice, 1941.
3136 Above Hope-Princeton highway, about 1.2 miles northeast of Chuwanten Cr. at elev. 5,380 ft. Coll. H. M. A. Rice, 1941.
3137 Above Hope-Princeton highway, 800 ft. west of loc. 3129, at elev. 4,700 ft. Coll. H. M. A. Rice, 1941.
3139 South side of Similkameen R., 1 mile east of creek entering river and 0.7 miles east of Chuwanten Cr. Coll. H. M. A. Rice, 1941.
3320 At elev. 6,750 ft., 400 yards southeast of 6,900 ft. mountain peak, 2 miles north of International Boundary line and about 3 miles west of Pasayten R. Coll. R. A. Daly, 1905.
3321 At elev. 4,200 ft. on east side Chuwanten Cr. canyon, about 400 yards north of International Boundary. Coll. R. A. Daly, 1905.

Spence Bridge Group—British Columbia

3173 Pimainus Hills. Coll. C. W. Drysdale, 1912.
3456 Thompson siding on C.P.R., Thompson R. near junction with Nicoamen R. Coll. S. Duffell, 1945.

Tantalus Formation—Yukon Territory

316 Nordenskiöldi R. Coll. J. B. Tyrrell, 1898.
372 Mt. Bush, Wheaten R. district. Coll. D. D. Cairnes, 1915.
374 Tantalus coal mine. Coll. D. D. Cairnes, 1916.
3177 Tantalus coal mine. Coll. J. R. Johnston.

Uslika Formation—British Columbia

3519 Vega Cr., long. 125°15′ west and lat. 56°7′ north. Coll. J. E. Armstrong, 1945.
3838 Vega Cr., 6,200 ft. upstream from road crossing. Coll. E. F. Roots, 1948.
3839 Vega Cr., 2,500 ft. upstream from Aiken L. road crossing, long. 125°14½′ west, lat. 56°6½′ north. Coll. E. F. Roots, 1948.

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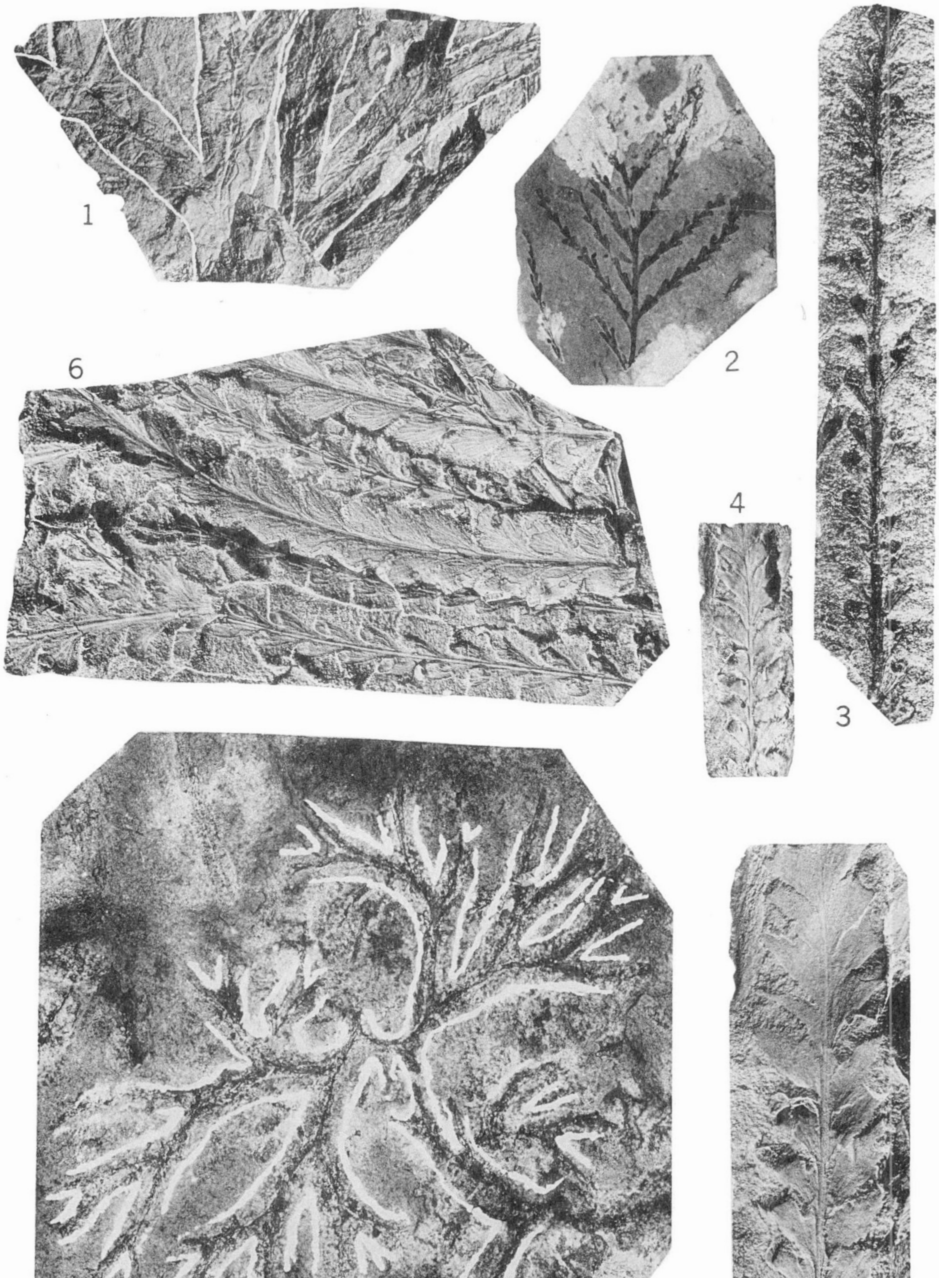

PLATE II

PLATE II

Figure 1. *Coniopteris brevifolia* (Fontaine). Hypotype, G.S.C. No. 4017 x 4. Luscar formation, loc. 1233. (Page 47)

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Figure 6. *Coniopteris brevifolia* (Fontaine). Hypotype, G.S.C. No. 4006. Kootenay formation, loc. 2158. (Page 47)

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Plate IV

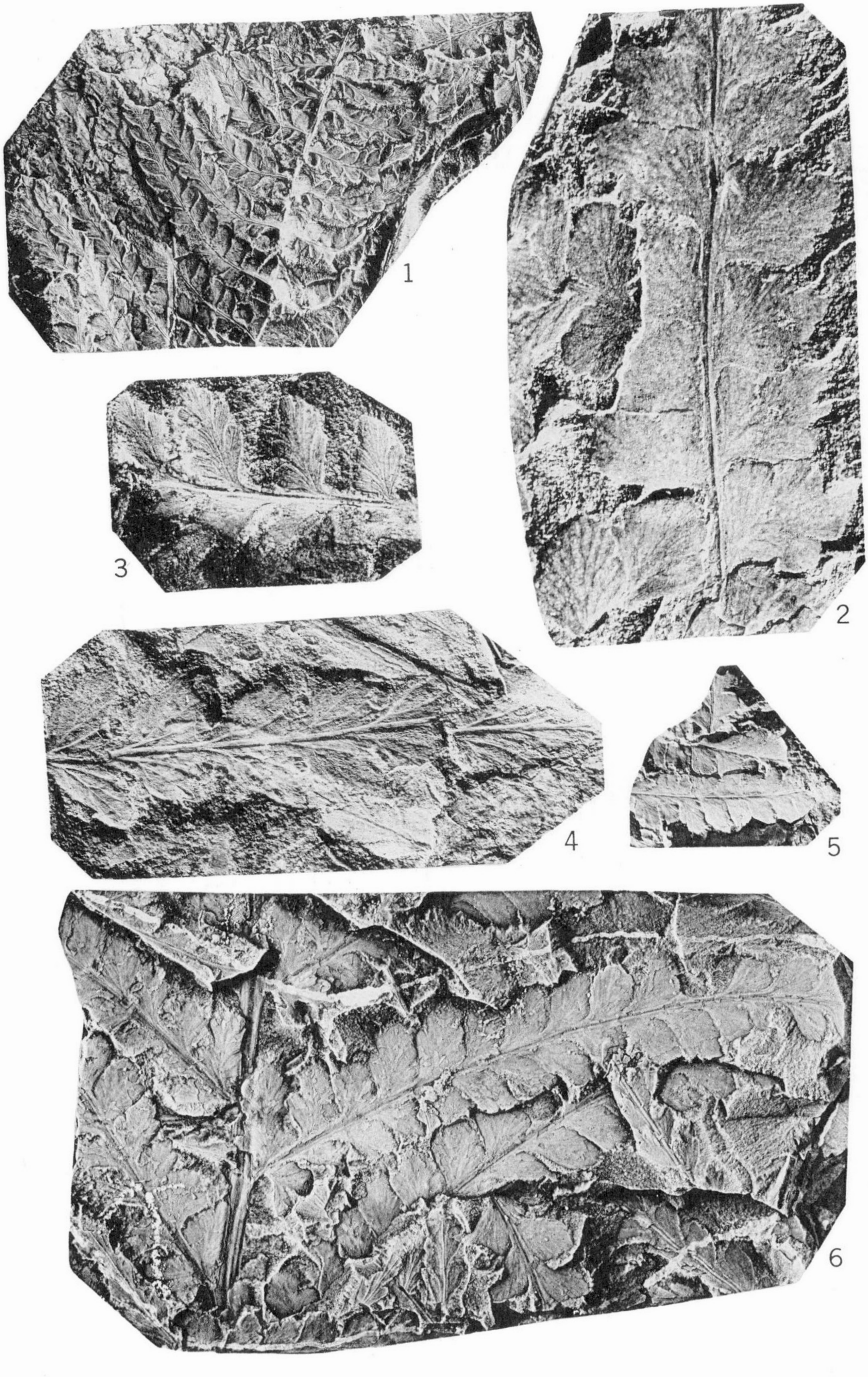

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Figure 2. *Coniopteris yukonensis* n. sp. Paratype, G.S.C. No. 6568 x 4. Tantalus formation, loc. 374. (Page 48)

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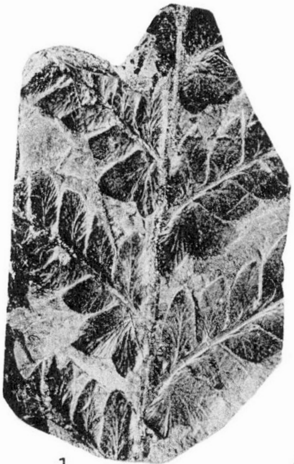
Figure 4. *Coniopteris berryi* n. sp. Holotype, G.S.C. No. 5357 x 4. Bullhead group, loc. 4018. (Page 49)

PLATE V



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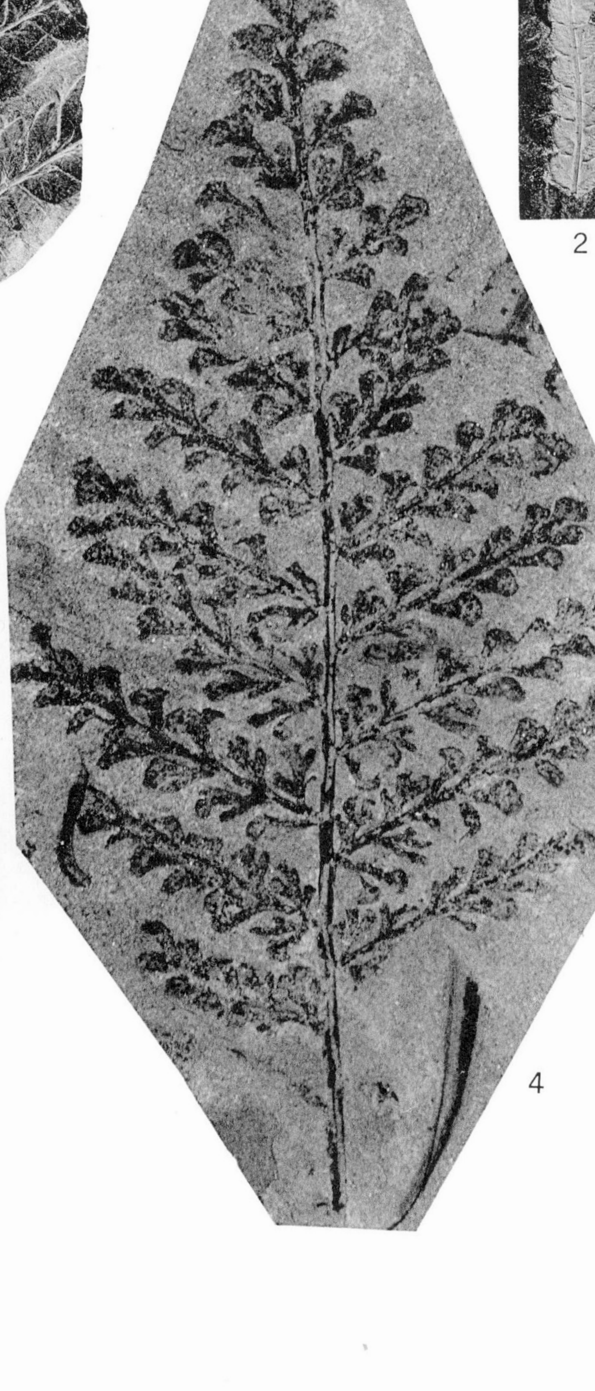

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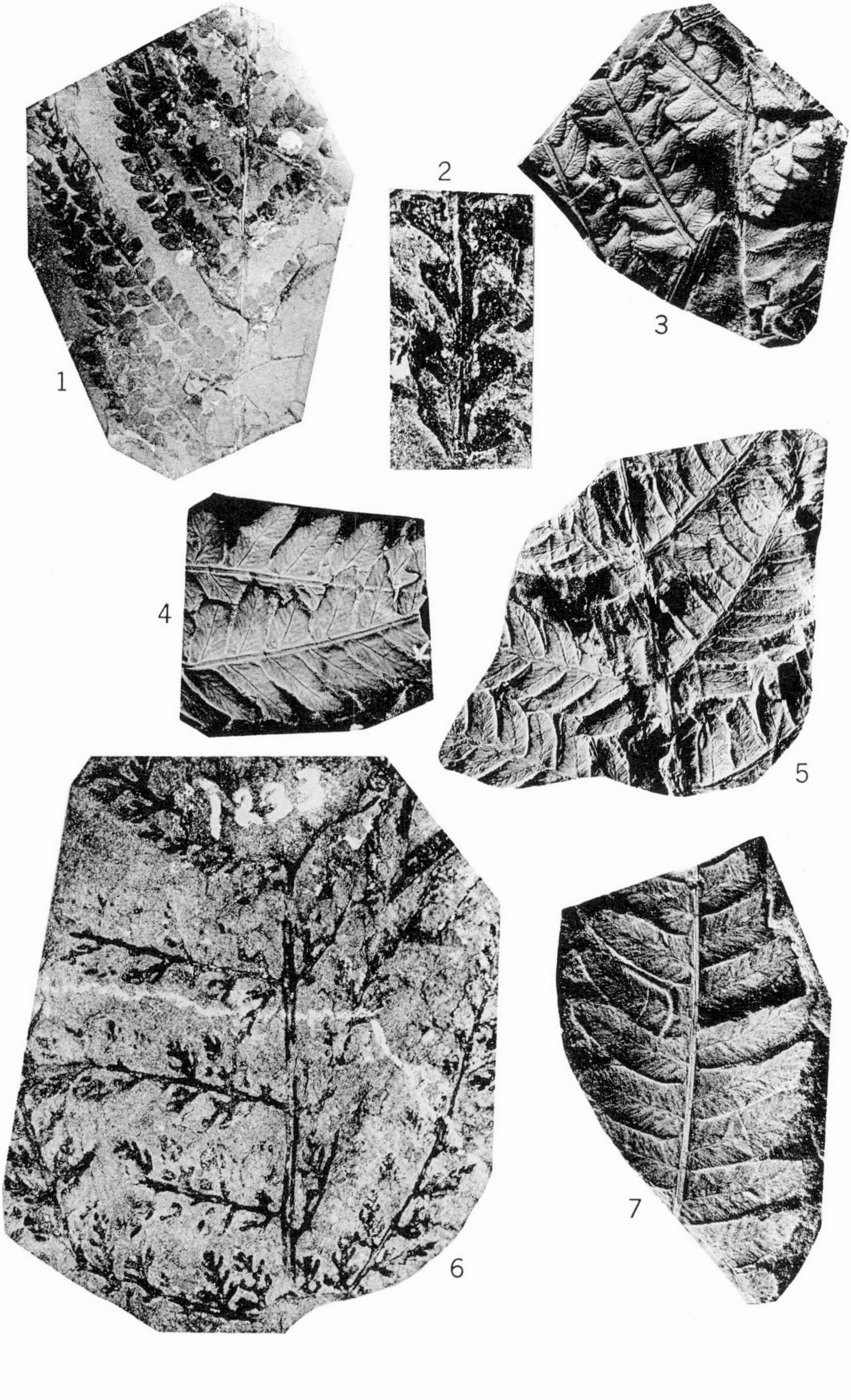

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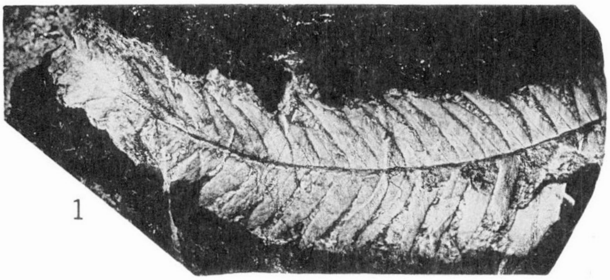

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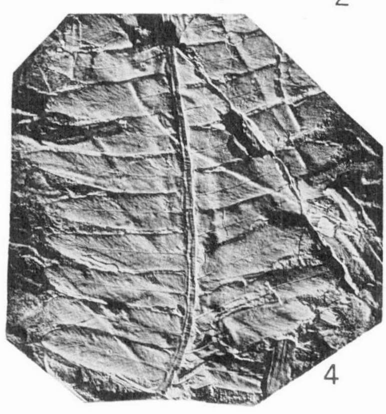

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Plate VIII

PLATE VIII

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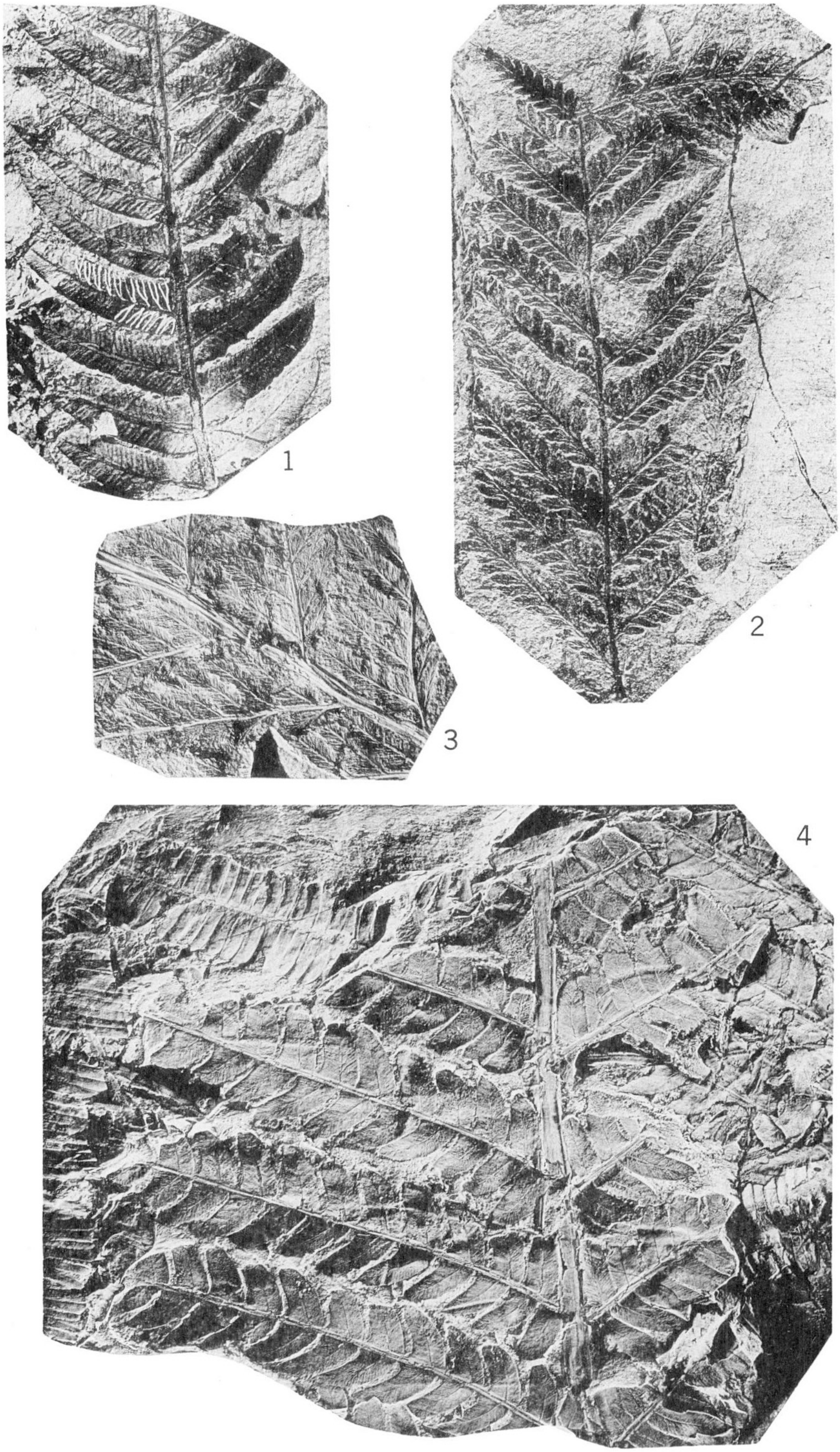

Plate X

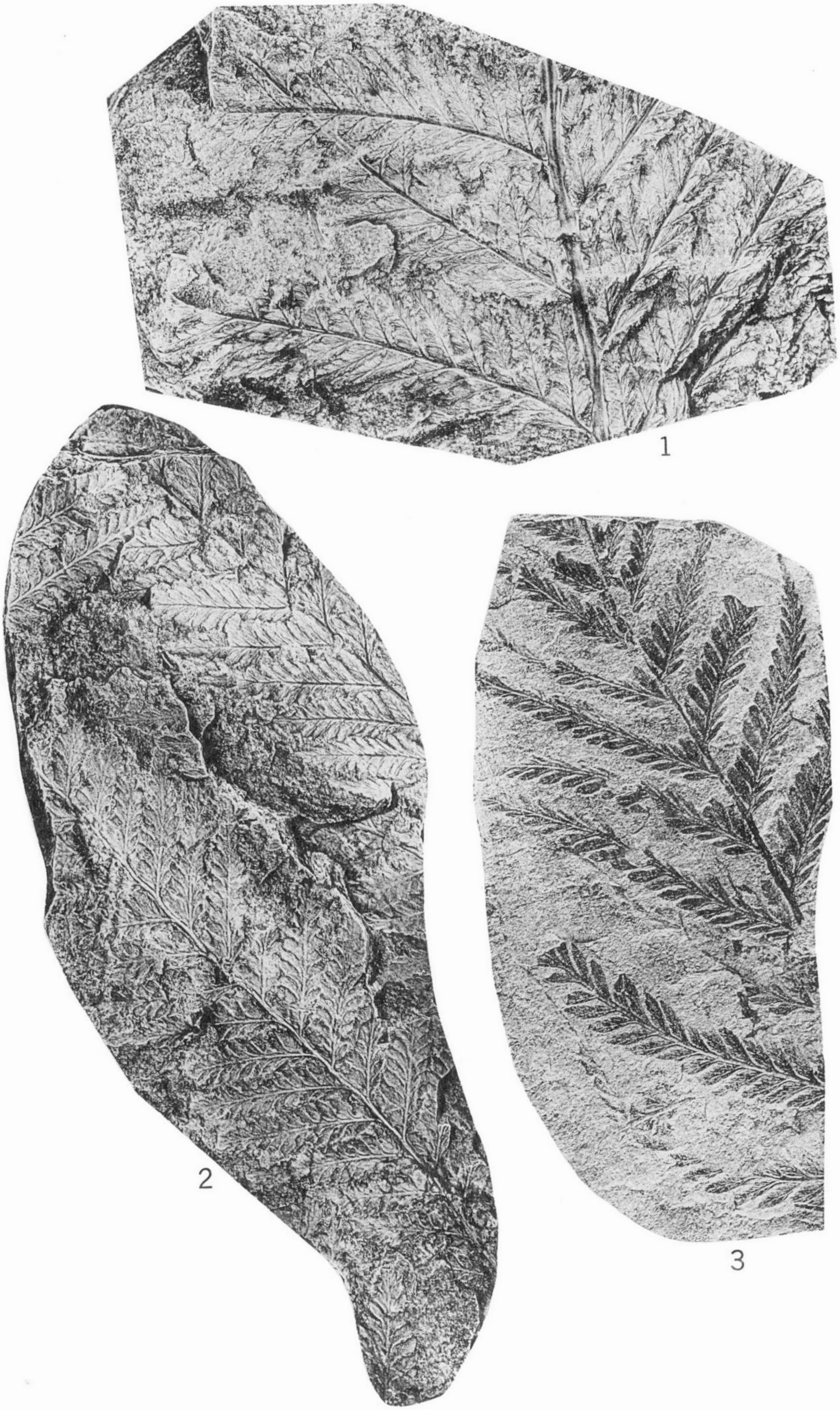

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Figure 1. *Cladophlebis strictinervis* (Fontaine). Hypotype G.S.C. No. 4057. Blairmore group (lower flora), loc. 4025. (Page 53)

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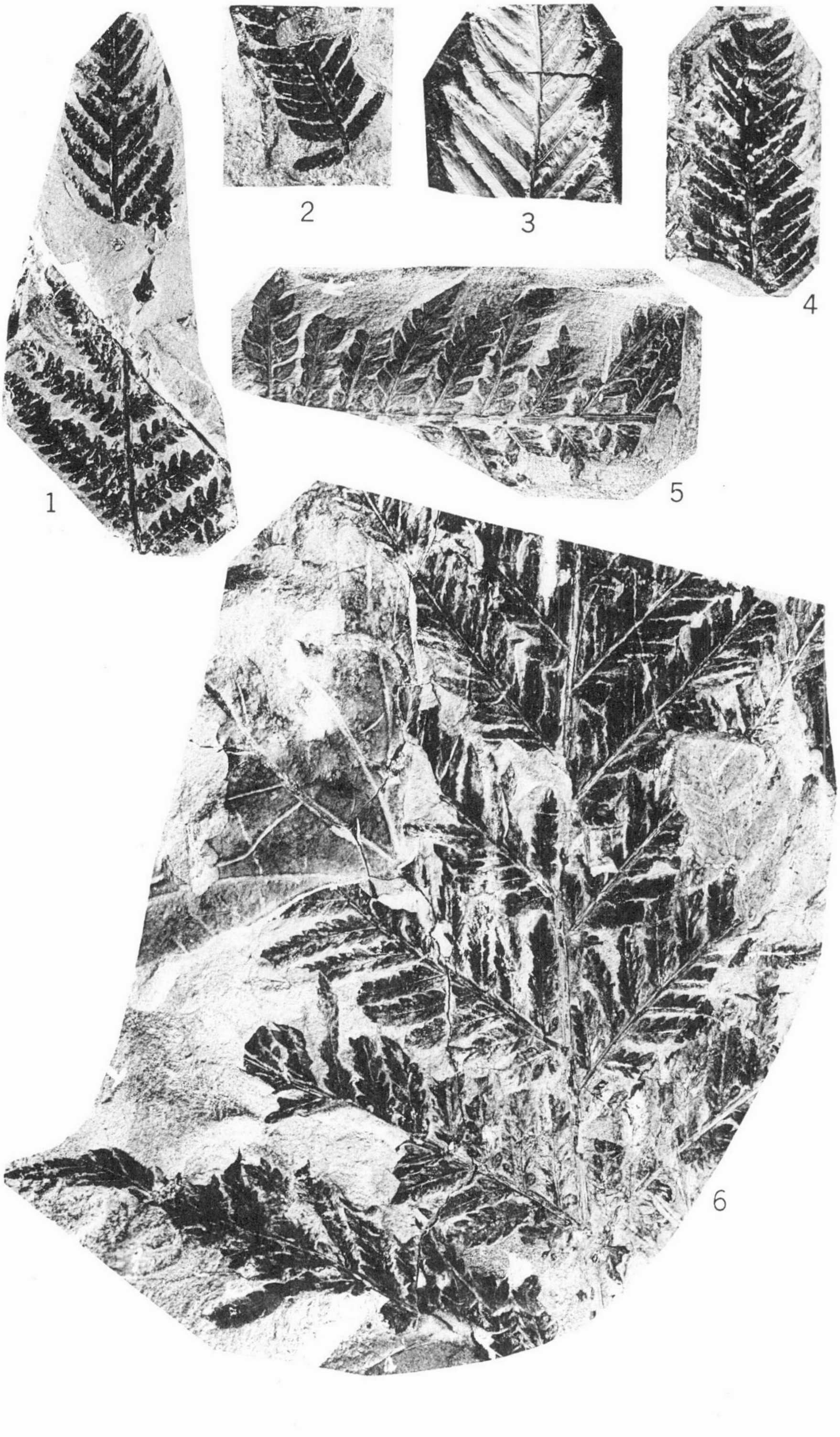

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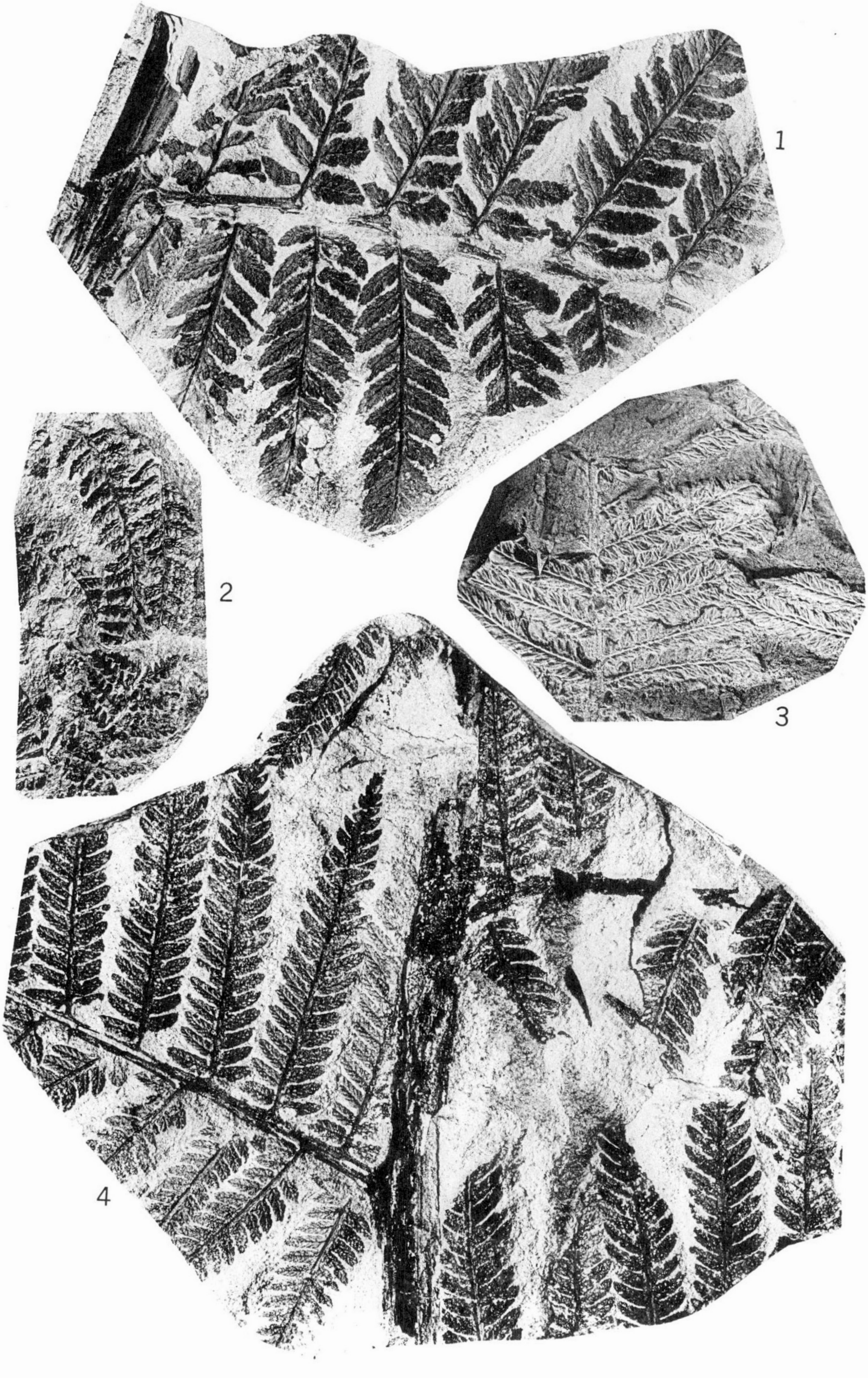

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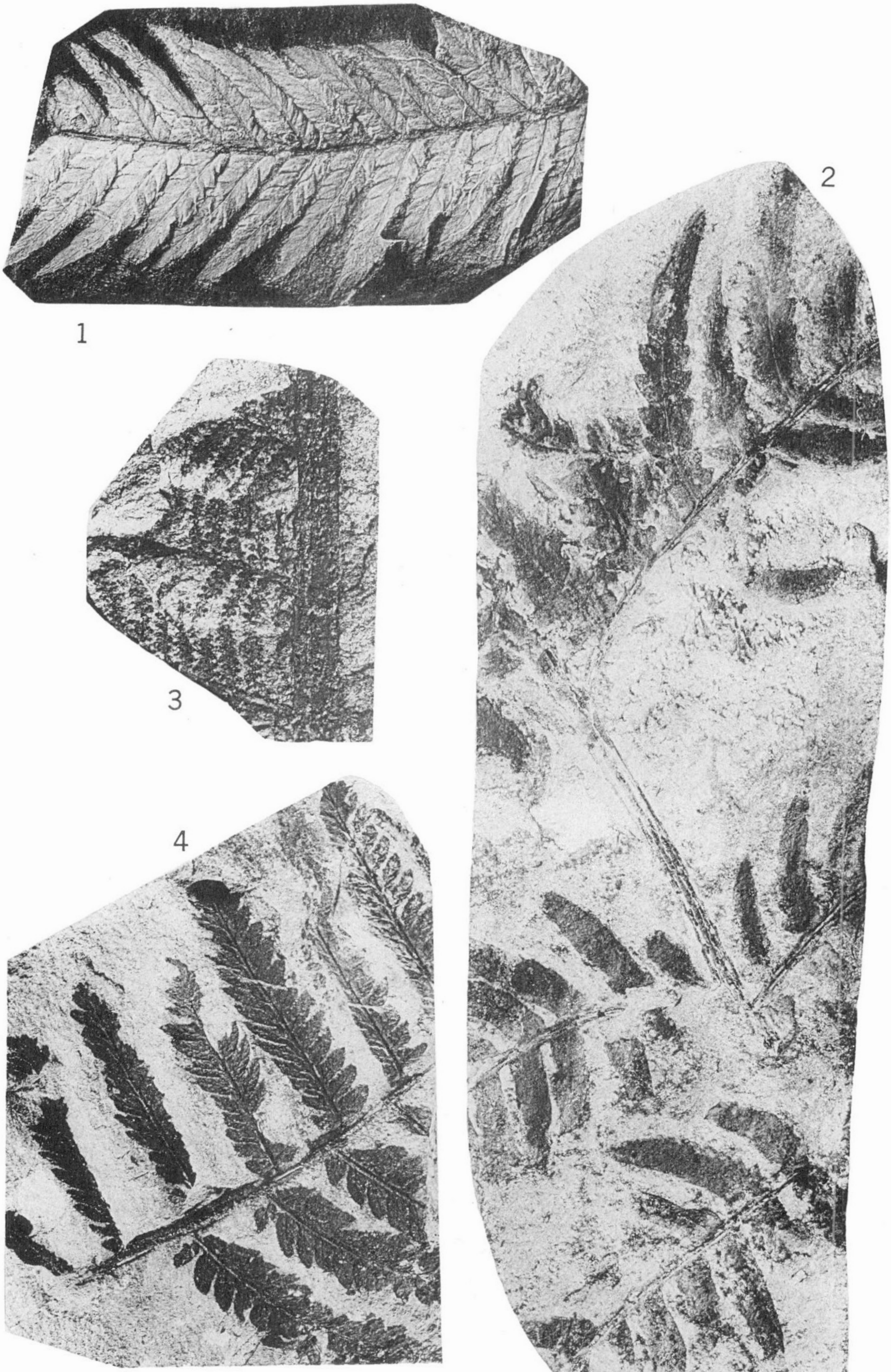
PLATE XIII



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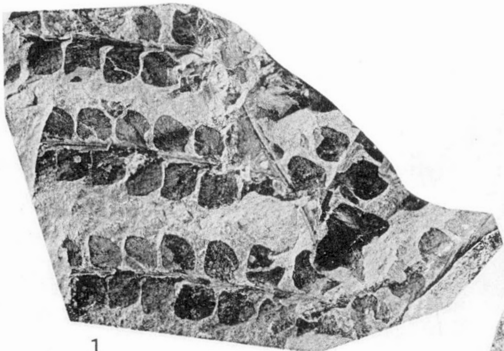

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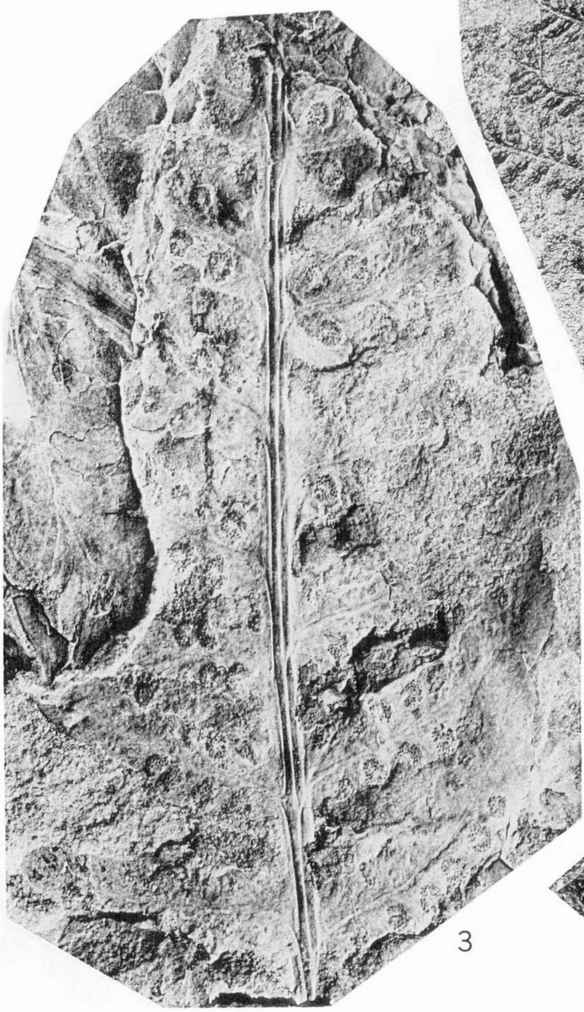

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PLATE XIV

Figure 1. *Cladophlebis heterophylla* Fontaine. Hypotype, G.S.C. No. 4061. Kootenay formation, loc. 4039. (Page 58)

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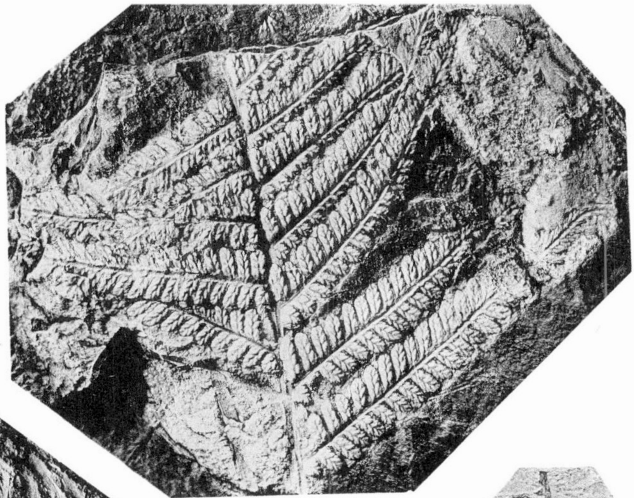
Figure 4. *Cladophlebis heterophylla* Fontaine. Hypotype, G.S.C. No. 4062. Kootenay formation, loc. 4041. (Page 58)



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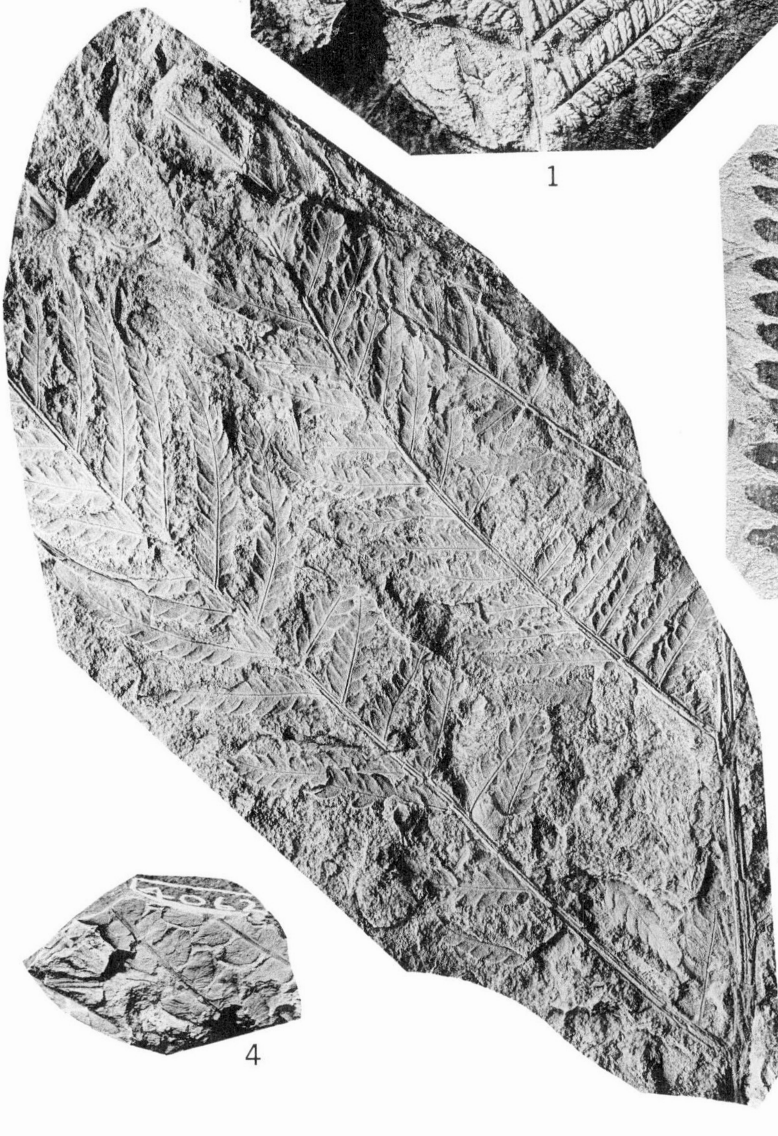

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Plate XVI

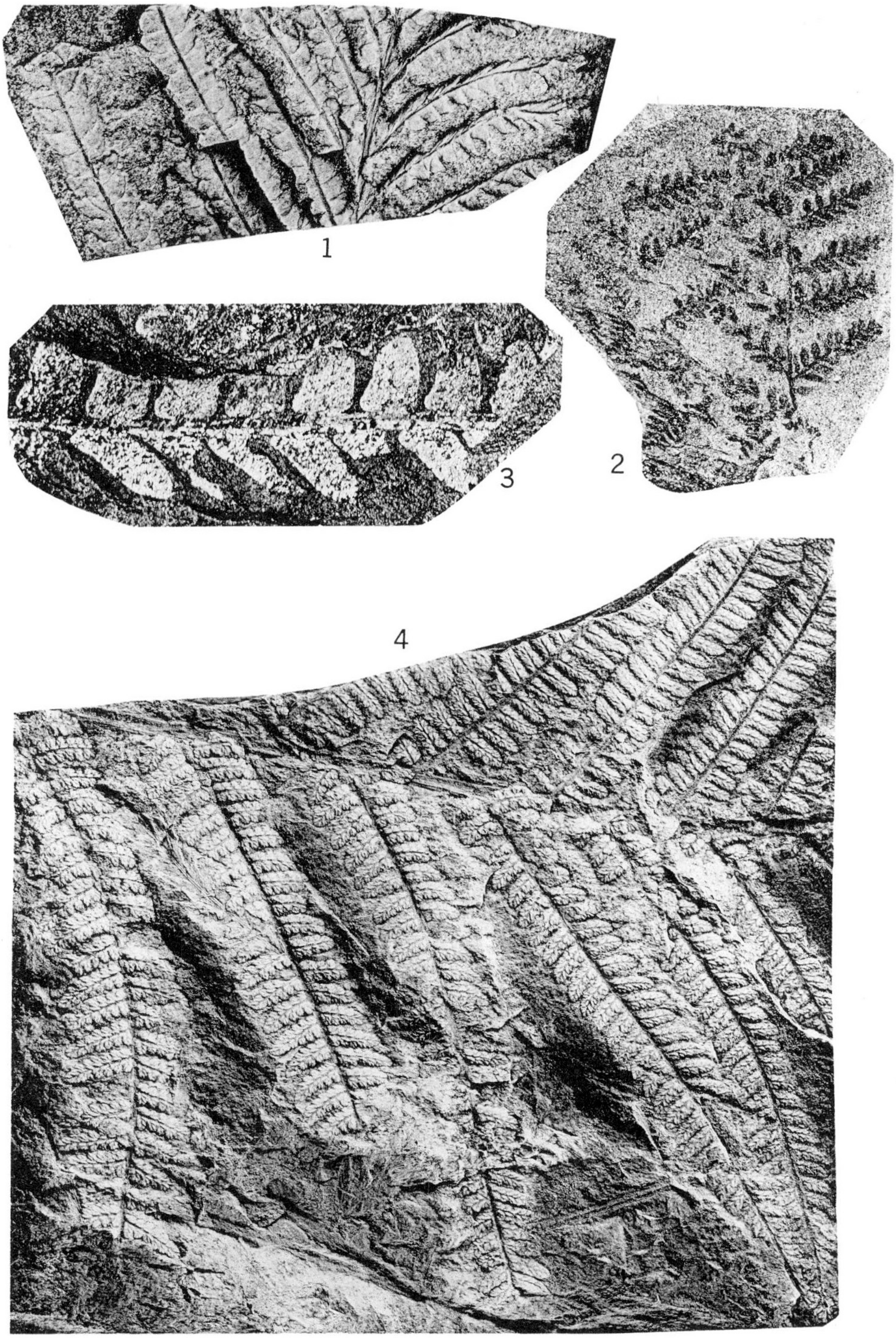

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Figure 2. *Gleichenites giesekianus* (Heer) Seward. Hypotype, G.S.C. No. 6572. Uslika formation, loc. 3839. (Page 61)

Figure 3. *Cladophlebis heterophylla* Fontaine. Hypotype, G.S.C. No. 4064 x 4. Kootenay formation, loc. 4051. (Page 58)

Figure 4. *Cladophlebis heterophylla* Fontaine. Hypotype, G.S.C. No. 4066 x 4. Kootenay formation, loc. 4051. (Page 58)

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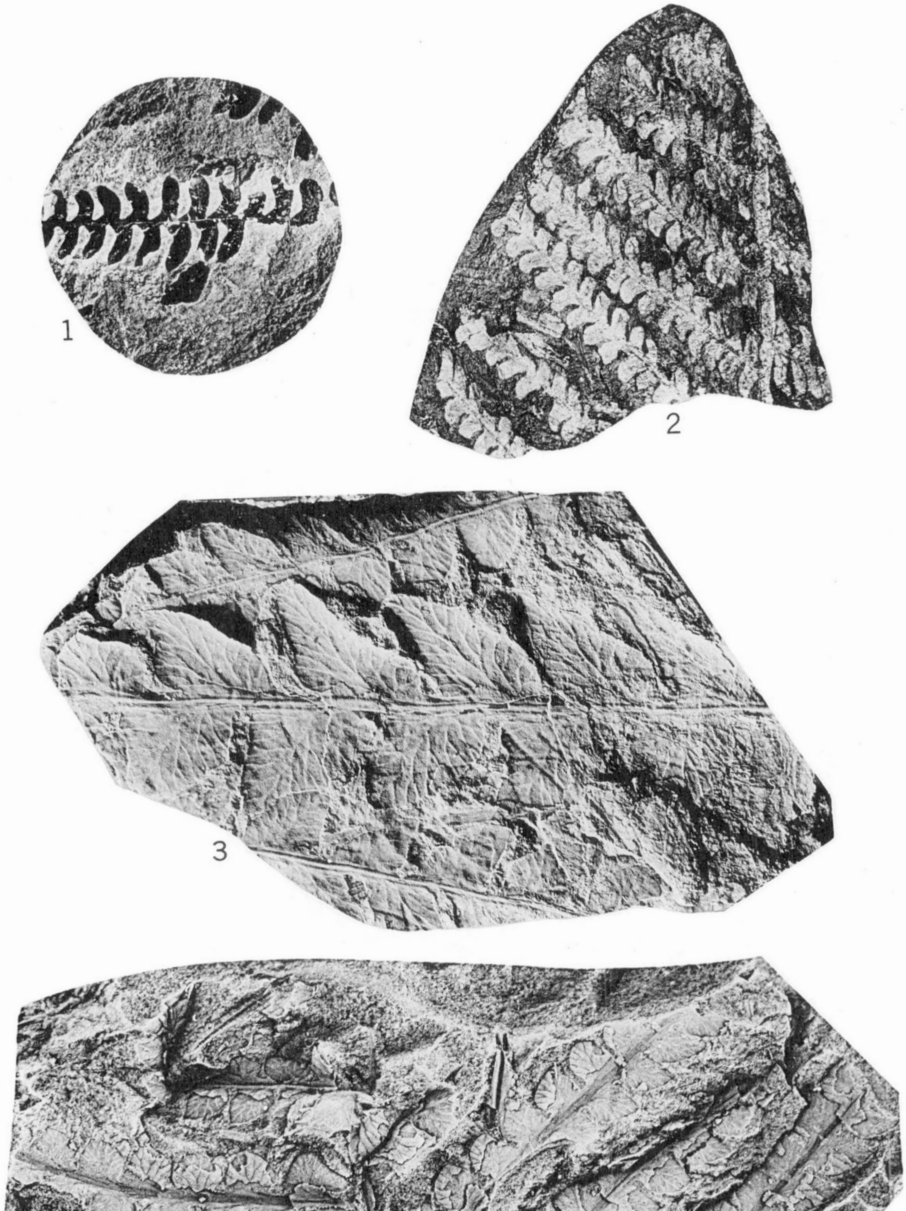

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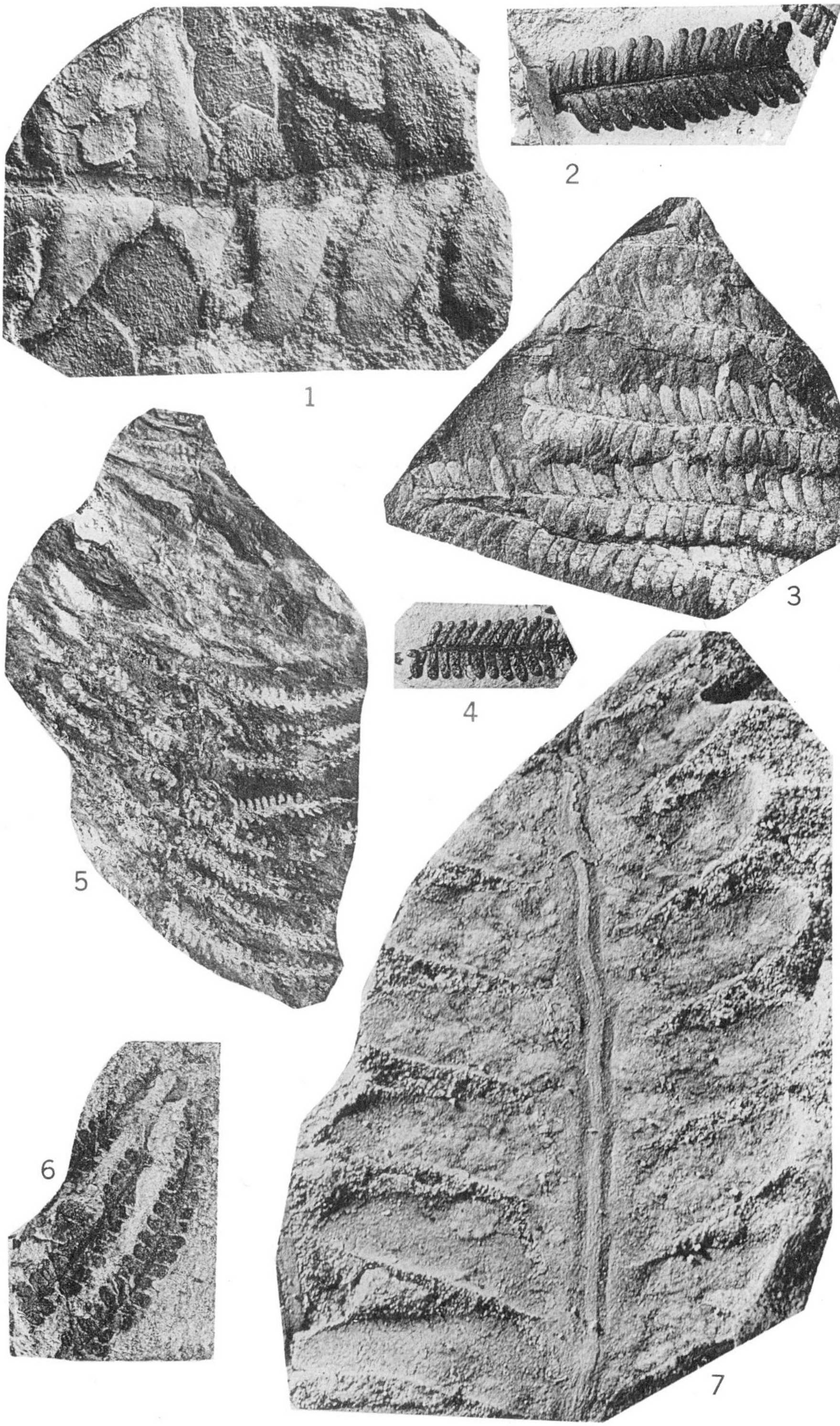

Plate XVIII

Figure 1. *Gleichenites nordenskiöldi* (Heer) Seward. Hypotype, G.S.C. No. 5774 x 4. Hazelton group, loc. 3304. (Page 62)

Figure 2. *Cladophlebis* (*Gleichenites* ?) sp. G.S.C. No. 5972. Kingsvale group, loc. 3449. (Page 65)

Figure 3. *Gleichenites nordenskiöldi* (Heer) Seward. Hypotype, G.S.C. No. 5769. Hazelton group, loc. 3299. (Page 62)

Figure 4. *Cladophlebis* (*Gleichenites* ?) sp. G.S.C. No. 5974. Kingsvale group, loc. 3449. (Page 65)

Figure 5. *Gleichenites giesekianus* (Heer) Seward. Hypotype, G.S.C. No. 6573. Uslika formation, loc. 3839. (Page 61)

Figure 6. *Cladophlebis* (*Gleichenites* ?) *waltoni* Seward. Hypotype, G.S.C. No. 5930. Leckie group, loc. 4305. (Page 64)

Figure 7. *Gleichenites nordenskiöldi* (Heer) Seward. Hypotype, G.S.C. No. 5734 x 9. Luscar formation, loc. 1233. (Page 62)

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Figure 1. *Cladophlebis* (*Gleichenites* ?) sp. G.S.C. No. 5973. Kingsvale group, loc. 3449. (Page 65)

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Figure 4. *Cladophlebis* (*Gleichenites*) *porsildi* Seward. Hypotype, G.S.C. No. 6658. Uslika formation, loc. 3519. (Page 63)

Figure 5. *Klukia canadensis* n. sp. Paratype, G.S.C. No. 5387. Luscar formation, loc. 3058. (Page 66)

Figure 6. *Sphenopteris* (*Gleichenites* ?) *erecta* n. sp. Holotype (in part), G.S.C. No. 5736a. Luscar formation, loc. 347. (Page 65)

Figure 7. *Gleichenites nordenskiöldi* (Heer) Seward. Hypotype, G.S.C. No. 5768 x ½ Hazelton group, loc. 3299. (Page 62)

Figure 8. *Klukia canadensis* n. sp. Holotype, G.S.C. No. 5383. Luscar formation, loc. 3058. (Page 66)

PLATE XIX

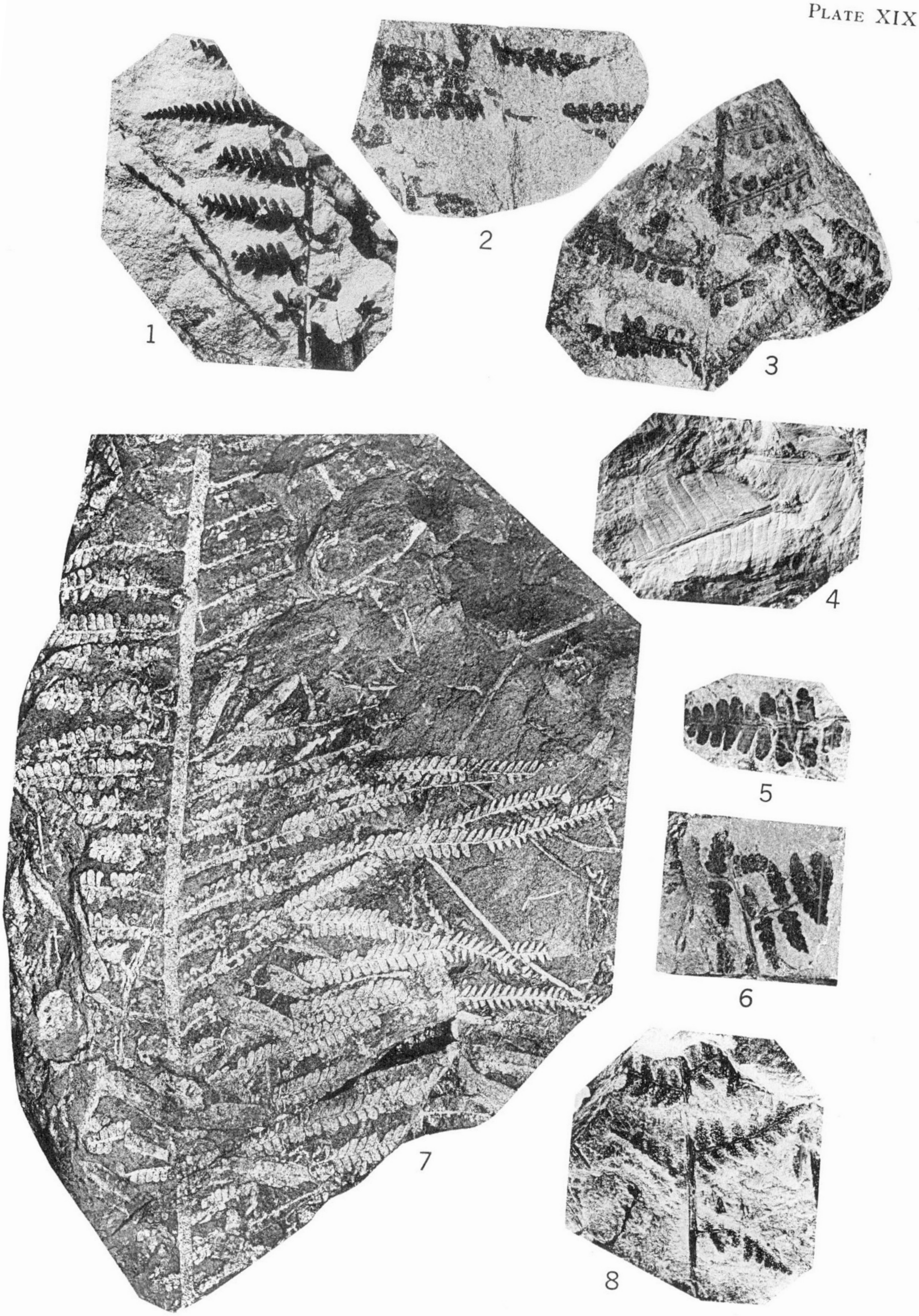

PLATE XX

PLATE XX

Gleichenites nordenskiöldi (Heer) Seward. Hypotype, G.S.C. No. 5808 (*Gleichenia gilbert-thompsoni* Penhallow). Pasayten group, loc. 3320. (Page 62)

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Figure 3. *Cladophlebis* (*Gleichenites*) *porsildi* Seward. Hypotype, G.S.C. No. 6576. Uslika formation, loc. 3839. (Page 63)

Figure 4. *Klukia canadensis* n. sp. Paratype, G.S.C. No. 4045 x 4. Blairmore group (lower flora), loc. 4035. (Page 66)

PLATE XXI

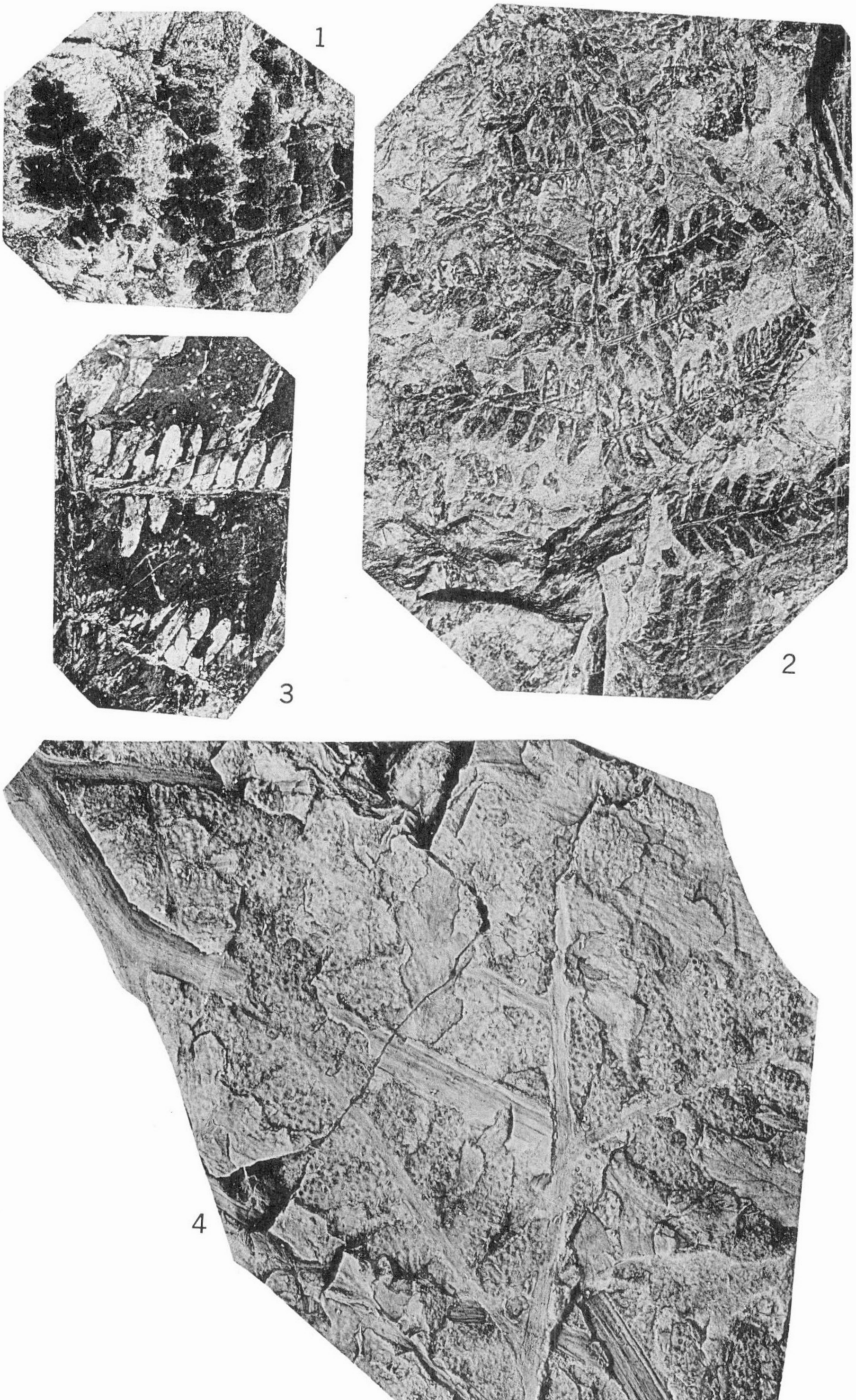

Plate XXII

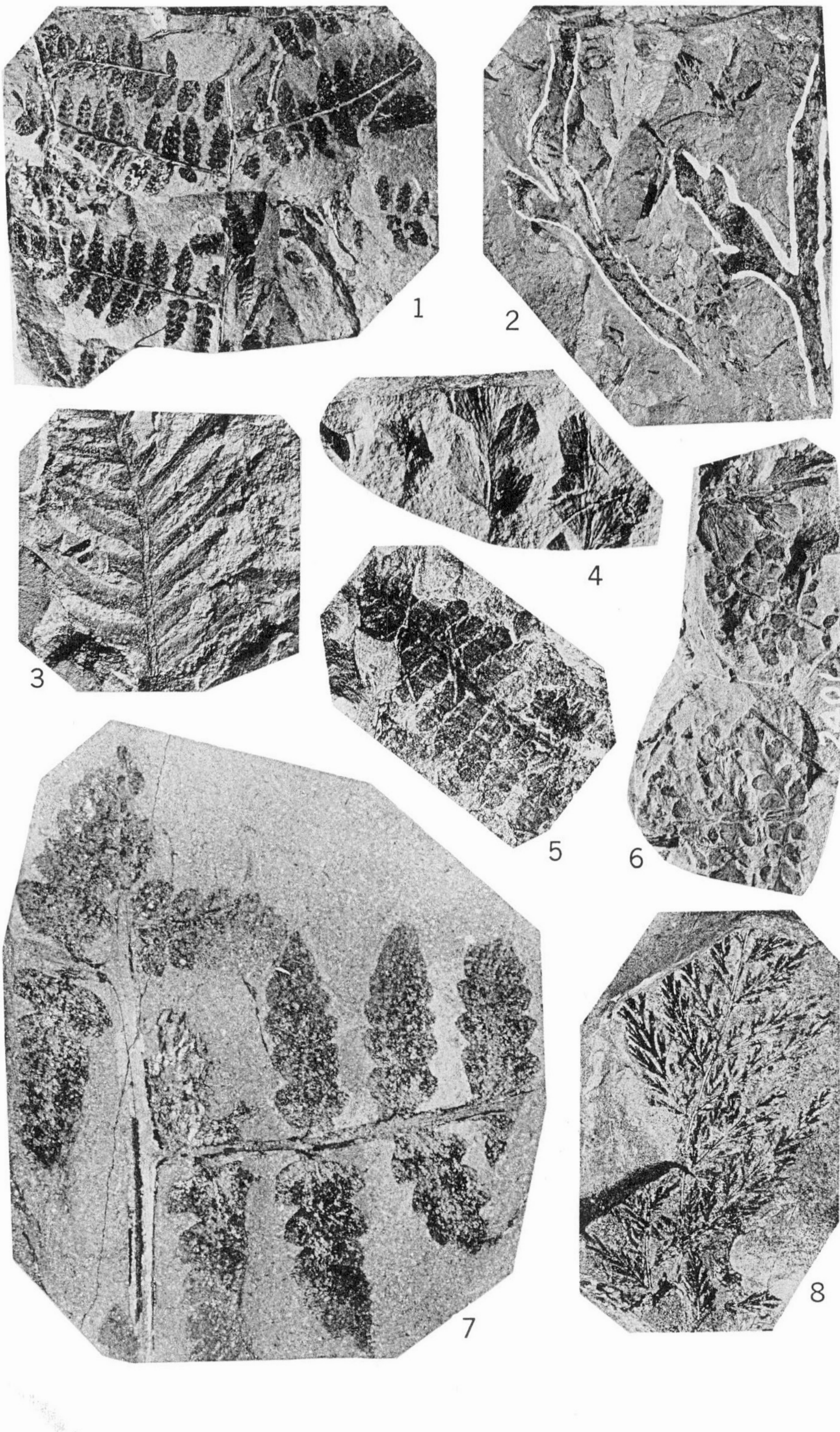

PLATE XXII

Figure 1. *Sphenopteris (Gleichenites ?) erecta* n. sp. Holotype, G.S.C. No. 5736. Luscar formation, loc. 347. (Page 65)

Figure 2. *Sphenopteris (Ruffordia) göpperti* (Dunker) Seward. Hypotype, G.S.C. No. 5372. Blairmore group (lower flora), loc. 3063. (Page 67)

Figure 3. *Phlebopteris ? elongata* n. sp. Paratype, G.S.C. No. 429. Hazelton group, loc. 1801. (Page 61)

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Figure 6. *Sphenopteris acrodentata* Fontaine. Hypotype, G.S.C. No. 6578. Hazelton group, loc. 2401. (Page 68)

Figure 7. *Sphenopteris (Gleichenites ?) erecta* n. sp. Holotype (in part), G.S.C. No. 5736a x 4. Luscar formation, loc. 347. (Page 65)

Figure 8. *Sphenopteris (Ruffordia) göpperti* (Dunker) Seward. Hypotype, G.S.C. No. 5370. Blairmore group (lower flora), loc. 4025. (Page 67)

Plate XXIII

Figure 1. *Sphenopteris* (*Ruffordia*) *göpperti* (Dunker) Seward. Hypotype, G.S.C. No. 5767. Hazelton group, loc. 3299. (Page 67)

Figure 2. *Sphenopteris acrodentata* Fontaine. Hypotype, G.S.C. No. 6564. Hazelton group, loc. 2413. (Page 68)

Figure 3. *Sphenopteris mclearni* n. sp. Paratype, G.S.C. No. 4815. Blairmore group (upper flora), loc. 257. (Page 73)

Figure 4. *Sphenopteris* (*Ruffordia*) *göpperti* (Dunker) Seward. Hypotype, G.S.C. No. 5780. Hazelton group, loc. 3304. (Page 67)

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PLATE XXIV

PLATE XXIV

Figure 1. *Onychiopsis psilotoides* (Stokes and Webb) Ward. Hypotype, G.S.C. No. 1029. Luscar formation, loc. 2138. (Page 59)

Figure 2. *Sphenopteris mclearni* n. sp. Holotype, G.S.C. No. 5834. Blairmore group (upper flora), loc. 3065. (Page 73)

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Figure 1. *Acrostichopteris foliosa* (Fontaine) Berry. Hypotype, G.S.C. No. 5375. Luscar formation, loc. 1233. (Page 69)

Figure 2. *Sphenopteris* sp. A. G.S.C. No. 6638. Blairmore group (upper flora), loc. 1581. (Page 74)

Figure 3. *Acrostichopteris foliosa* (Fontaine) Berry. Hypotype, G.S.C. No. 5378. Luscar formation, loc. 1233. (Page 69)

PLATE XXV

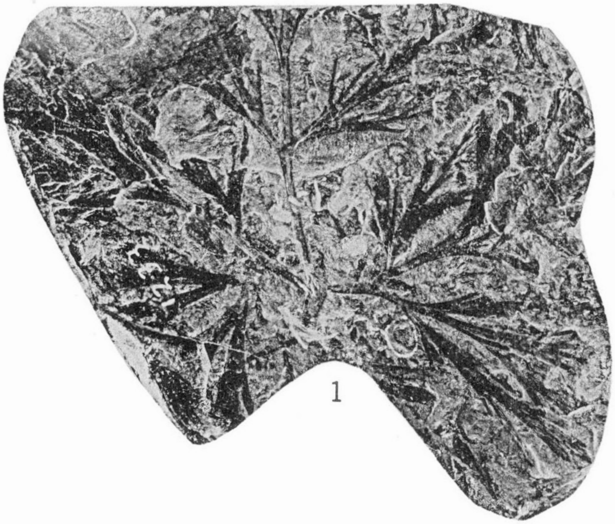

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PLATE XXVI

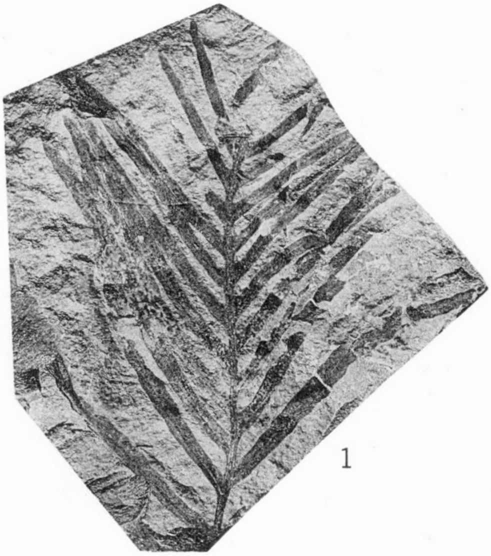

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PLATE XXVI

Figure 1. *Phlebopteris ? elongata* n. sp. Holotype, G.S.C. No. 5798. Nikanassin formation, loc. 346. (Page 61)

Figure 2. *Sphenopteris* sp. A. G.S.C. No. 6638 x 2. Blairmore group (upper flora), loc. 1581. (Page 74)

Figure 3. *Onychiopsis psilotoides* (Stokes and Webb) Ward. Hypotype, G.S.C. No. 4833 x 2 (*Glyptostrobus groenlandicus* Dawson). Blairmore group (upper flora), loc. 257. (Page 59)

PLATE XXVII

Figure 1. *Sphenopteris newberryi* n. sp. Paratype, G.S.C. No. 572 x 4. Pasayten group, loc. 3126. (Page 72)

Figure 2. *Sphenopteris newberryi* n. sp. Holotype, G.S.C. No. 5837. Pasayten group, loc. 3126. (Page 72)

Figure 3. *Sphenopteris mclearni* n. sp. Holotype, G.S.C. No. 5834 x 2. Blairmore group (upper flora), loc. 3065. (Page 73)

Plate XXVII

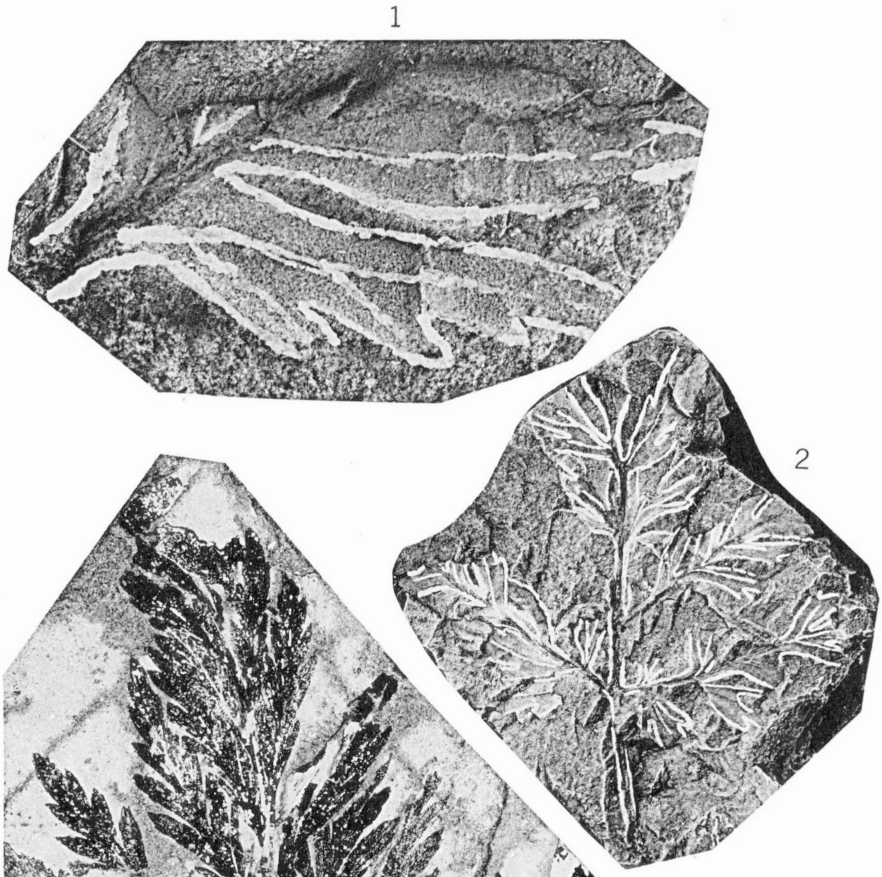

PLATE XXVIII

Plate XXVIII

Figure 1. *Sphenopteris cordai* (Dunker) Schenk. Hypotype, G.S.C. No. 6667. Kootenay formation, loc. 1820. (Page 74)

Figure 2. *Sphenopteris* sp. B. G.S.C. No. 5840. Blairmore group (upper flora), loc. 4023. (Page 75)

Figure 3. *Sphenopteris latiloba* Fontaine. Hypotype, G.S.C. No. 6579. Blairmore group (lower flora), loc. 3608. (Page 69)

Figure 4. *Sphenopteris* sp. B. G.S.C. No. 5839. Kingsvale group, loc. 3020. (Page 75)

Figure 5. *Equisetites lyelli* (Mantell) forma *burchardti*. Hypotype, G.S.C. No. 5751. Blairmore group (lower flora), loc. unknown. (Page 76)

Figure 6. *Equisetites lyelli* (Mantell) forma *burchardti*. Hypotype, G.S.C. No. 5801. Luscar formation, loc. 2168. (Page 76)

Figure 7. *Equisetites lyelli* (Mantell) Unger. Hypotype, G.S.C. No. 5749. Hazelton group, loc. 2406. (Page 76)

Figure 8. *Equisetites lyelli* (Mantell) forma *burchardti*. Hypotype, G.S.C. No. 5800. Blairmore group (upper flora), loc. 257. (Page 76)

Figure 9. *Acrostichopteris foliosa* (Fontaine) Berry. Hypotype, G.S.C. No. 5376. Luscar formation, loc. 1233. (Page 69)

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Figure 1. *Sphenopteris latiloba* Fontaine. Hypotype, G.S.C. No. 4044. Luscar formation, loc. 2054. (Page 69)

Figure 2. *Sphenopteris latiloba* Fontaine. Hypotype, G.S.C. No. 4042. Luscar formation, loc. 2054. (Page 69)

Figure 3. *Sagenopteris mclearni* Berry. Hypotype, G.S.C. No. 5335. Blairmore group (lower flora), loc. 1253. (Page 81)

Figure 4. *Sagenopteris mclearni* Berry. Hypotype, G.S.C. No. 5336. Blairmore group (lower flora), loc. 3067. (Page 81)

Figure 5. *Sagenopteris mclearni* Berry. Hypotype, G.S.C. No. 5334. Blairmore group (lower flora), loc. 3067. (Page 81)

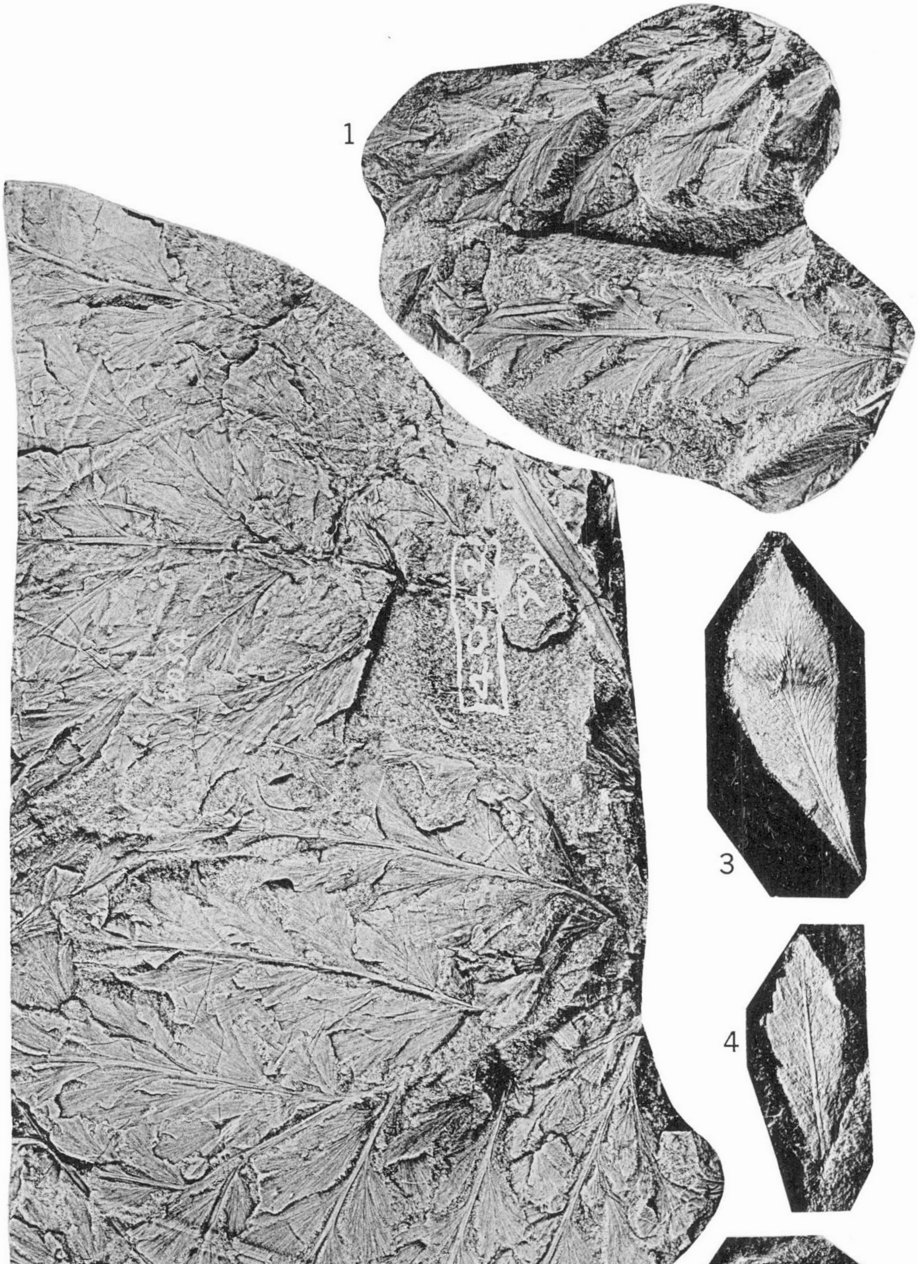

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PLATE XXX

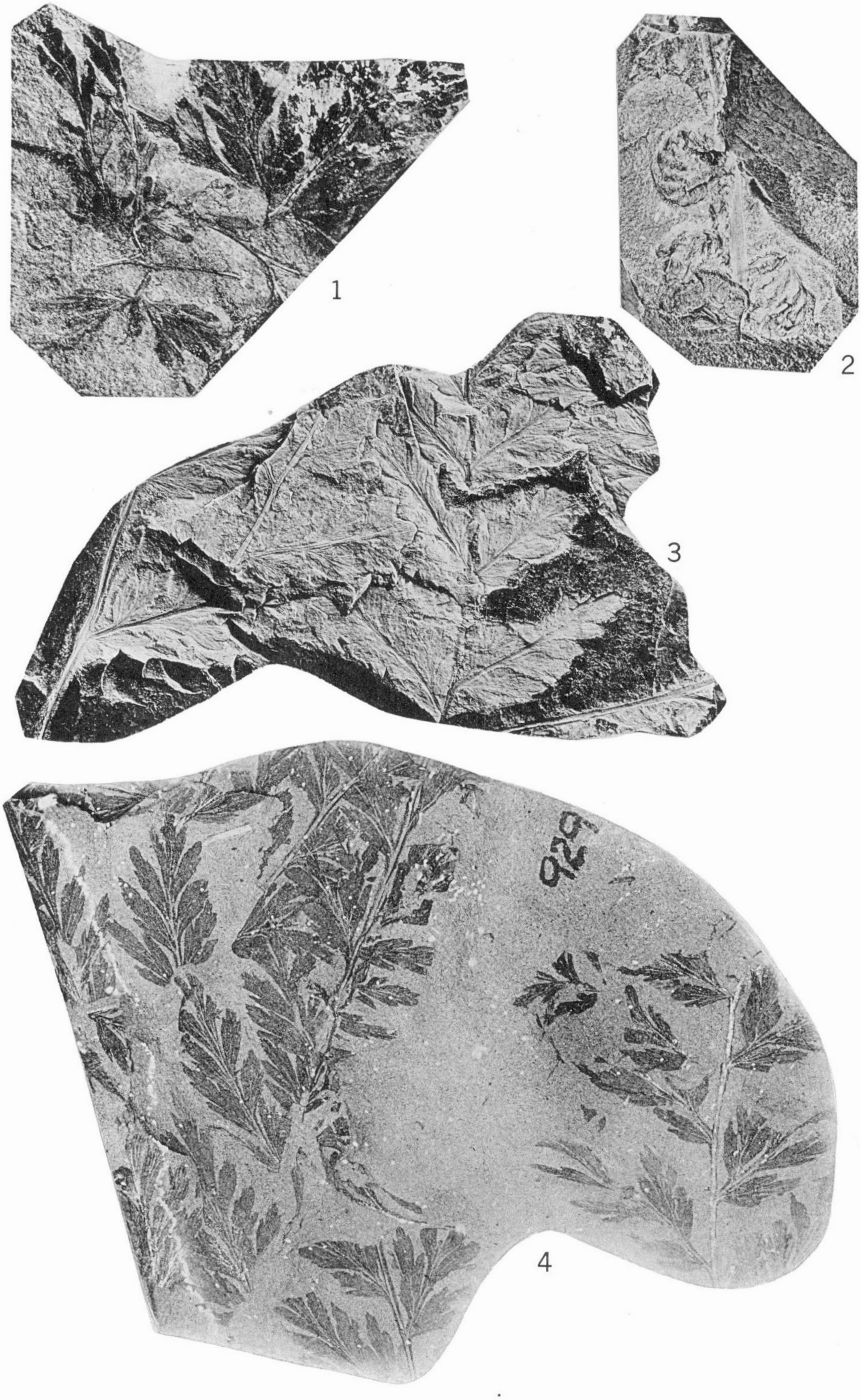

PLATE XXX

Figure 1. *Sphenopteris latiloba* Fontaine. Hypotype, G.S.C. No. 6565. Blairmore group (lower flora), loc. 3908. (Page 69)

Figure 2. *Caytonia canadensis* (Berry). Syntype, G.S.C. No. 4993. Blairmore group (lower flora), loc. 4033. (Page 79)

Figure 3. *Sphenopteris latiloba* Fontaine. Hypotype, G.S.C. No. 4027. Blairmore group (lower flora), loc. 4026. (Page 69)

Figure 4. *Sphenopteris latiloba* Fontaine. Hypotype, G.S.C. No. 4043. Luscar formation, loc. 2054. (Page 69)

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Figure 1. *Hydropterangium canadense* (Berry). Syntype, G.S.C. No. 5003 x 2. Blairmore group (lower flora), loc. 4025. (Page 83)

Figure 2. *Sagenopteris williamsii* (Newberry). Hypotype, G.S.C. No. 5348. Hazelton group, loc. 2415. (Page 80)

Figure 3. *Sphenopteris brulensis* n. sp. Paratype, G.S.C. No. 5350. Luscar formation, loc. 1233. (Page 71)

Figure 4. *Sphenopteris brulensis* n. sp. Holotype, G.S.C. No. 5349. Luscar formation, loc. 3058. (Page 71)

Figure 5. *Selaginellites* sp. G.S.C. No. 5746 x 8. Luscar formation, loc. 324. (Page 77)

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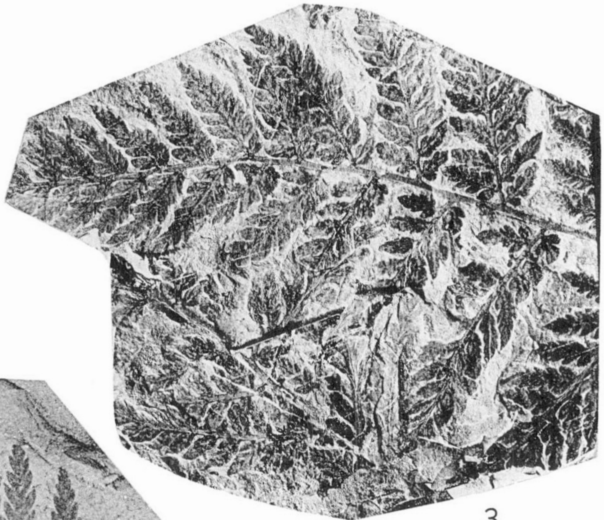

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PLATE XXXII

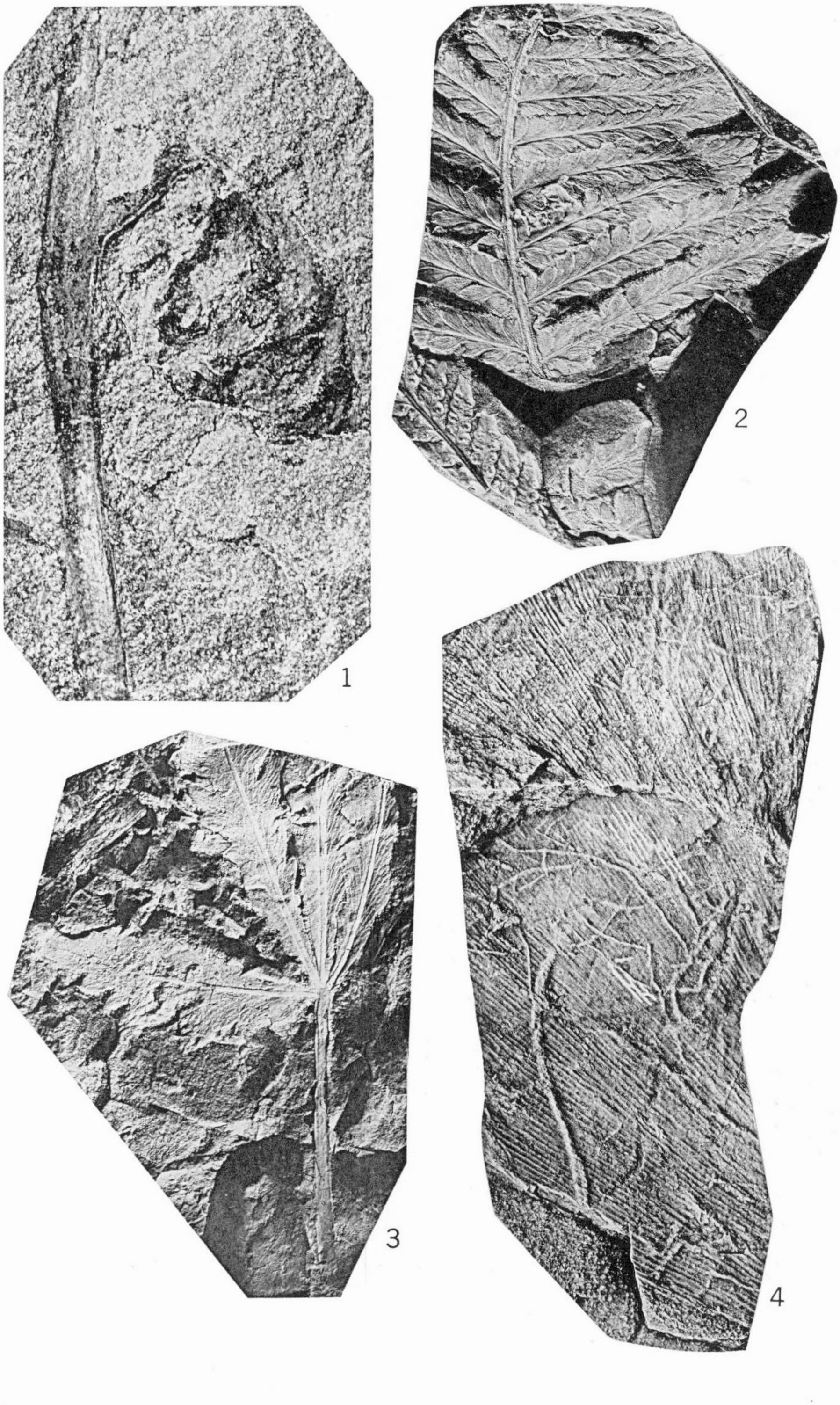

PLATE XXXII

Figure 1. *Caytonia canadensis* (Berry). Syntype, G.S.C. No. 4992 x 4. Blairmore group (lower flora), loc. 4033. (Page 79)

Figure 2. *Sphenopteris bidens* n. sp. Paratype, G.S.C. No. 4024. Blairmore group (lower flora), loc. 4033. (Page 71)

Figure 3. *Sagenopteris mclearni* Berry. Hypotype, G.S.C. No. 5333. Luscar formation, loc. 347. (Page 81)

Figure 4. *Phyllites asplenioides* ? Berry. Hypotype (?), G.S.C. No. 5910. Kingsvale group, loc. 3125. (Page 76)

Plate XXXIII

Figure 1. *Taeniopteris canmorensis* (Dawson). Holotype, G.S.C. No. 4839. Kootenay formation, loc. 3235. (Page 75)

Figure 2. *Ginkgo nana* ? Dawson. Hypotype (?), G.S.C. No. 4825 (*Salisburia* (*Ginkgo*) *lepida* Dawson). Kootenay formation, loc. 276. (Page 86)

Figure 3. *Baiera* cf. *furcata* (Lindley and Hutton) Braun. G.S.C. No. 5329. Nikanassin (?) formation, loc. 1192. (Page 84)

Figure 4. *Sagenopteris williamsii* (Newberry). Hypotype, G.S.C. No. 5339. Blairmore group (lower flora), loc. 1257. (Page 80)

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Figure 6. *Sagenopteris elliptica* Fontaine. Hypotype, G.S.C. No. 5347. Blairmore group (lower flora), loc. 4028. (Page 82)

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Plate XXXIV

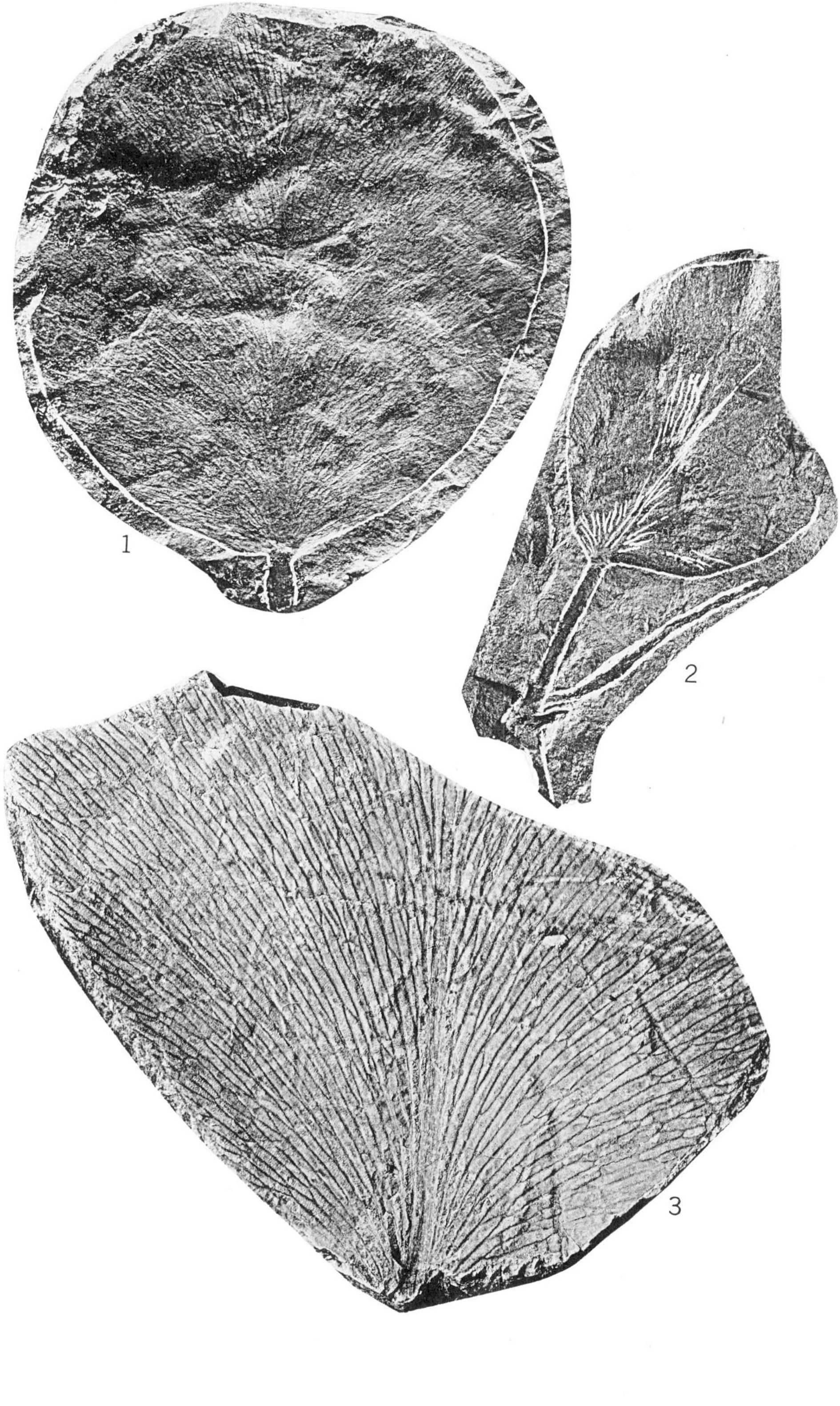


PLATE XXXIV

Figure 1. *Sagenopteris williamsii* (Newberry). Hypotype, G.S.C. No. 6583. Luscar formation, loc. 3750. (Page 80)

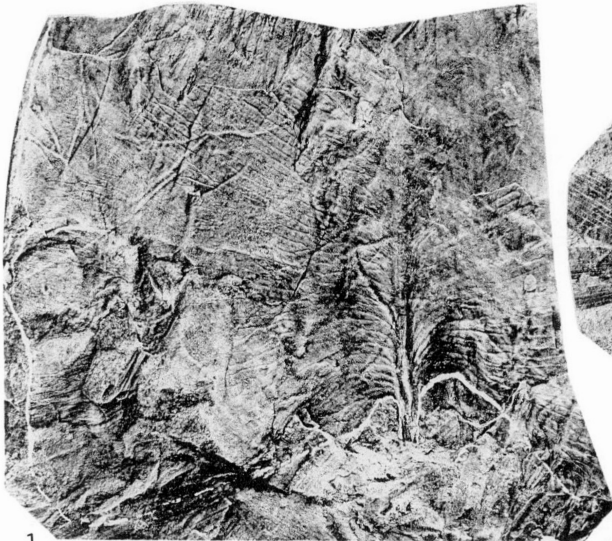
Figure 2. *Sagenopteris williamsii* (Newberry). Hypotype, G.S.C. No. 5337. Bullhead group (Gething formation), loc. 3208. (Page 80)

Figure 3. *Sagenopteris williamsii* (Newberry). Hypotype, No. 5342 x 2. Luscar formation, loc. 1626. (Page 80)

PLATE XXXV

Dictyophyllum fuchsiforme n. sp. Holotype, G.S.C. No. 5796 x $\frac{2}{3}$ approx. Hazelton group, loc. 2374. (Page 60)

PLATE XXXVI



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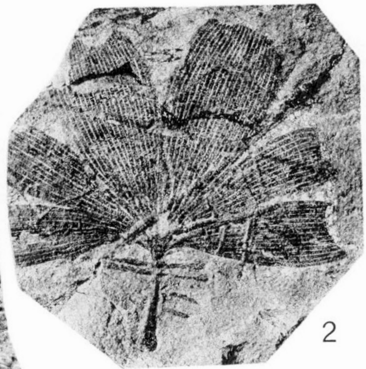

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PLATE XXXVI

Figure 1. *Sagenopteris williamsii* (Newberry). Hypotype, G.S.C. No. 5344. Luscar formation, loc. 2153. (Page 80)

Figure 2. *Ginkgo pluripartita* (Schimper) Heer. Hypotype, G.S.C. No. 6588. Hazelton group, loc. 2416. (Page 85)

Figure 3. *Ginkgo pluripartita* (Schimper) Heer. Hypotype, G.S.C. No. 5318. Blairmore group (lower flora), loc. 1727. (Page 85)

Figure 4. *Dictyophyllum fuchsiforme* n. sp. Paratype, G.S.C. No. 5797. Hazelton group, loc. 2374. (Page 60)

Figure 5. *Sagenopteris elliptica* Fontaine. Hypotype, G.S.C. No. 5872. Kingsvale group, loc. 3125. (Page 82)

PLATE XXXVII

Figure 1. *Baiera* cf. *furcata* (Lindley and Hutton) Braun. G.S.C. No. 5328. Nikanassin (?) formation, loc. 1192. (Page 84)

Figure 2. *Ginkgo pluripartita* (Schimper) Heer. Hypotype, G.S.C. No. 575. Luscar formation, loc. 324. (Page 85)

Figure 3. *Ginkgo pluripartita* (Schimper) Heer. Hypotype, G.S.C. No. 6587. Hazelton group, loc. 2416. (Page 85)

Figure 4. *Ginkgo nana* Dawson. Hypotype, G.S.C. No. 5321. Nikanassin formation, loc. 346. (Page 86)

Figure 5. *Ginkgo* cf. *lepida* Heer. G.S.C. No. 5327. Kootenay formation, loc. 2309. (Page 87)

Figure 6. *Stenorachis striolatus* (Heer, pars) Nathorst. Hypotype, G.S.C. No. 6598 x 2. Bullhead or Blairmore (?) group, loc. 4309. (Page 88)

PLATE XXXVII.

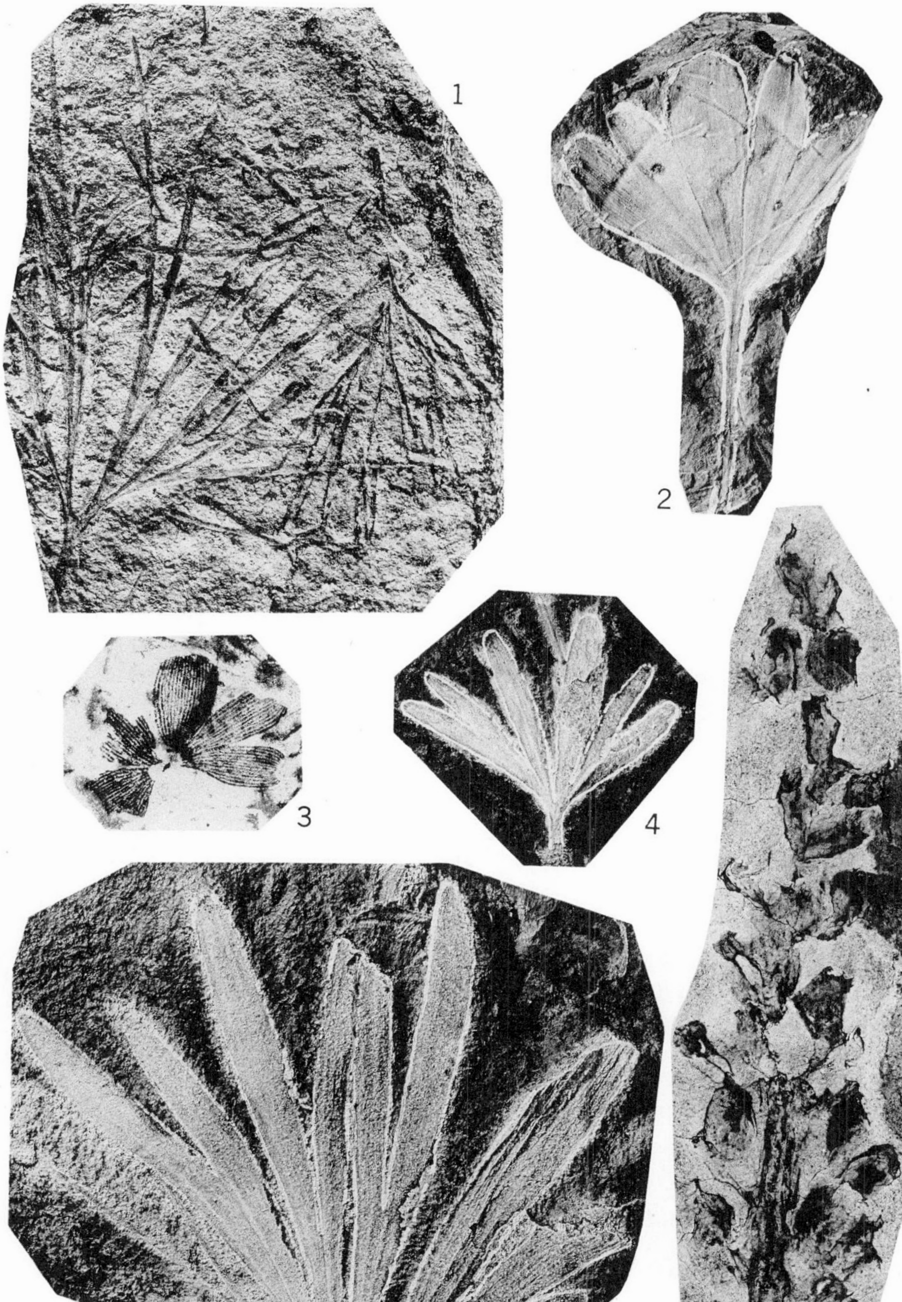

Plate XXXVIII

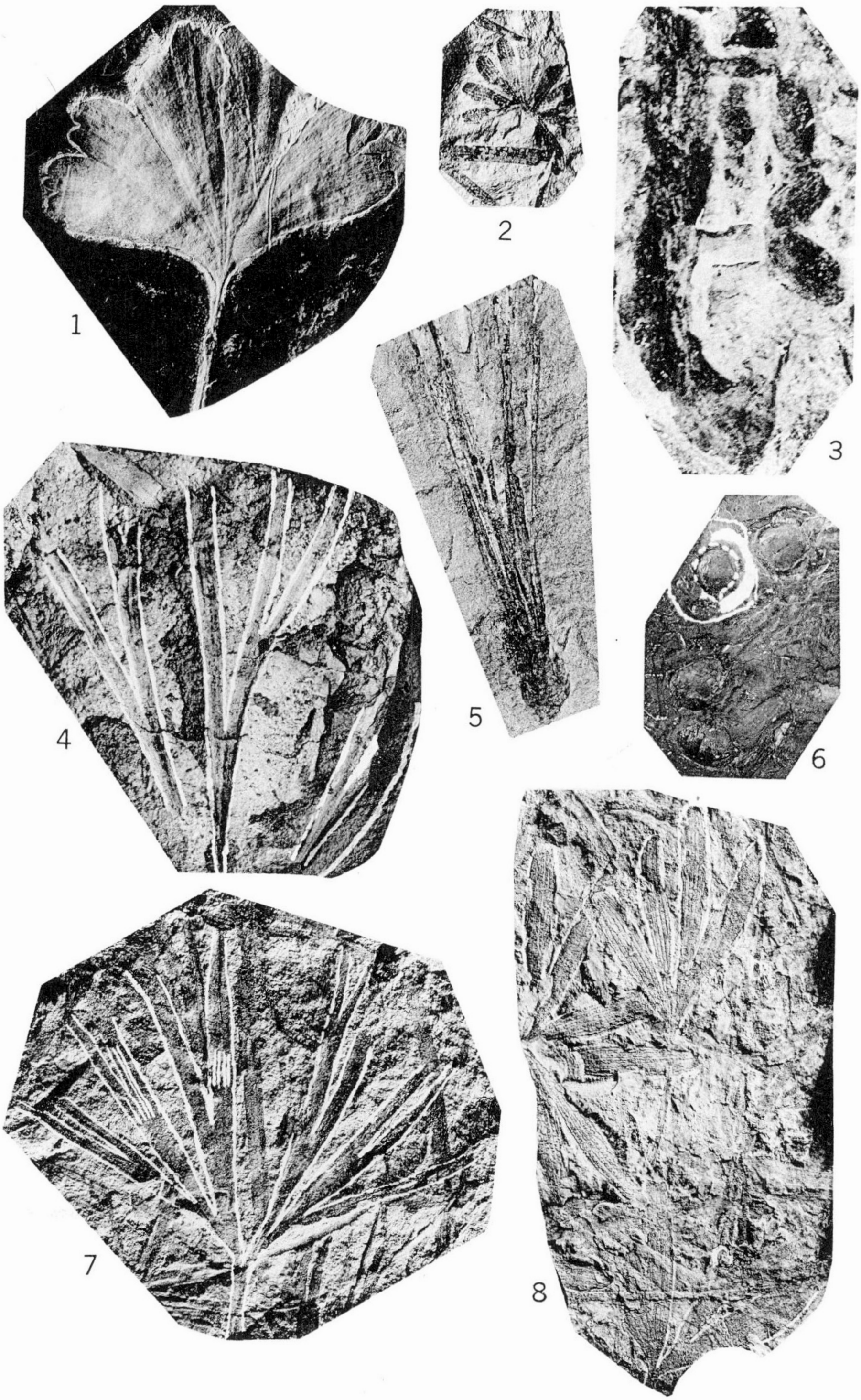

PLATE XXXVIII

Figure 1. *Ginkgo pluripartita* (Schimper) Heer. Hypotype, G.S.C. No. 5317. Blairmore group (lower flora), loc. 3174. (Page 85)

Figure 2. *Ginkgo nana* Dawson. Hypotype, G.S.C. No. 5323. Nikanassin formation, loc. 346. (Page 86)

Figure 3. *Stenorachis* sp. G.S.C. No. 6625 x 8. Luscar formation, loc. 324. (Page 88)

Figure 4. *Baiera* cf. *gracilis* (Bean) Bunbury. G.S.C. No. 5325. Bullhead group (Gething formation), loc. 1997. (Page 84)

Figure 5. *Czekanowskia* cf. *rigida* Heer. G.S.C. No. 1045. Nikanassin formation, loc. 2139. (Page 89)

Figure 6. *Carpites* (*Ginkgo* ?) sp. Dawson. G.S.C. No. 4859b. Kootenay formation, loc. 3235. (Page 87)

Figure 7. *Baiera* cf. *gracilis* (Bean) Bunbury. G.S.C. No. 5331. Hazelton group, loc. 3027. (Page 84)

Figure 8. *Ginkgo nana* Dawson. Hypotype, G.S.C. No. 6586. Kootenay formation, location unknown. (Page 86)

Plate XXXIX

Figure 1. *Phoenicopsis angustifolia* Heer forma *media* Krasser. Hypotype, G.S.C. No. 5310. Bullhead group (Gething formation), loc. 3208. (Page 90)

Figure 2. *Czekanowskia* cf. *rigida* Heer. G.S.C. No. 6590. Hazelton group, loc. 2401. (Page 89)

Figure 3. *Phoenicopsis arctica* (Heer). Hypotype, G.S.C. No. 5294 x 4. Blairmore group (lower flora), loc. 4033. (Page 91)

Figure 4. *Czekanowskia* cf. *rigida* Heer. G.S.C. No. 5306. Kootenay formation, loc. 1579. (Page 89)

PLATE XXXIX

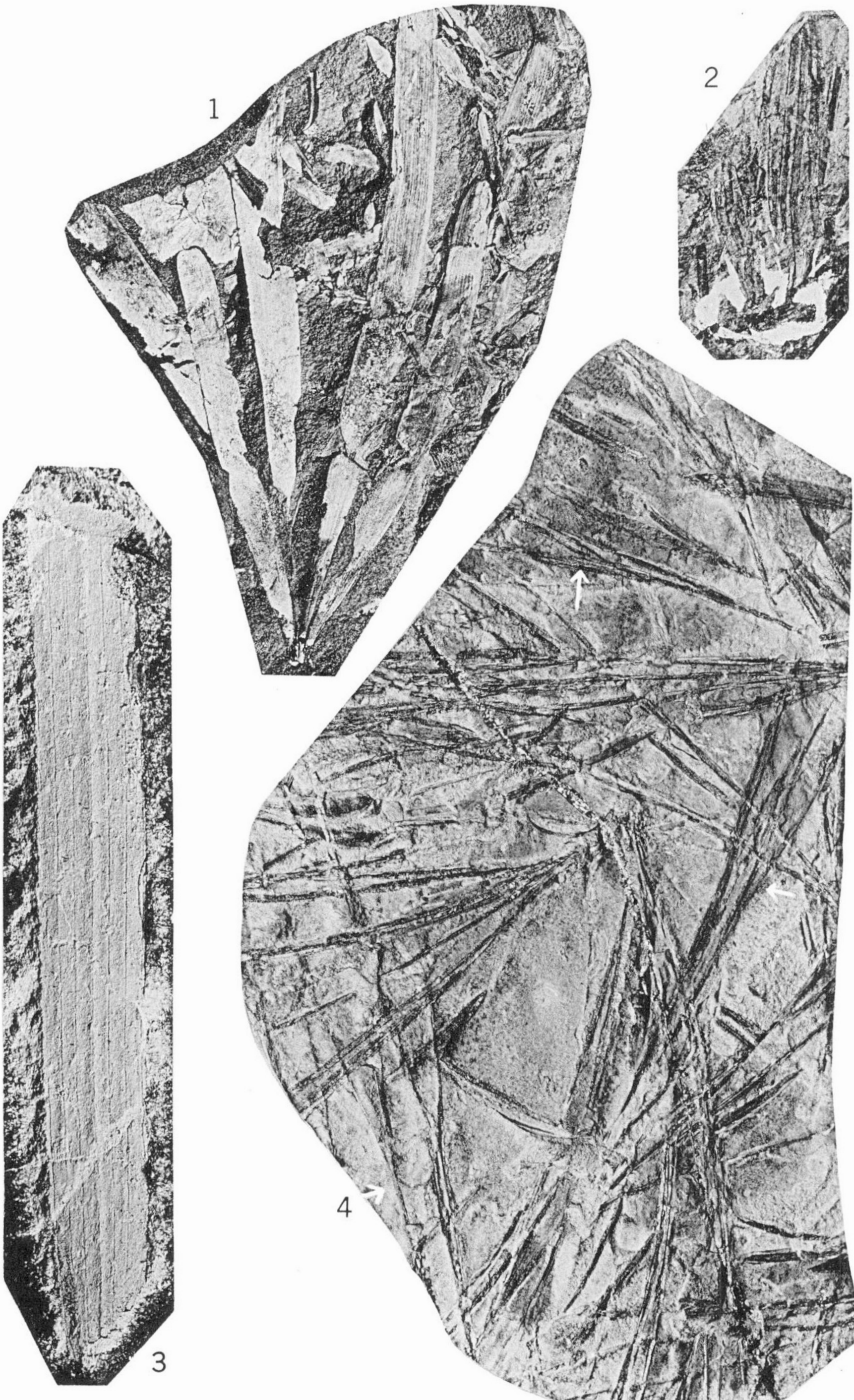

PLATE XL

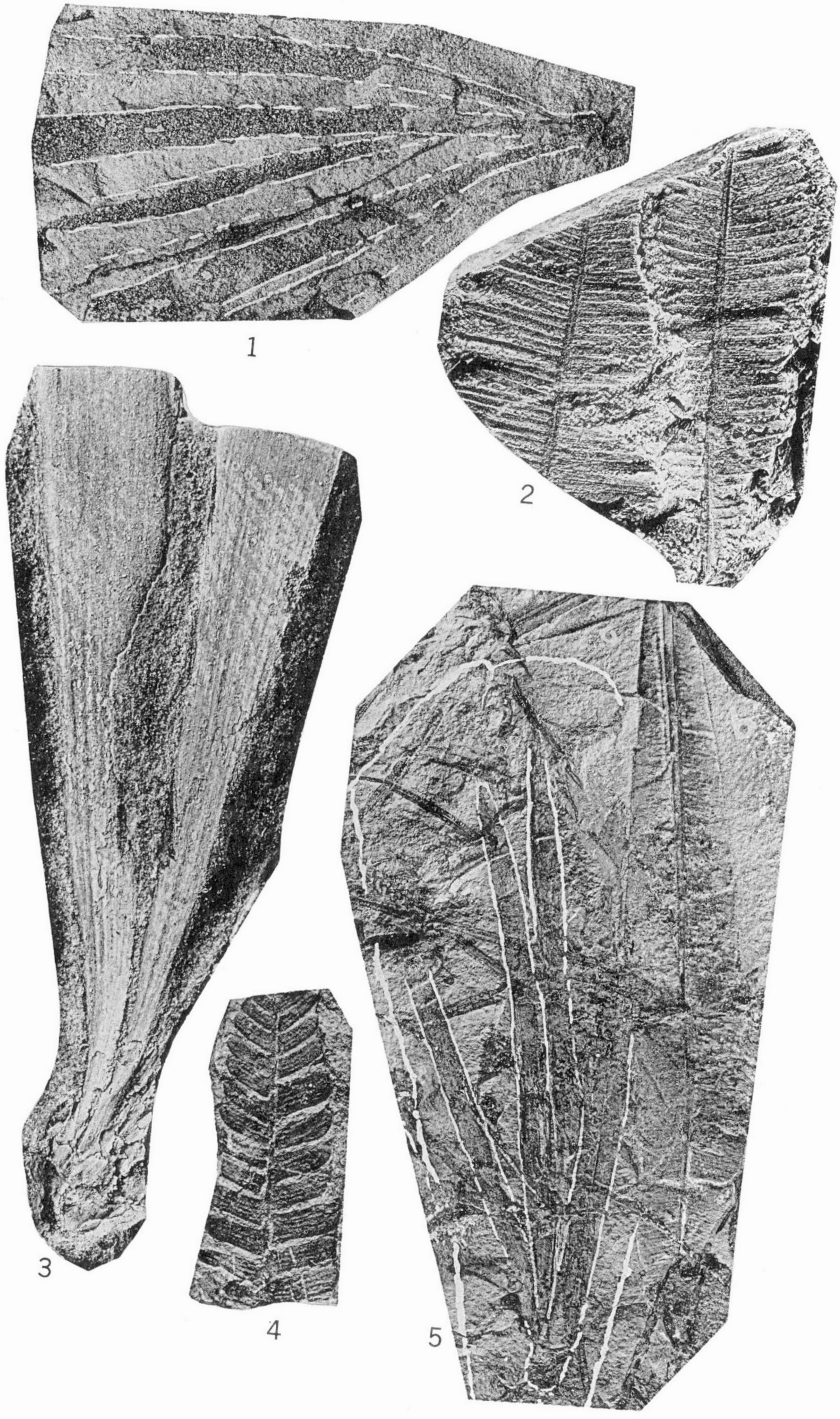

PLATE XL

Figure 1. *Phoenicopsis angustifolia* Heer forma *media* Krasser. Hypotype, G.S.C. No. 6589. Bullhead or Blairmore group, loc. 4310. (Page 90)

Figure 2. *Ptilophyllum* (*Anomozamites*) *montanense* (Fontaine). Hypotype, G.S.C. No. 5228. Hazelton group, loc. 836. (Page 91)

Figure 3. *Phoenicopsis angustifolia* Heer forma *media* Krasser. Hypotype, G.S.C. No. 5310 (in part) x 4. Bullhead group (Gething formation), loc. 3208. (Page 90)

Figure 4. *Pterophyllum plicatum* n. sp. Paratype, G.S.C. No. 5262. Bullhead group (Gething formation), loc. 3091. (Page 93)

Figure 5. *Phoenicopsis angustifolia* Heer forma *media* Krasser. Hypotype, G.S.C. No. 5309. Bullhead group (Gething formation), loc. 3208. (and *Nilssonia canadensis* n. sp.) (Page 90)

PLATE XLI

Figure 1. *Ptilophyllum* (*Anomozamites*) *montanense* (Fontaine). Hypotype, G.S.C. No. 5249. Luscar formation, loc. 2053. (Page 91)

Figure 2. *Ptilophyllum* (*Anomozamites*) *montanense* (Fontaine). Hypotype, G.S.C. No. 5251. Luscar formation, loc. 3163. (Page 91)

Figure 3. *Ptilophyllum* (*Anomozamites*) *montanense* (Fontaine). Hypotype, G.S.C. No. 5250. Luscar formation, loc. 2235. (Page 91)

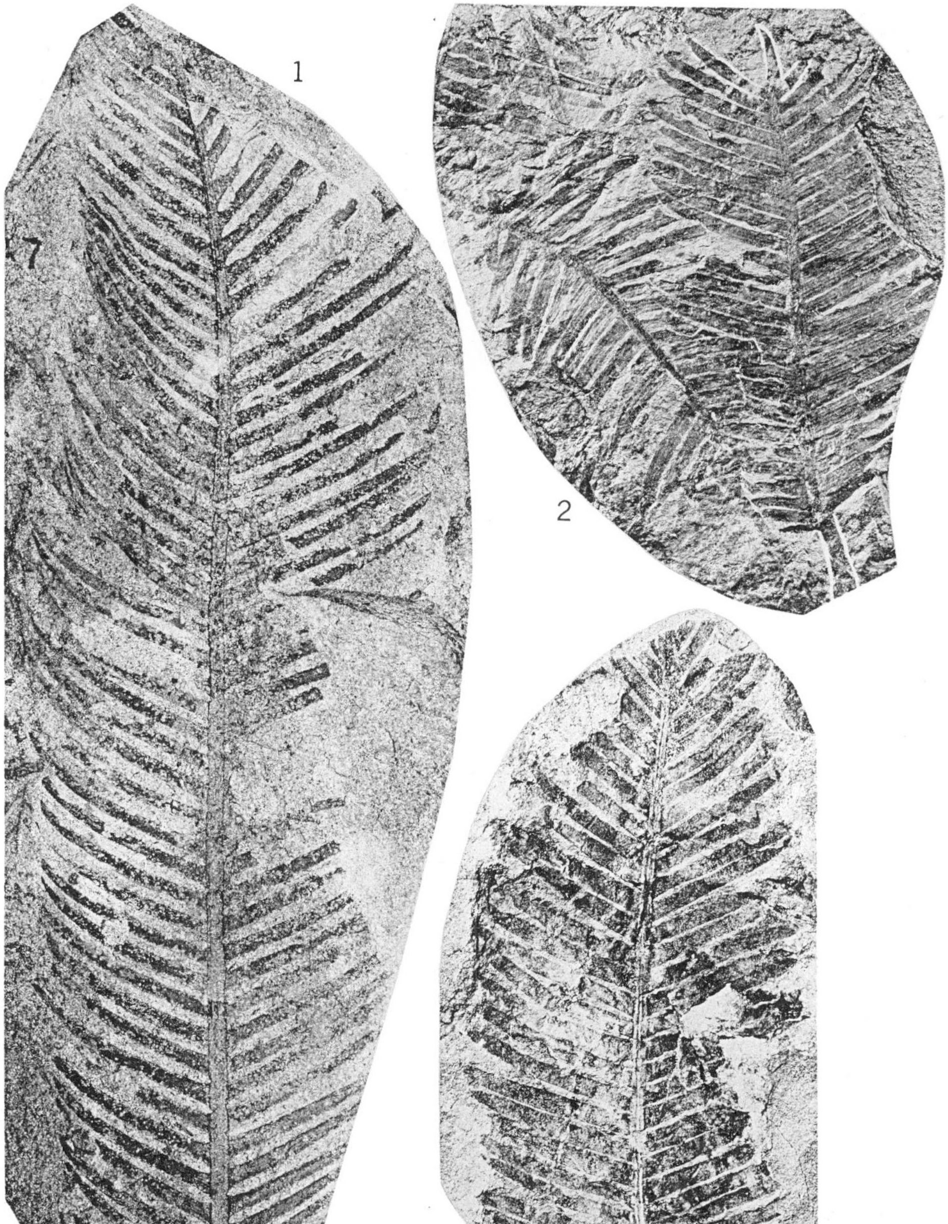
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Plate XLII

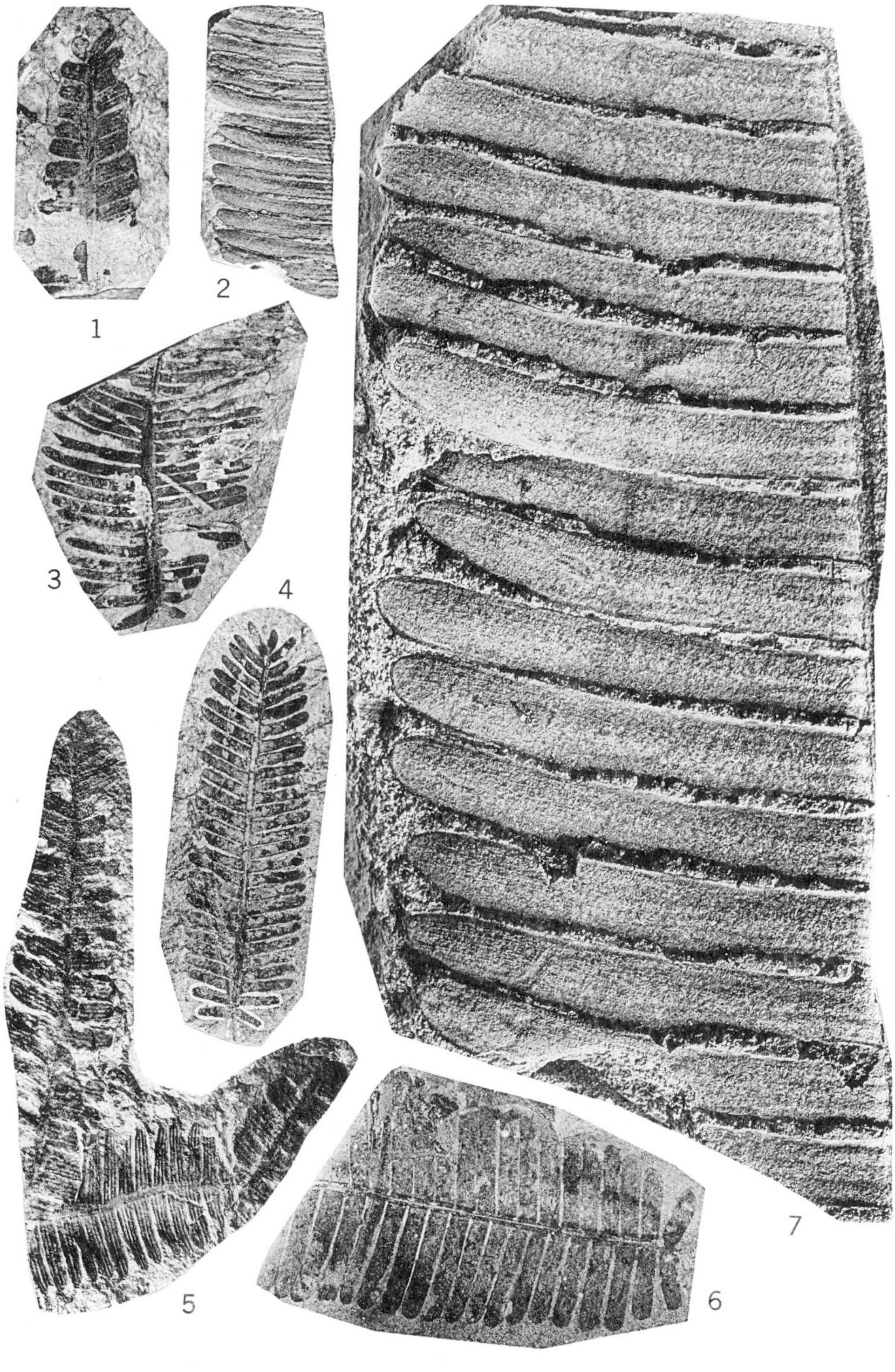


Plate XLII

Figure 1. *Pterophyllum plicatum* n. sp. Paratype, G.S.C. No. 5263. Bullhead group (Gething formation), loc. 3091. (Page 93)

Figure 2. *Ptilophyllum hirtum* n. sp. Paratype, G.S.C. No. 5789. Hazelton group, loc. 3029. (Page 96)

Figure 3. *Pterophyllum rectangulare* n. sp. Paratype, G.S.C. No. 5257. Bullhead group (Gething formation), loc. 3095. (Page 92)

Figure 4. *Pterophyllum rectangulare* n. sp. Holotype, G.S.C. No. 5254. Bullhead group (Gething formation), loc. 3095. (Page 92)

Figure 5. *Pterophyllum plicatum* n. sp. Holotype, G.S.C. No. 5259. Bullhead group (Gething formation), loc. 3091. (Page 93)

Figure 6. *Pterophyllum rectangulare* n. sp. Paratype, G.S.C. No. 5256. Bullhead group (Gething formation), loc. 3095. (Page 92)

Figure 7. *Ptilophyllum hirtum* n. sp. Paratype, G.S.C. No. 5789 x 4. Hazelton group, loc. 3029. (Page 96)

Plate XLIII

Figure 1. *Czekanowskia* cf. *rigida* Heer. G.S.C. No. 5308. Hazelton group, loc. 396. (Page 89)

Figure 2. *Pterophyllum plicatum* n. sp. Paratype, G.S.C. No. 5258. Bullhead group (Gething formation), loc. 3091. (Page 93)

Figure 3. *Ptilophyllum arcticum* (Göppert) Seward. Hypotype, G.S.C. No. 5266. Kootenay formation, loc. 1222. (Page 94)

Figure 4. *Ptilophyllum hirtum* n. sp. Holotype, G.S.C. No. 5788. Hazelton group, loc. 3029. (Page 96)

Figure 5. *Pterophyllum plicatum* n. sp. Paratype, G.S.C. No. 5261 x 4. Bullhead group (Gething formation), loc. 3091. (Page 93)

Figure 6. *Pseudocycas dunkeriana* (Göppert) Florin. Hypotype, G.S.C. No. 5299. Bullhead group (Gething formation), loc. 3091. (Page 97)

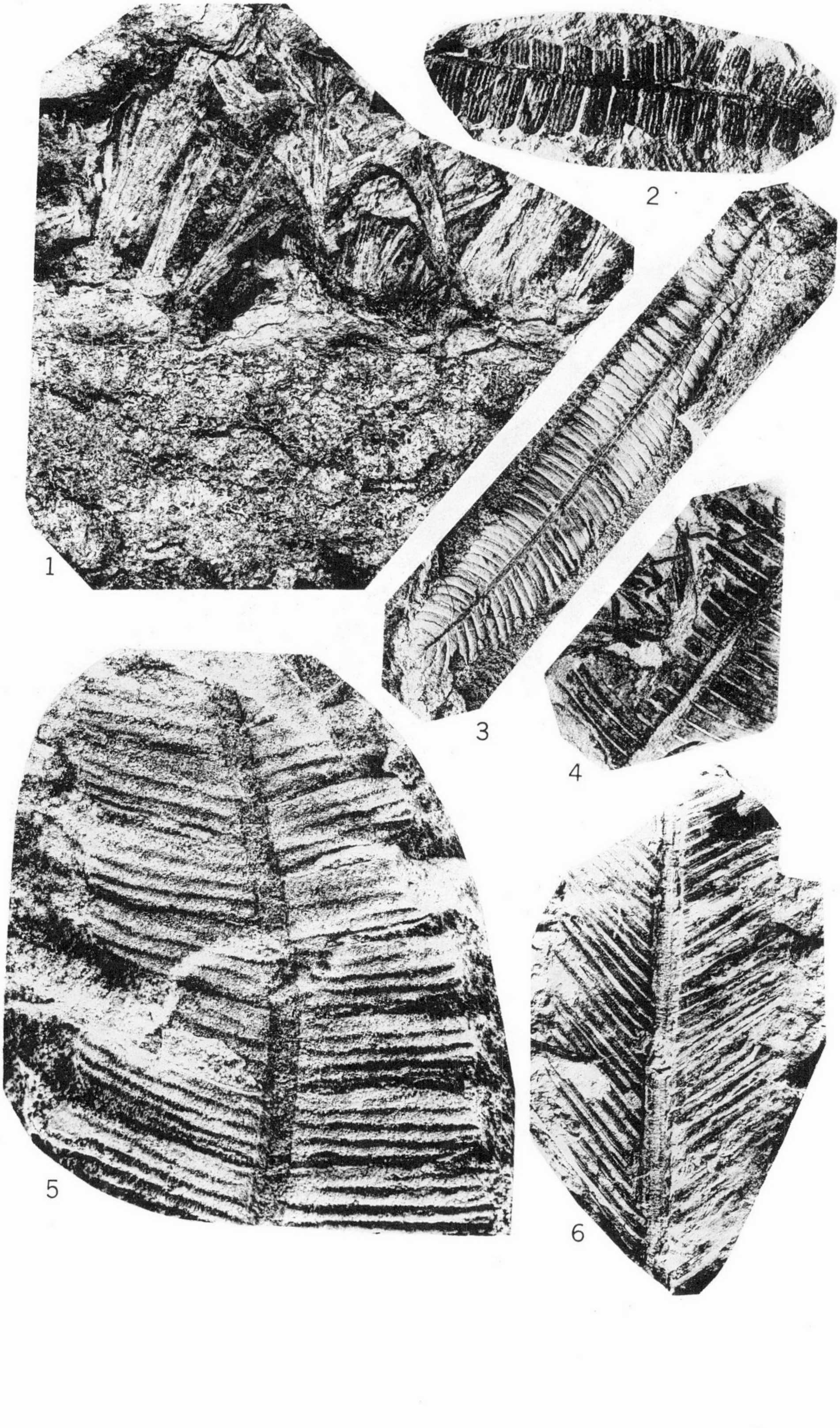
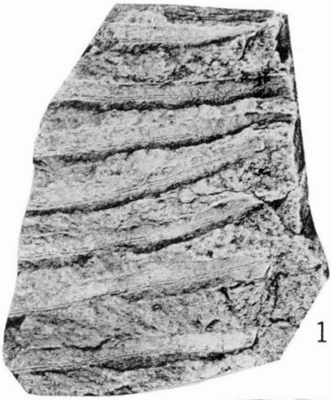


PLATE XLIV



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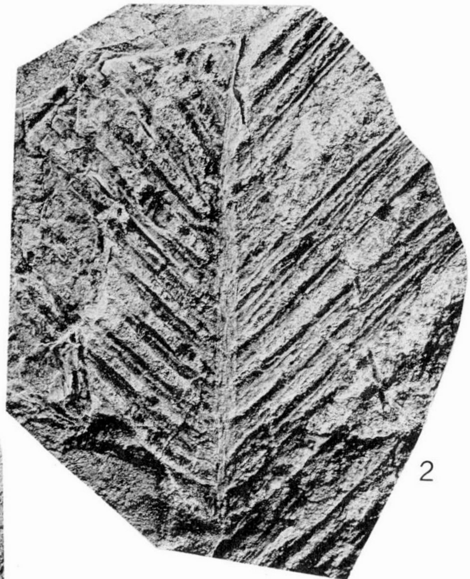

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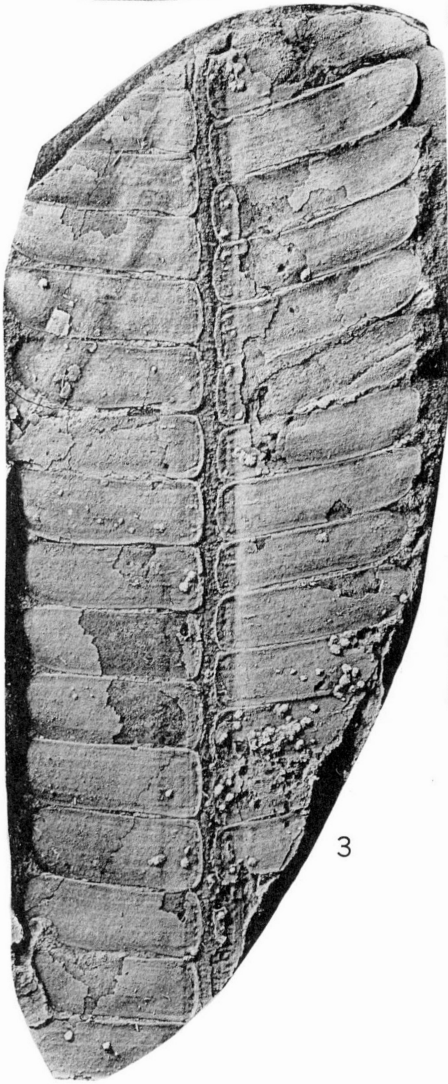

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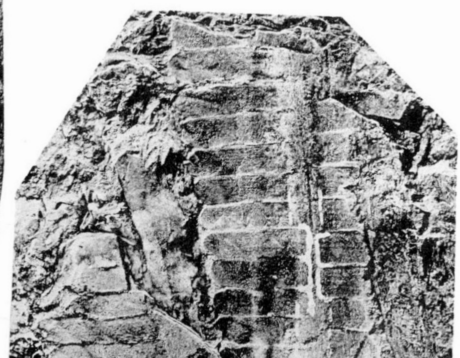

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PLATE XLIV

Figure 1. *Pseudocycas* sp. B cf. *P. unjiga* (Dawson). G.S.C. No. 6660. Pasayten group, loc. 3129. (Page 99)

Figure 2. *Pseudocycas* sp. A cf. *P. unjiga* (Dawson). G.S.C. No. 5300. Blairmore group (upper flora), loc. 4022. (Page 98)

Figure 3. *Ptilophyllum arcticum* (Göppert) Seward. Hypotype, G.S.C. No. 5269 x 4. Kootenay formation, loc. 4039. (Page 94)

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PLATE XLV

Figure 1. *Zamites* ? sp. (Dawson). G.S.C. No. 6591. Luscar formation, loc. 1907. (Page 100)

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Figure 4. *Cycadolepis* sp. Berry. G.S.C. No. 5297. Kootenay formation, loc. 4044. (Page 101)

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Figure 6. *Ptilophyllum columbianum* n. sp. Paratype, G.S.C. No. 5759. Hazelton group, loc. 3297. (Page 96)

PLATE XLV

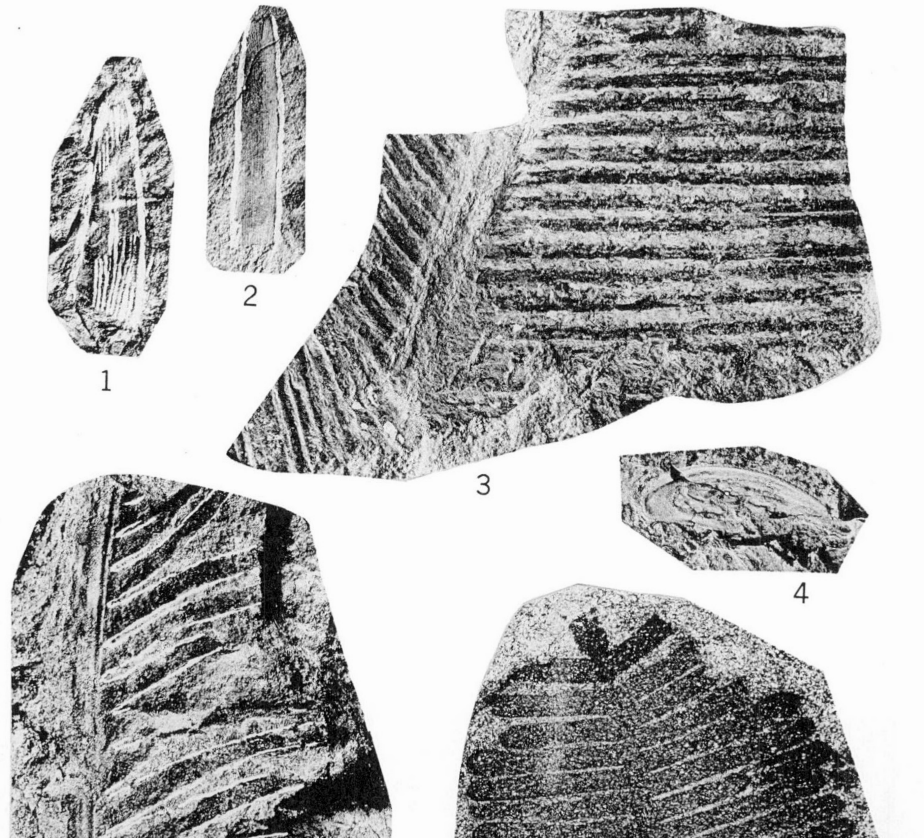
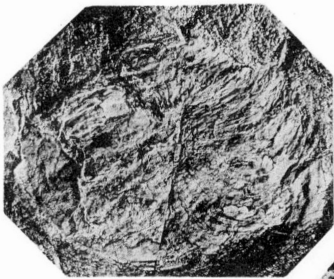


Plate XLVI



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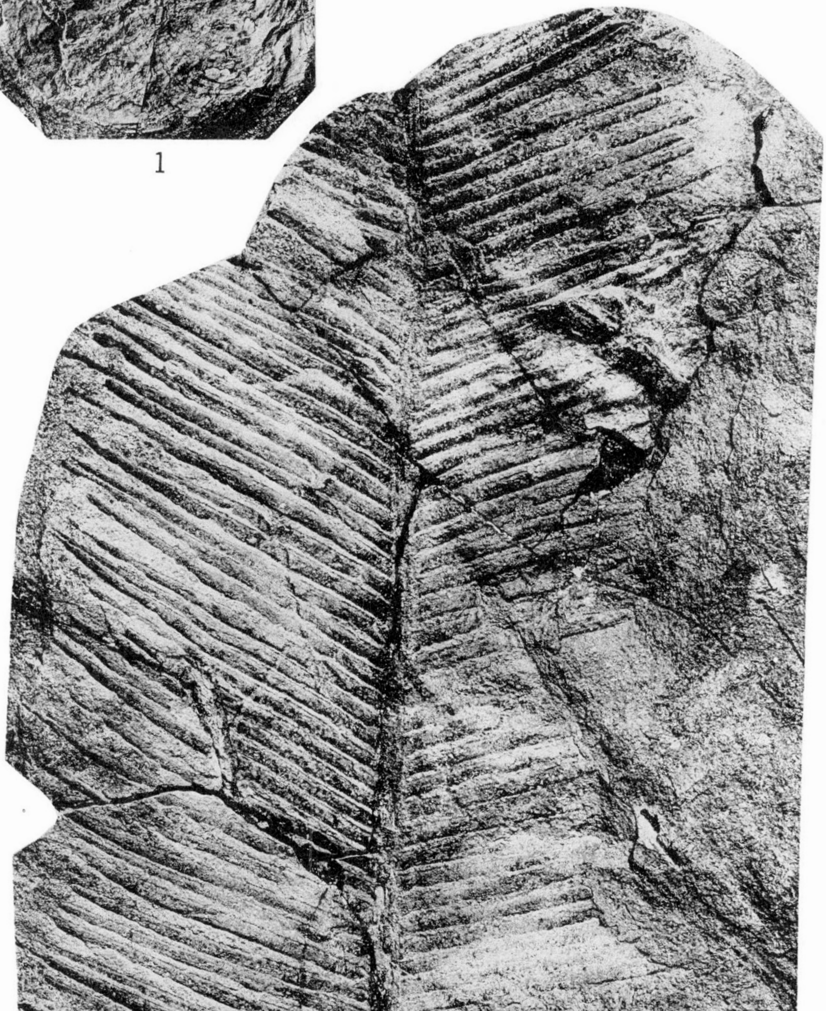

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PLATE XLVI

Figure 1. *Williamsonia ? recentior* Dawson. Hypotype, G.S.C. No. 6636 x 2. Blairmore group (upper flora), loc. 3066. (Page 101)

Figure 2. *Pseudocycas* sp. A cf. *P. unjiga* (Dawson). G.S.C. No. 5271. Bullhead group (Gething formation), loc. 3091. (Page 98)

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Figure 2. *Pseudocycas dunkeriana* (Göppert) Florin. Hypotype, G.S.C. No. 6593. Bullhead group (Gething formation), loc. 3636. (Page 97)

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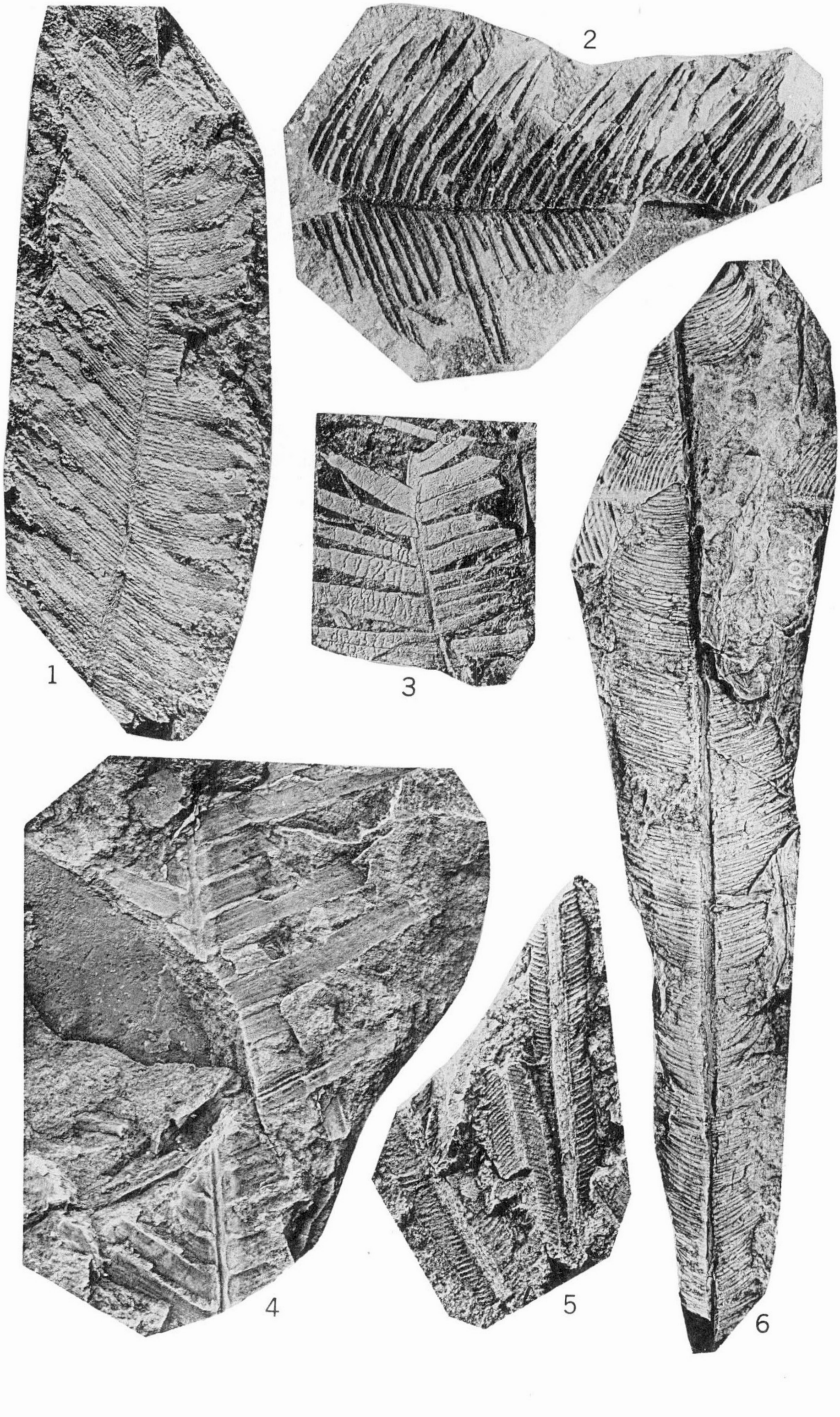
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PLATE XLVIII

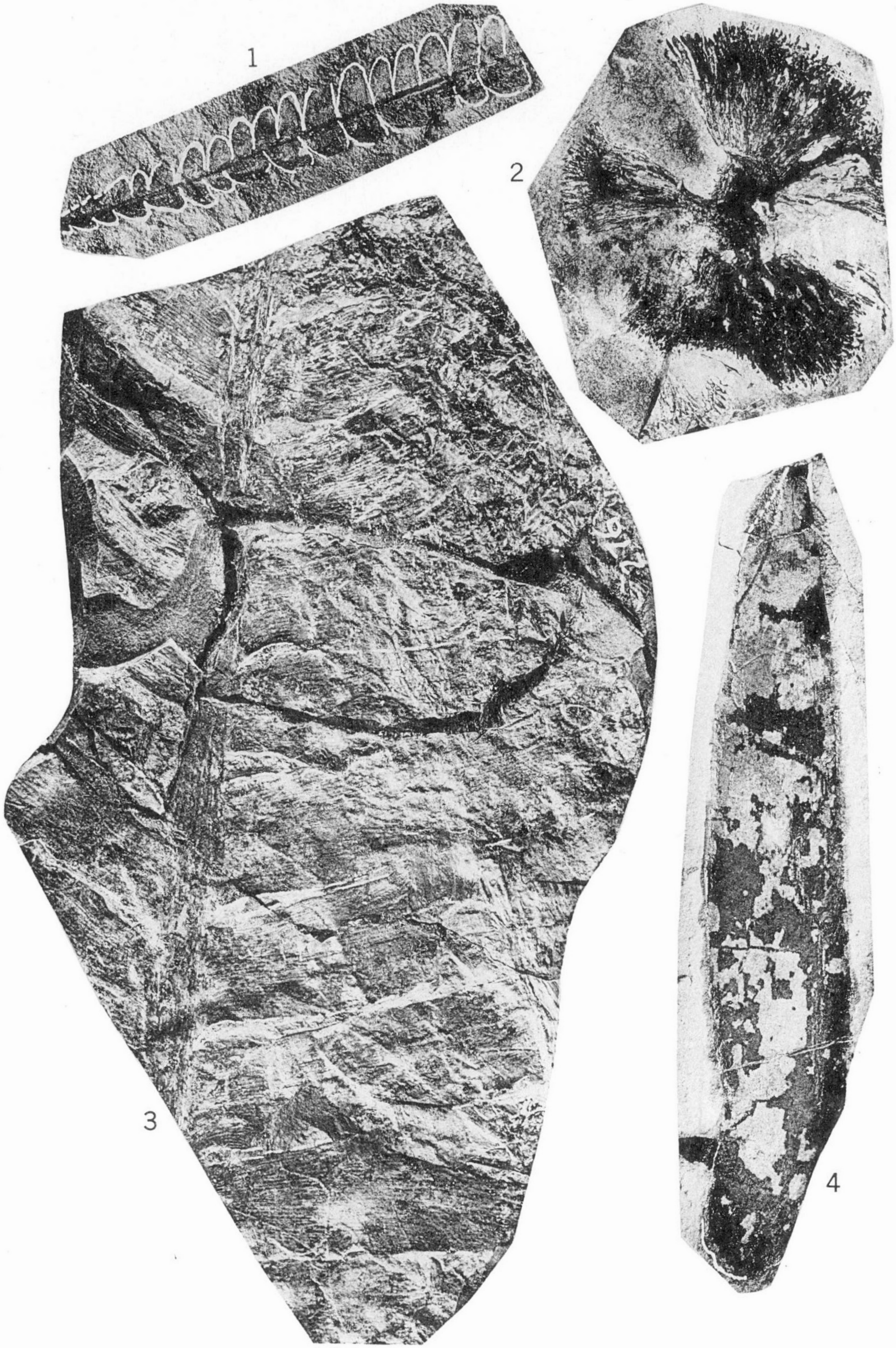

PLATE XLVIII

Figure 1. *Nilssonia schaumburgensis* (Dunker) Nathorst. Hypotype, G.S.C. No. 5285. Hazelton group, loc. 2411. (Page 102)

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Figure 6. *Nilssonia nigracollensis* Wieland. Hypotype, No. 3293 x 2. Hazelton group, loc. 1690. (Page 103)

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PLATE L

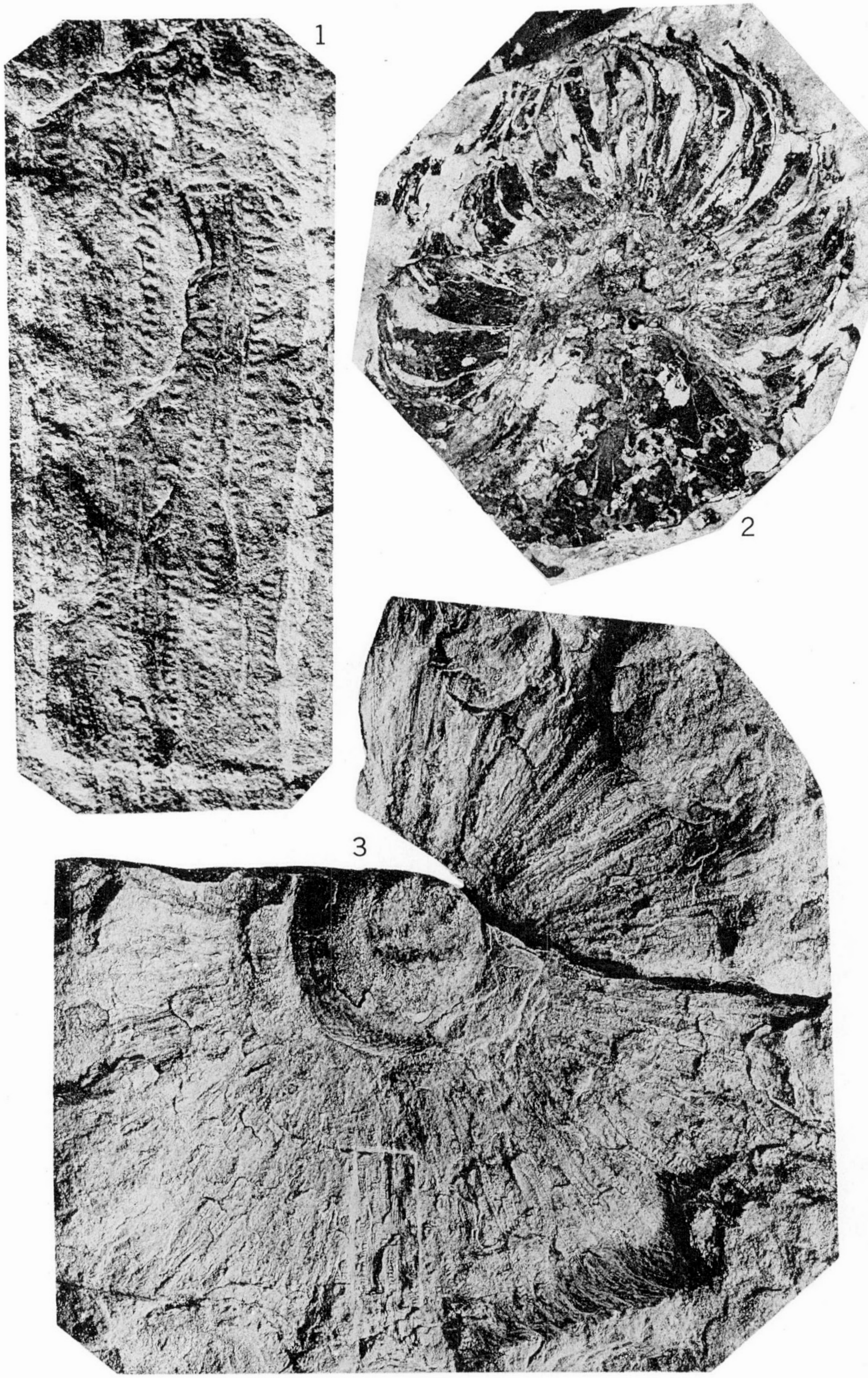

PLATE L

Figure 1. *Isoetites horridus* (Dawson). Holotype (in part x 4). G.S.C. No. 5388. Dunvegan formation (U. Cretaceous), loc. 4207. (Page 78)

Figure 2. *Williamsonia ? recentior* Dawson. Holotype, No. 5105 x 2. Blairmore group (upper flora), loc. 1815. (Page 101)

Figure 3. *Isoetites horridus* (Dawson). Holotype, G.S.C. No. 5388. Dunvegan formation (U. Cretaceous), loc. 4207. (Page 78)

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Figure 2. *Nilssonia canadensis* n. sp. Paratype, G.S.C. No. 5869. Kingsvale group, loc. 3125. (Page 104)

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Figure 6. *Williamsonia ? recentior* Dawson. Hypotype, G.S.C. No. 6645. Blairmore group (upper flora), loc. 1815. (Page 101)

PLATE LI

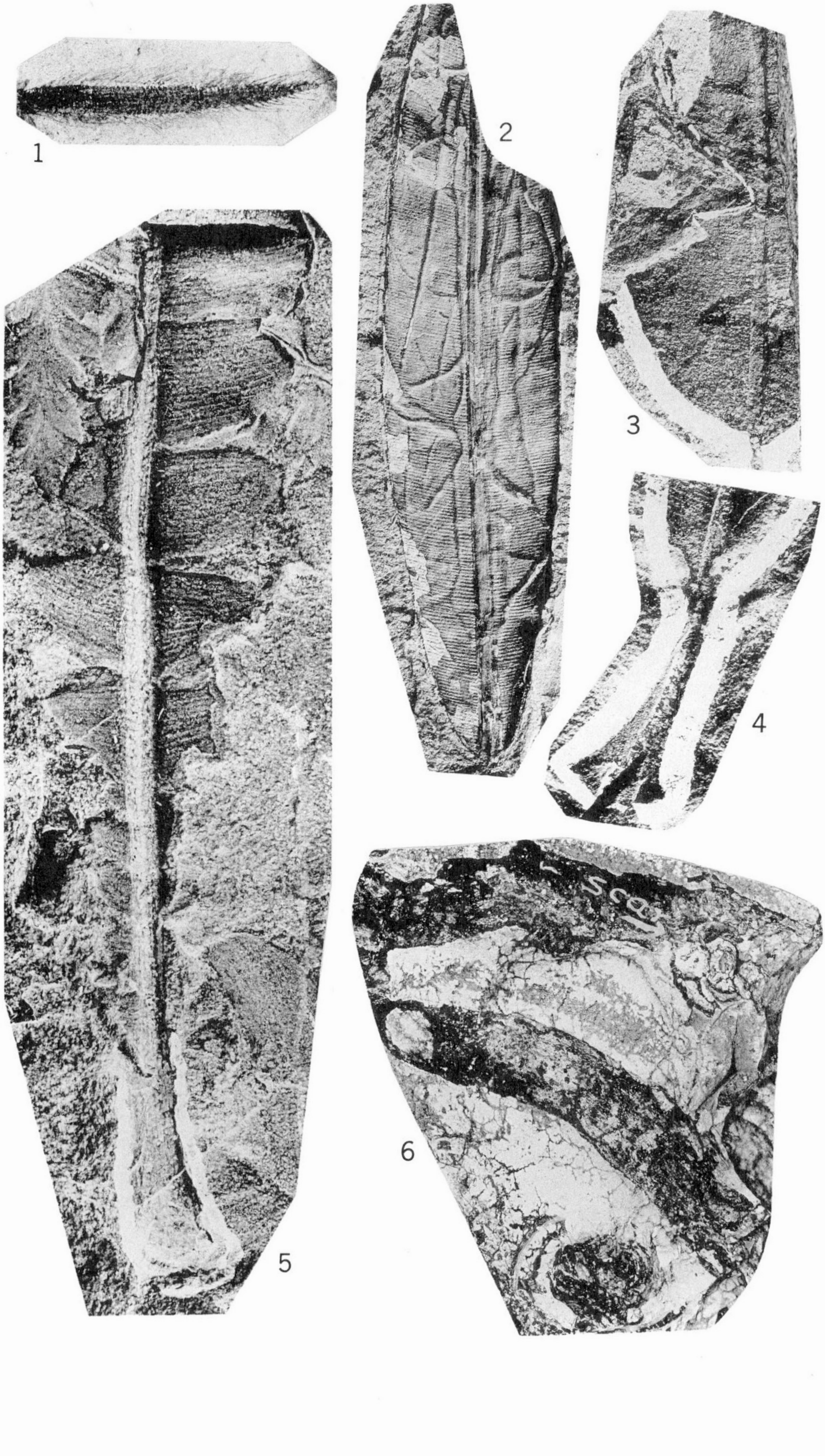

PLATE LII

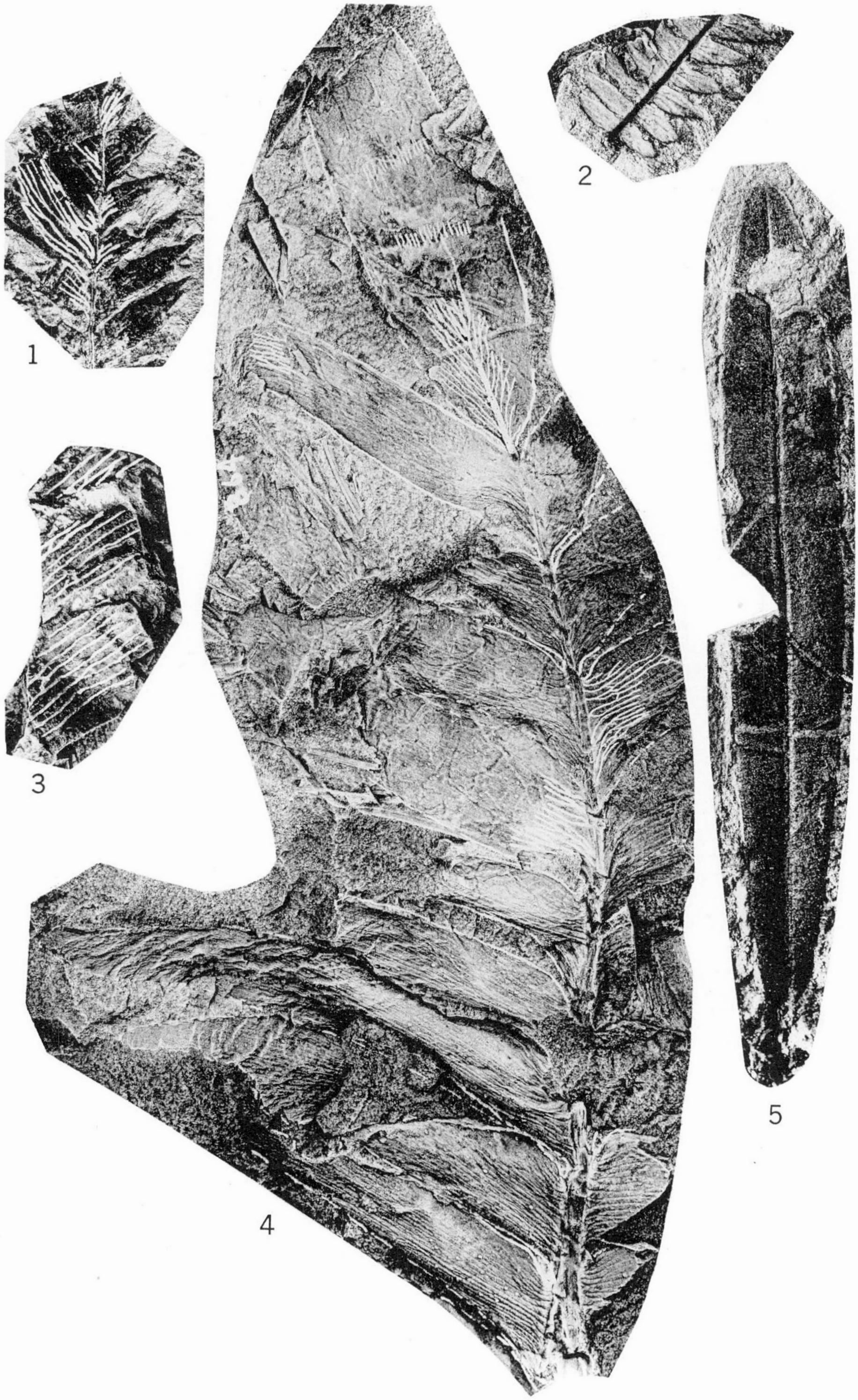

Plate LII

Figure 1. *Ctenopteris insignis* Fontaine. Hypotype, G.S.C. No. 5756. Luscar formation, loc. 3181. (Page 108)

Figure 2. *Ctenopteris insignis* Fontaine. Hypotype, G.S.C. No. 5298. Luscar formation, loc. 3182. (Page 108)

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Figure 4. *Ctenis borealis* (Dawson). Hypotype, G.S.C. No. 5723 x $\frac{4}{5}$ approx. Kootenay formation, loc. 864. (Page 106)

Figure 5. *Nilssonia canadensis* n. sp. Paratype, G.S.C. No. 5281. Bullhead group (Gething formation), loc. 3208. (Page 104)

PLATE LIII

Figure 1. *Ctenis borealis* (Dawson). Hypotype, G.S.C. No. 5728 x $\frac{1}{3}$ approx. Kootenay formation, loc. 864. (Page 106)

Figure 2. *Elatocladus brevifolia* (Fontaine). Hypotype, G.S.C. No. 5860. Kingsvale group, loc. 3125. (Page 109)

PLATE LIII

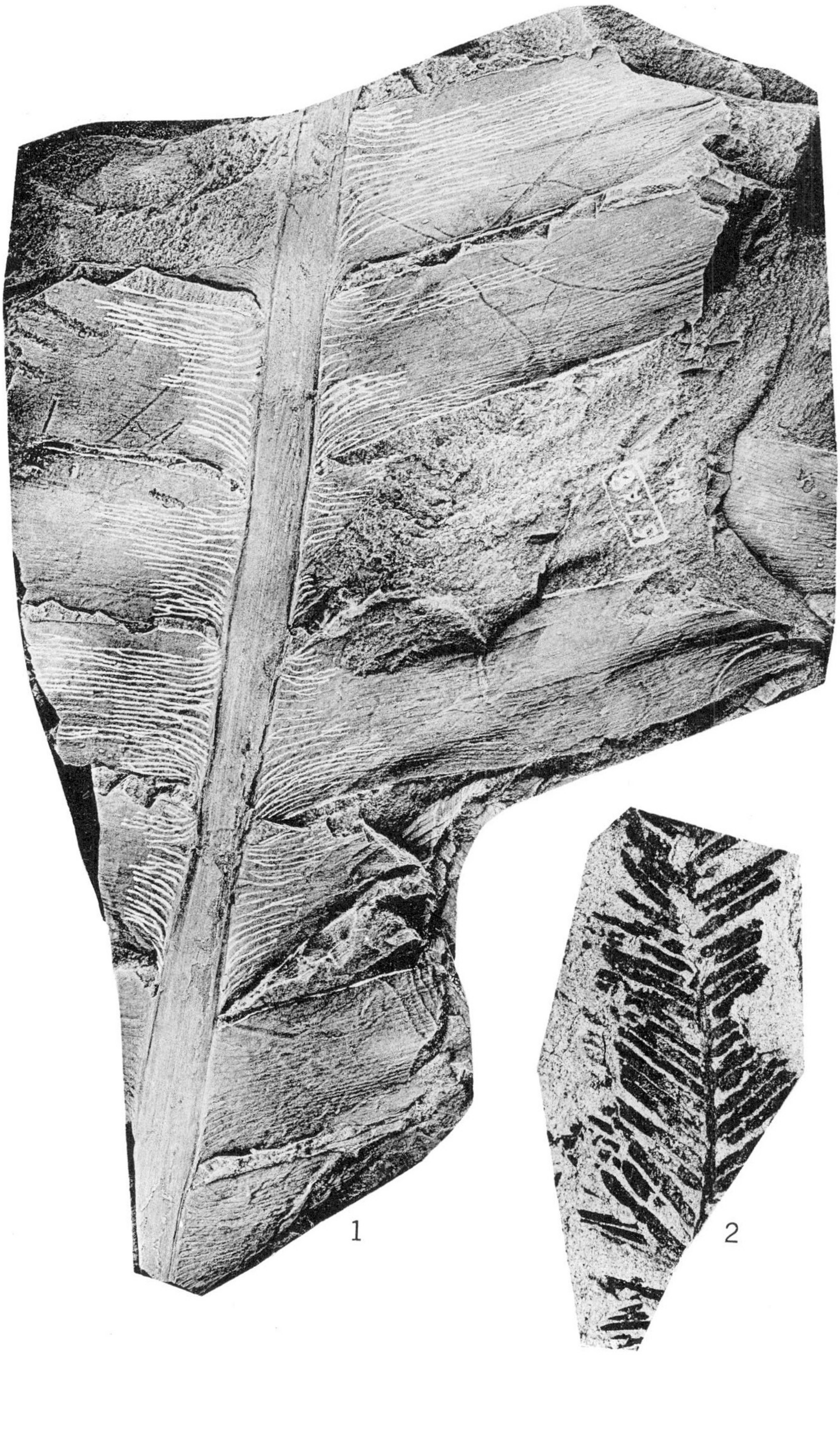

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Plate LIV

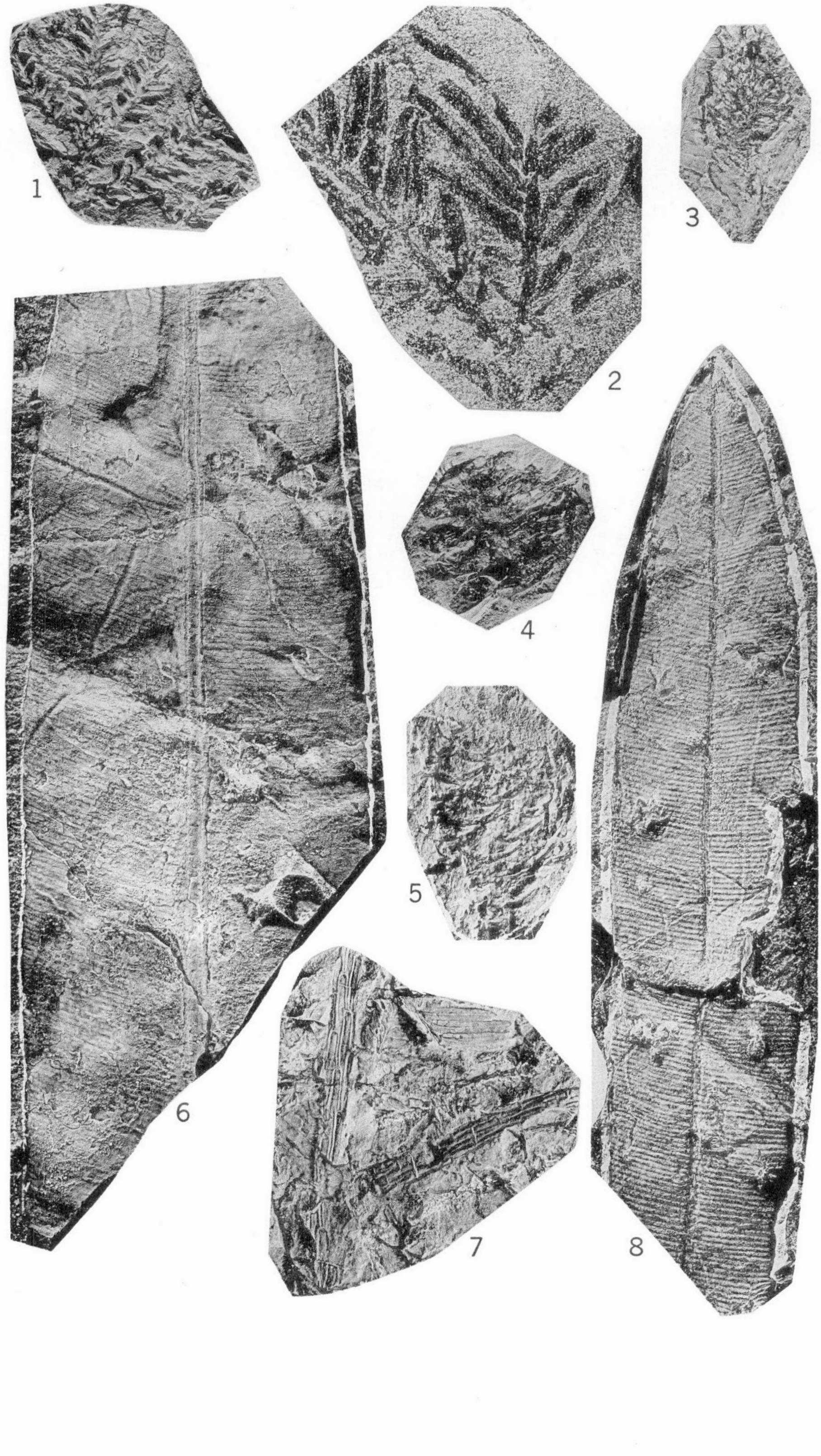

Plate LIV

Figure 1. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 6605. Blairmore group (lower flora), loc. 1254. (Page 110)

Figure 2. *Elatocladus brevifolia* (Fontaine). Hypotype, G.S.C. No. 6602 x 2. Blairmore group (lower flora), loc. 4027. (Page 109)

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Figure 7. *Elatocladus brevifolia* (Fontaine). Hypotype, G.S.C. No. 6603. Blairmore group (lower flora), loc. 4027. (Page 109)

Figure 8. *Nilssonia canadensis* n. sp. Holotype, G.S.C. No. 5282. Bullhead group (Gething formation), loc. 1997. (Page 104)

PLATE LV

Pseudoctenis hazeltonensis n. sp. Paratype, G.S.C. No. 5787 x $\frac{4}{5}$. Hazelton group, loc. 397. (Page 107)

Plate LVI

PLATE LVI

Ctenis borealis (Dawson). Hypotype, G.S.C. No. 4817. Kootenay formation, loc. 276.
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Figure 1. *Elatocladus brevifolia* (Fontaine). Hypotype, G.S.C. No. 6601. Blairmore group (lower flora), loc. 4027. (Page 109)

Figure 2. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 6607. Bullhead group (Gething formation), loc. 3631. (Page 110)

Figure 3. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 5232. Luscar formation, loc. 3181. (Page 110)

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Figure 5. *Pseudoctenis hazeltonensis* n. sp. Holotype, G.S.C. No. 5316. Hazelton group, loc. 2410. (Page 107)

Figure 6. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 5230. Luscar formation, loc. 3201. (Page 110)

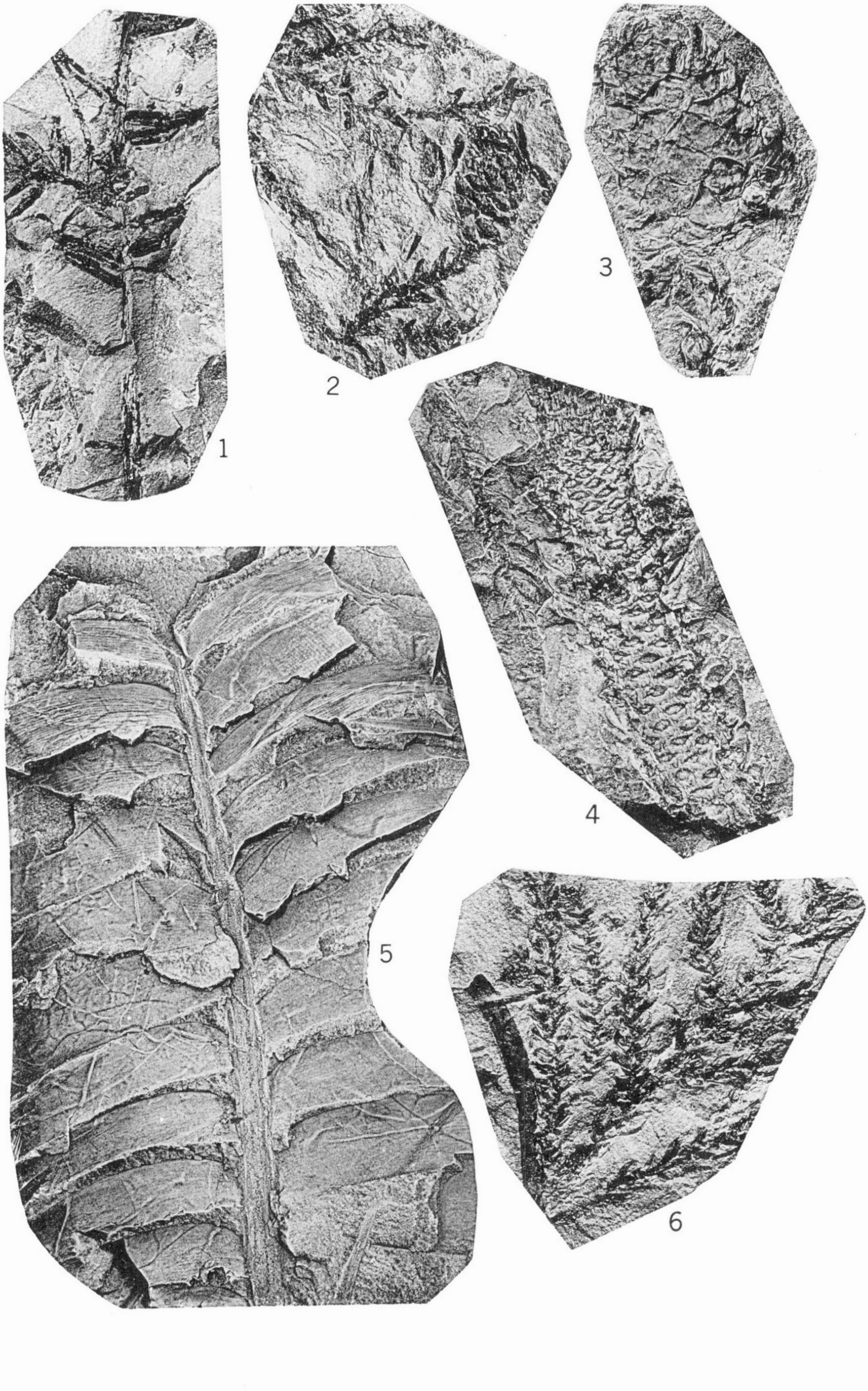
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PLATE LVIII

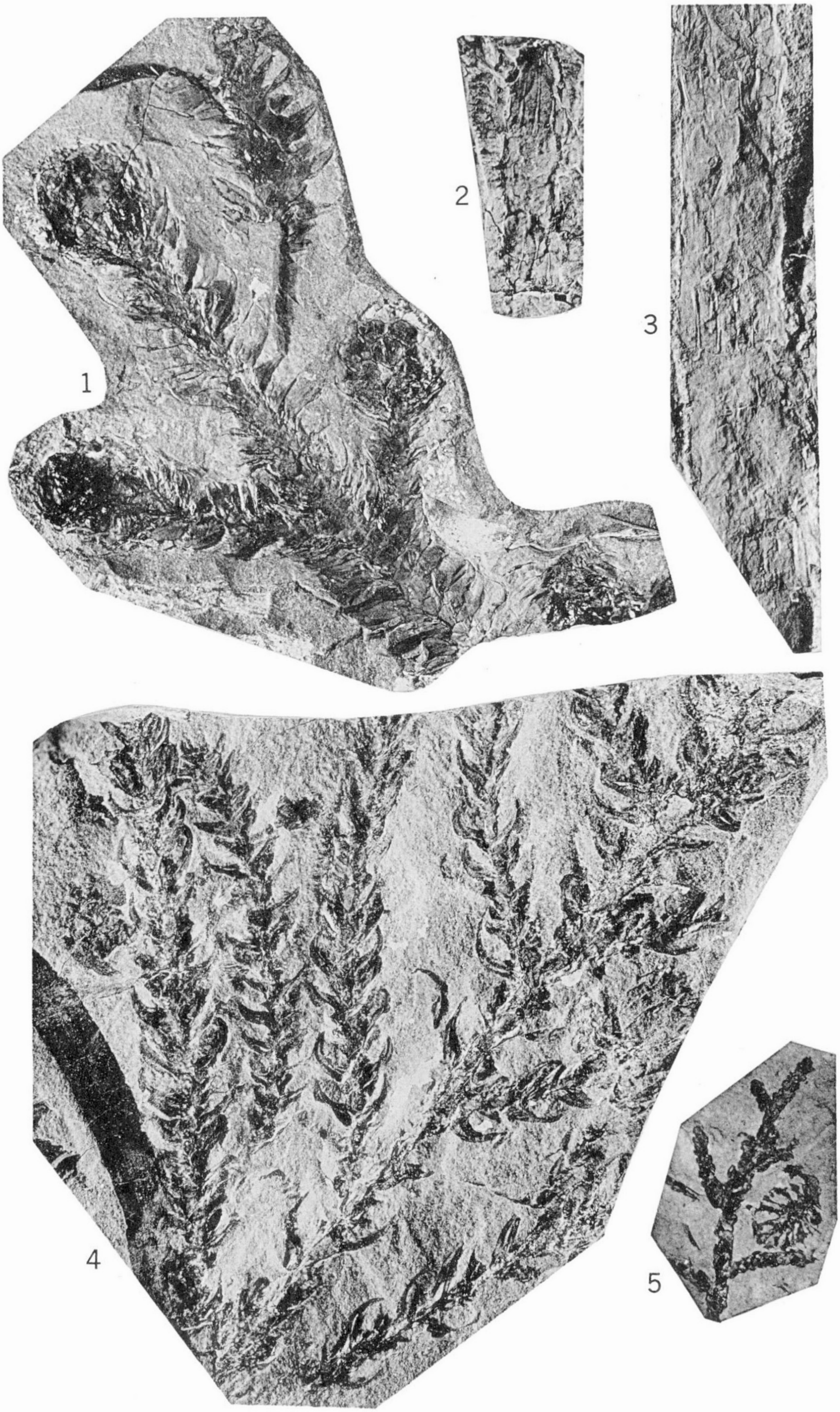

Plate LVIII

Figure 1. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 5231. Bullhead group (Gething formation), loc. 3167. (Page 110)

Figure 2. *Equisetites lyelli* (Mantell) Unger. Hypotype, G.S.C. No. 5748 x 2. Kootenay formation, loc. 1574. (Page 76)

Figure 3. *Equisetites lyelli* (Mantell) Unger. Hypotype, G.S.C. No. 4838 x 2. Kootenay formation, loc. 1574. (Page 76)

Figure 4. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 5229 x 2. Luscar formation, loc. 2201. (Page 110)

Figure 5. *Athrotaxites berryi* n. sp. Holotype, G.S.C. No. 5221. Luscar formation, loc. 2052. (Page 115)

PLATE LIX

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Figure 2. *Elatocladus brevifolia* (Fontaine) forma *lata*. Hypotype, G.S.C. No. 6619. Kingsvale group, loc. 3020. (Page 110)

Figure 3. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 5229. Luscar formation, loc. 2201. (Page 110)

Figure 4. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5239 x 2. Bullhead group (Gething formation), loc. 3208. (Page 111)

PLATE LIX

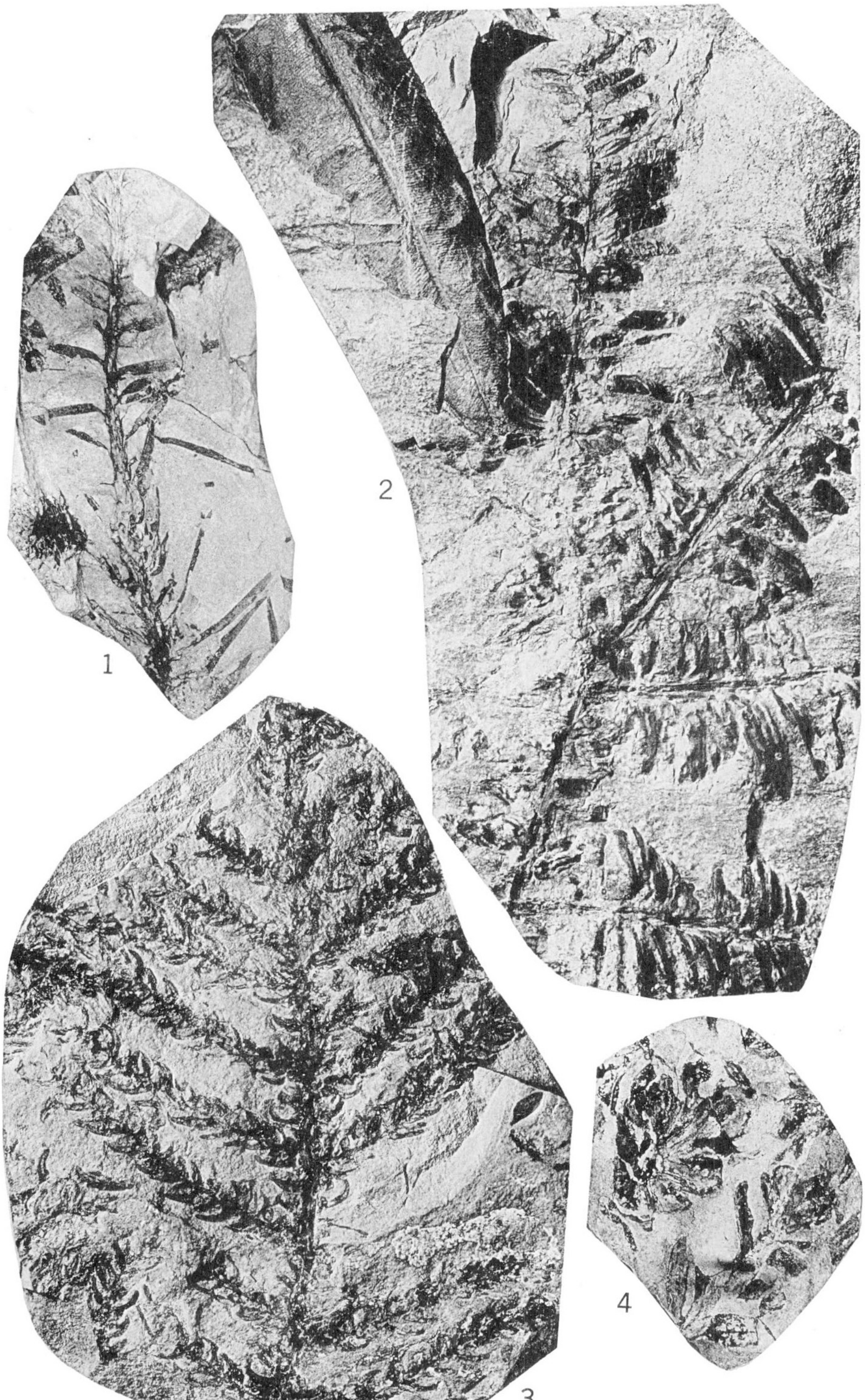

PLATE LX

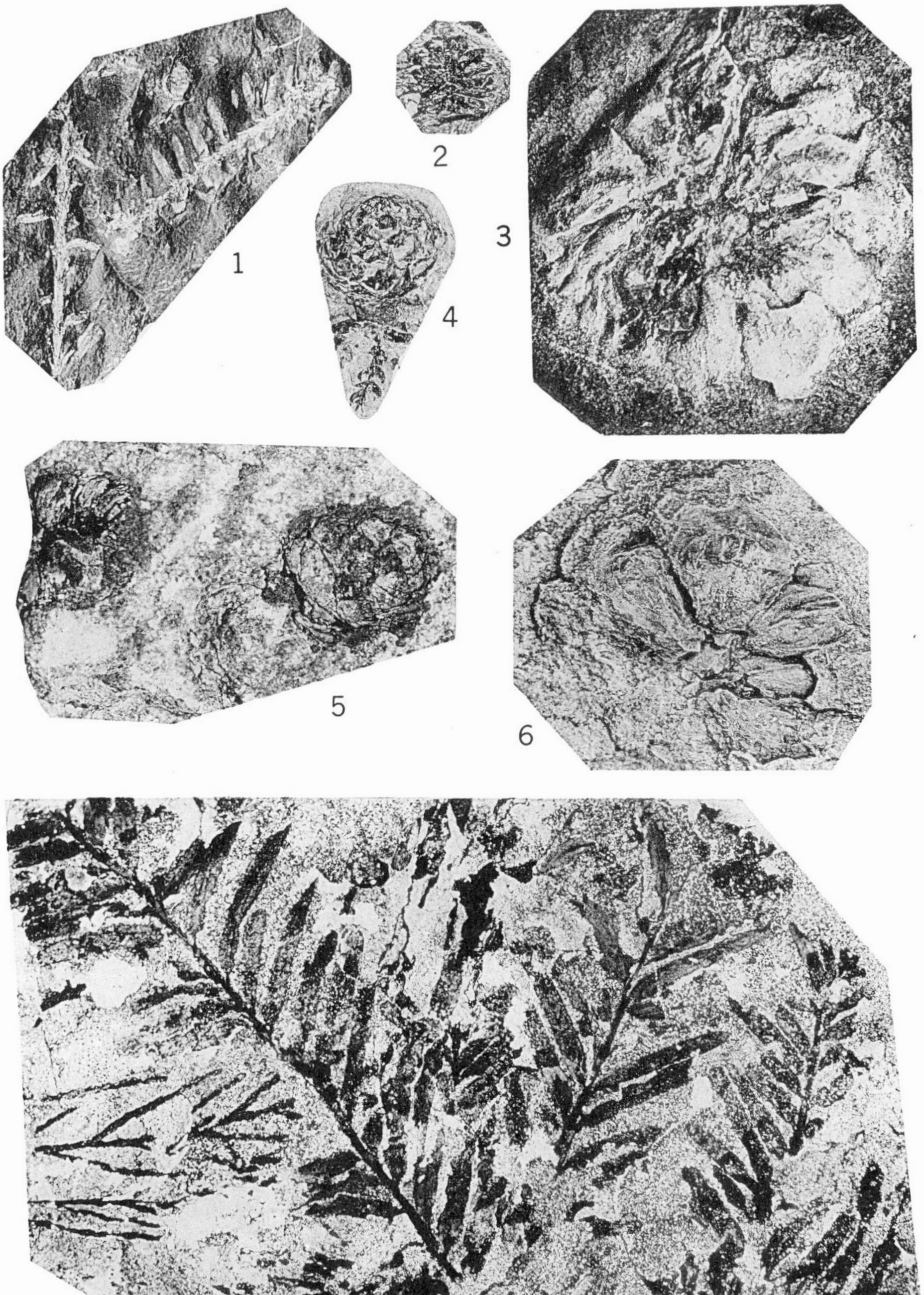

PLATE LX

Figure 1. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5790. Hazelton group, loc. 3319. (Page 111)

Figure 2. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5240. Luscar formation, loc. 2052. (Page 111)

Figure 3. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5240 x 4. Luscar formation, loc. 2052. (Page 111)

Figure 4. *Elatides curvifolia* (Dunker) Nathorst. Hypotype, G.S.C. No. 5234. Luscar formation, loc. 2052. (Page 110)

Figure 5. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 6626 x 2. Blairmore group (lower flora), loc. 4016. (Page 115)

Figure 6. *Elatides splendida* n. sp. Paratype, G.S.C. No. 6612 x 4. Luscar formation, loc. 2052. (Page 111)

Figure 7. *Elatocladus brevifolia* (Fontaine) forma *lata*. Hypotype, G.S.C. No. 5856. Kingsvale group, loc. 3020. (Pages 109, 110)

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Figure 1. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5241 x 4, and *Ptilophyllum arcticum*. Luscar formation, loc. 2053. (Page 111)

Figure 2. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5242. Bullhead group (Gething formation), loc. 3209. (Page 111)

Figure 3. *Pityophyllum* cf. *nordenskiöldi* (Heer). G.S.C. No. 5311 x 2. Kootenay formation, loc. 1579. (Page 112)

Figure 4. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5236. Bullhead group (Gething formation), loc. 1997. (Page 111)

Figure 5. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 5215. Luscar formation, loc. 1558. (Page 115)

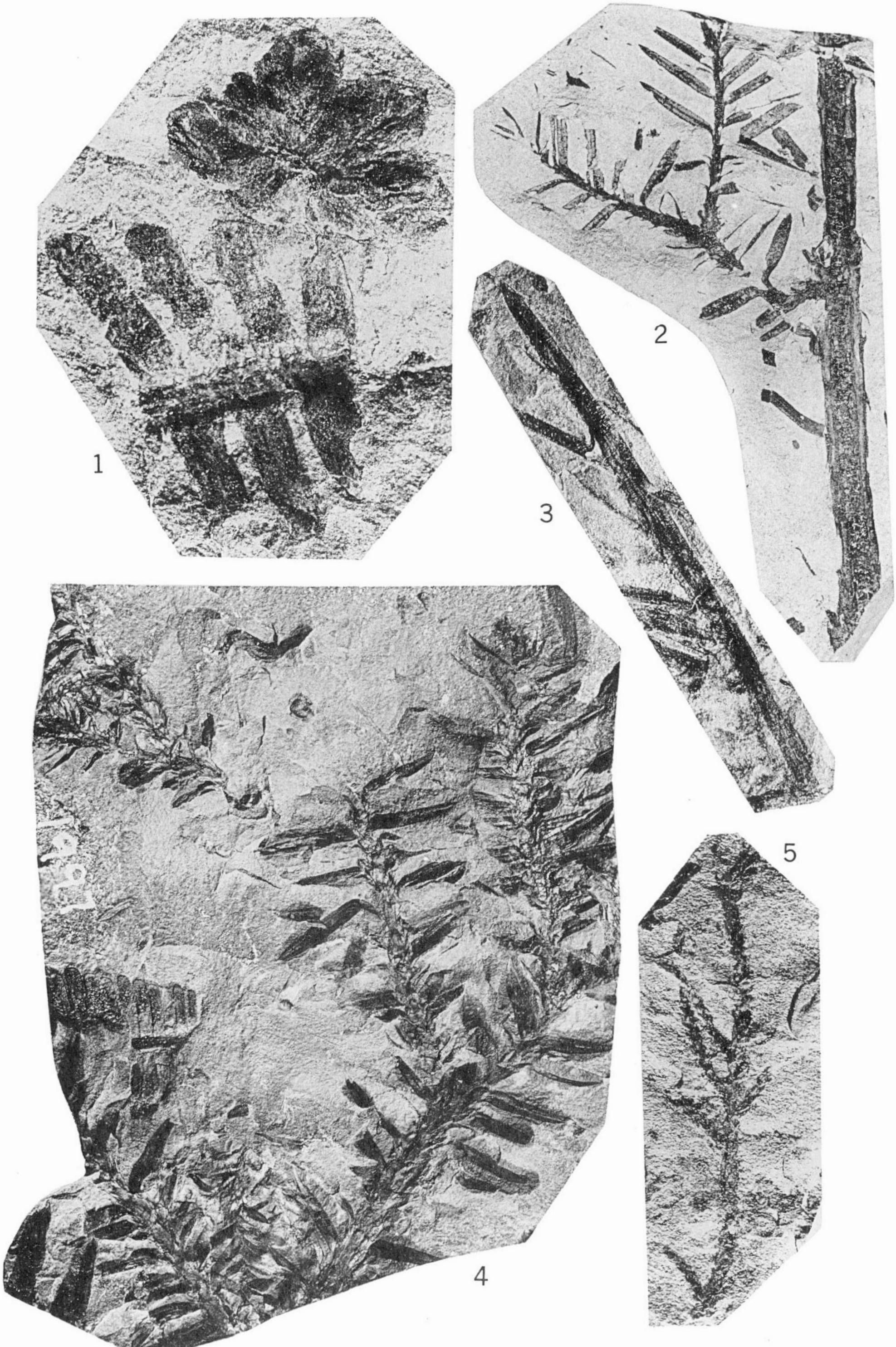
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PLATE LXII

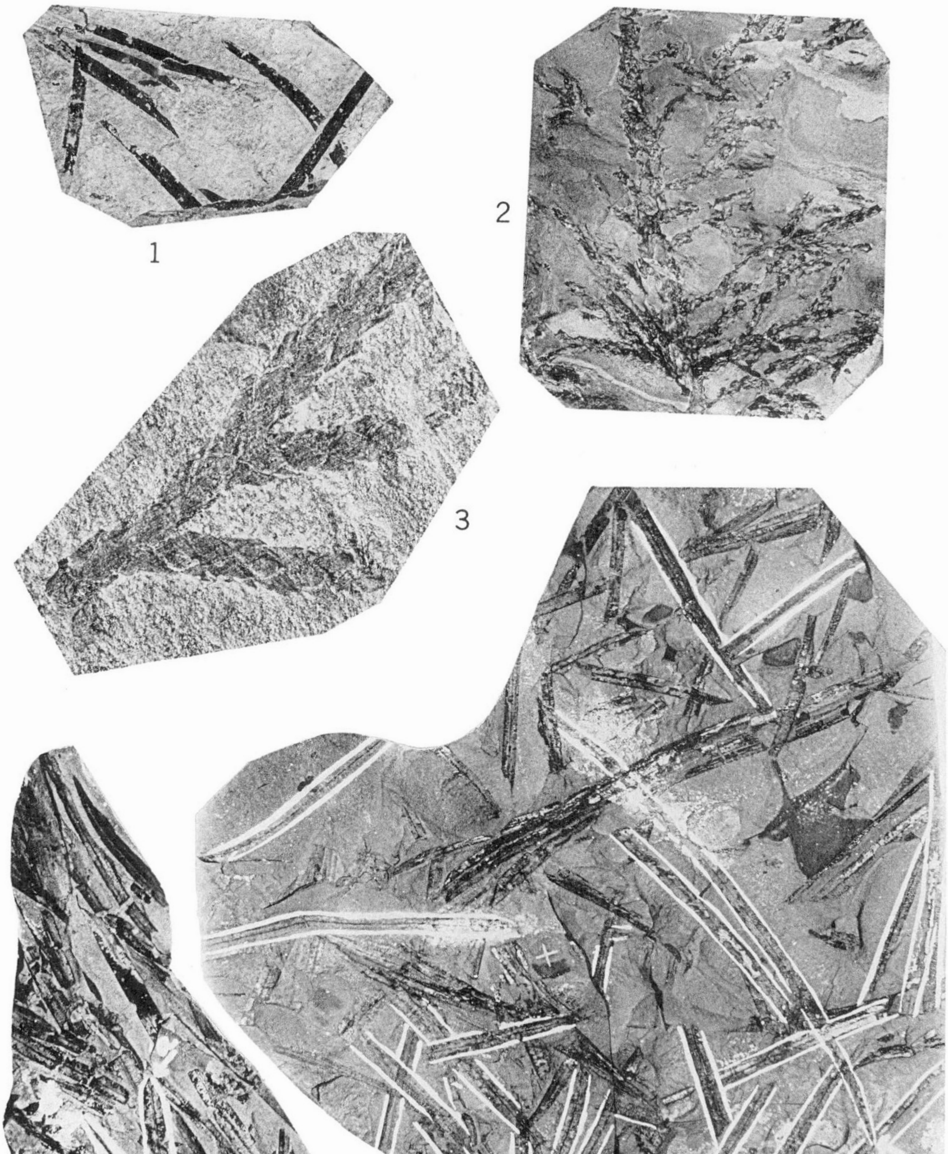

PLATE LXII

Figure 1. *Pityophyllum* cf. *nordenskiöldi* (Heer). G.S.C. No. 5312. Blairmore group (lower flora), loc. 2493. (Page 112)

Figure 2. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 6668. Luscar formation, loc. 3530. (Page 115)

Figure 3. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 6627 x 4. Blairmore group (lower flora), loc. 4026. (Page 115)

Figure 4. *Pityophyllum* cf. *nordenskiöldi* (Heer) Krystofovich. G.S.C. No. 549. Bullhead group (Gething formation), loc. 3208. (Page 112)

Figure 5. *Pityophyllum* cf. *nordenskiöldi* (Heer) Krystofovich. G.S.C. No. 4852. Kootenay formation, loc. 1574. (Page 112)

PLATE LXIII

Figure 1. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 5218 x 4. Luscar formation, loc. 2151. (Page 115)

Figure 2. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5237. Bullhead group (Gething formation), loc. 1997. (Page 111)

Figure 3. *Elatides splendida* n. sp. Paratype, G.S.C. No. 5235. Bullhead group (Gething formation), loc. 3210. (Page 111)


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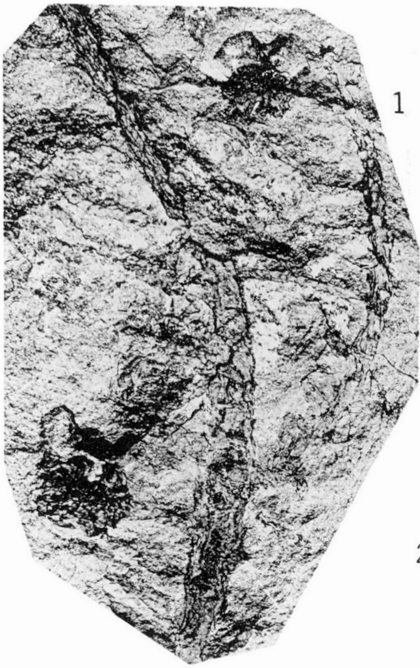
PLATE LXIV



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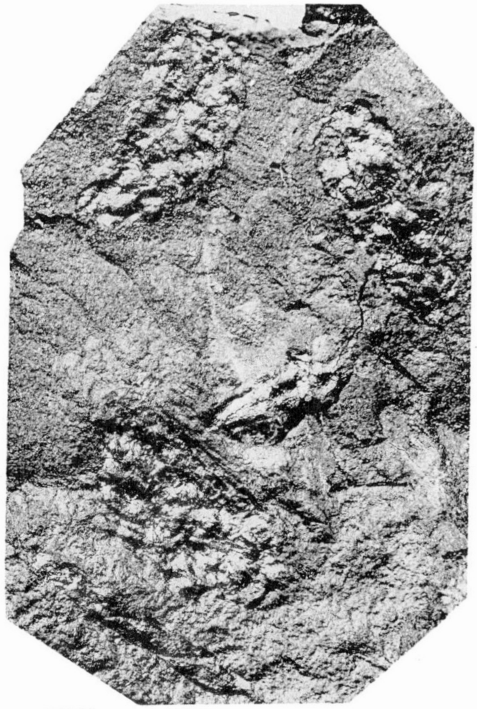

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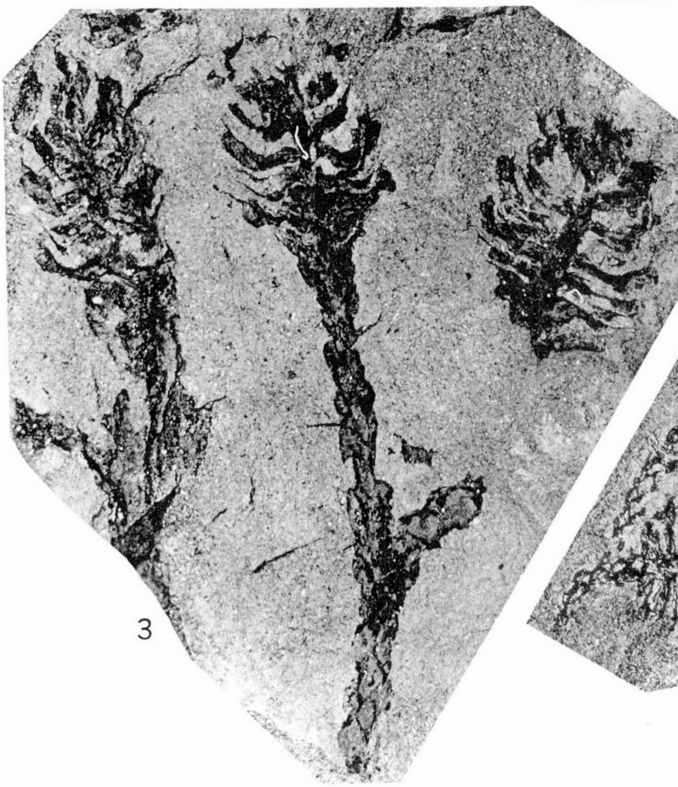

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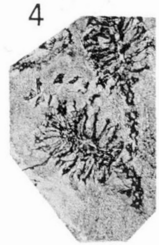

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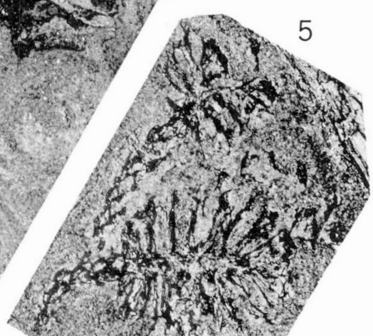

PLATE LXIV

Figure 1. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 5217. Luscar formation, loc. 2151. (Page 115)

Figure 2. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 6629 x 4. Luscar formation, loc. 1689. (Page 115)

Figure 3. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 6646 x 4. Bullhead group (Gething formation), loc. 4308. (Page 115)

Figure 4. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 5219. Blairmore group (lower flora), loc. 1233. (Page 115)

Figure 5. *Athrotaxites berryi* n. sp. Paratype, G.S.C. No. 5219a x 2. (Page 115)

PLATE LXV

Figure 1. *Sequoia condita* Lesquereux. Hypotype, G.S.C. No. 5848 x 4. Crowsnest formation, loc. 3135. (Page 117)

Figure 2. *Pityospermum yukonense* n. sp. Holotype, G.S.C. No. 5781 x 4. Tantalus formation, loc. 372. (Page 114)

Figure 3. *Pityospermum yukonense* n. sp. Holotype, G.S.C. No. 5781. (Page 114)

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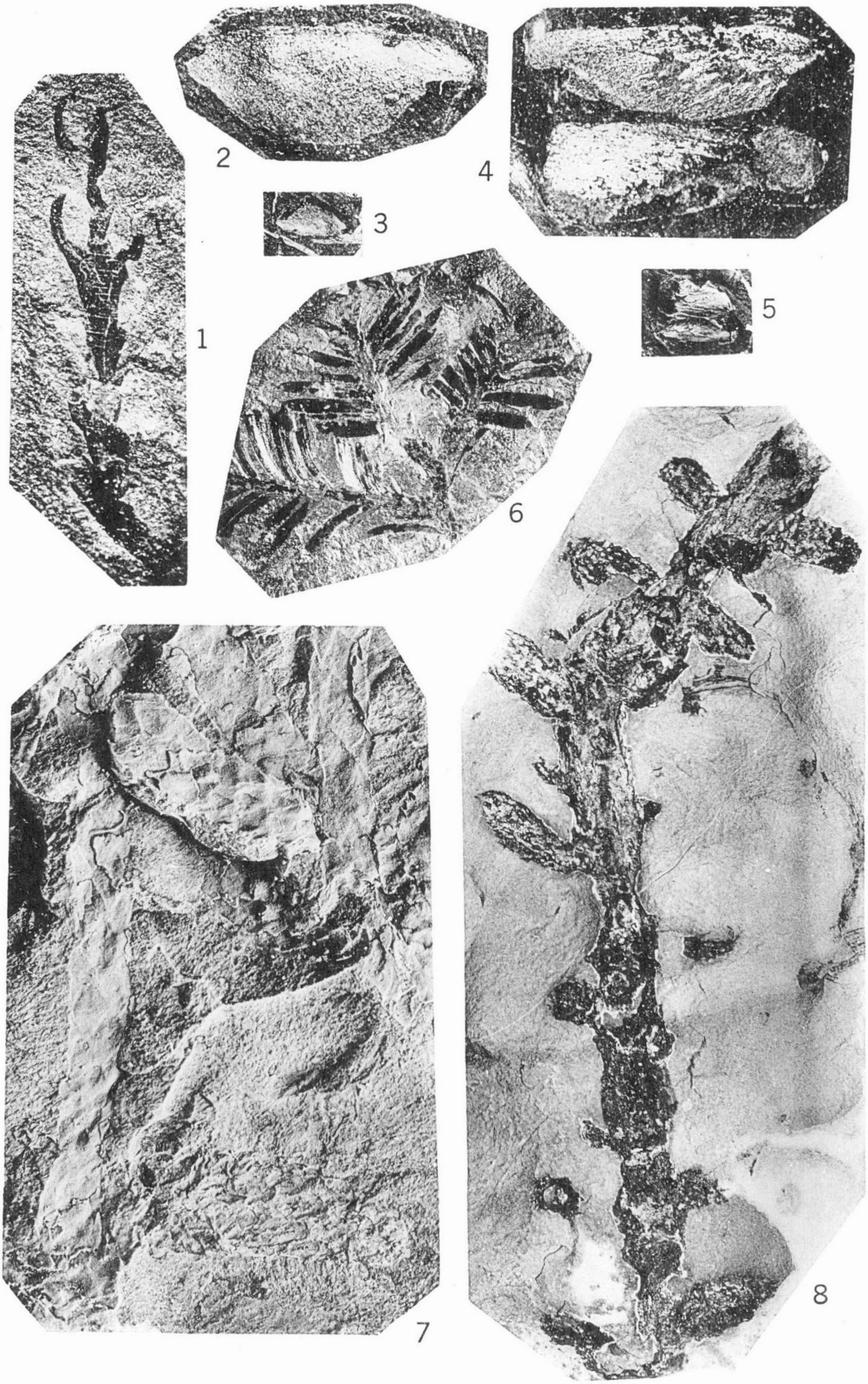
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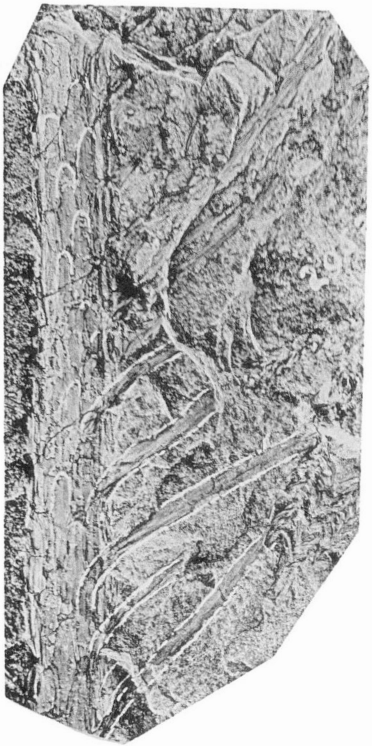

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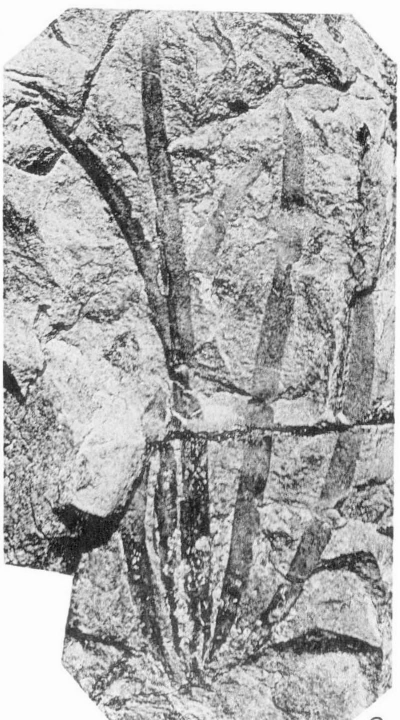

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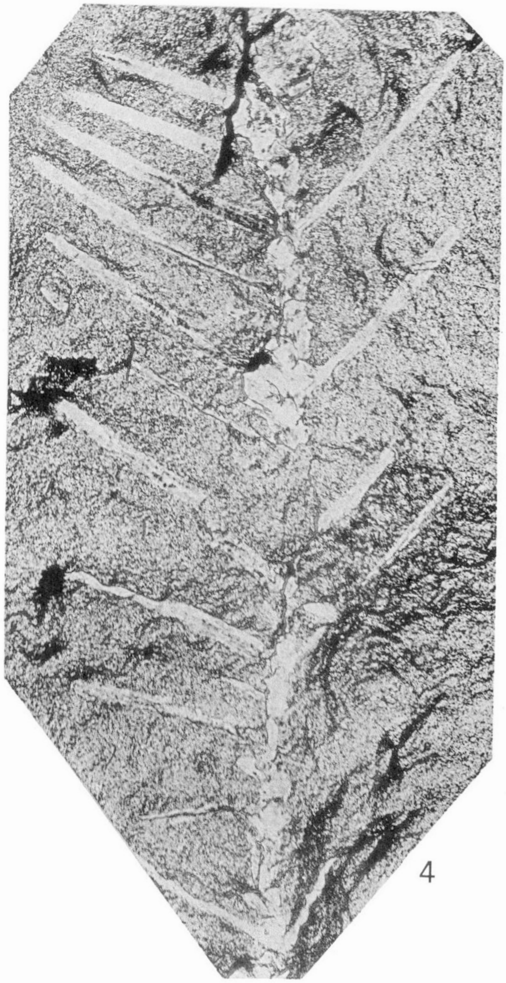

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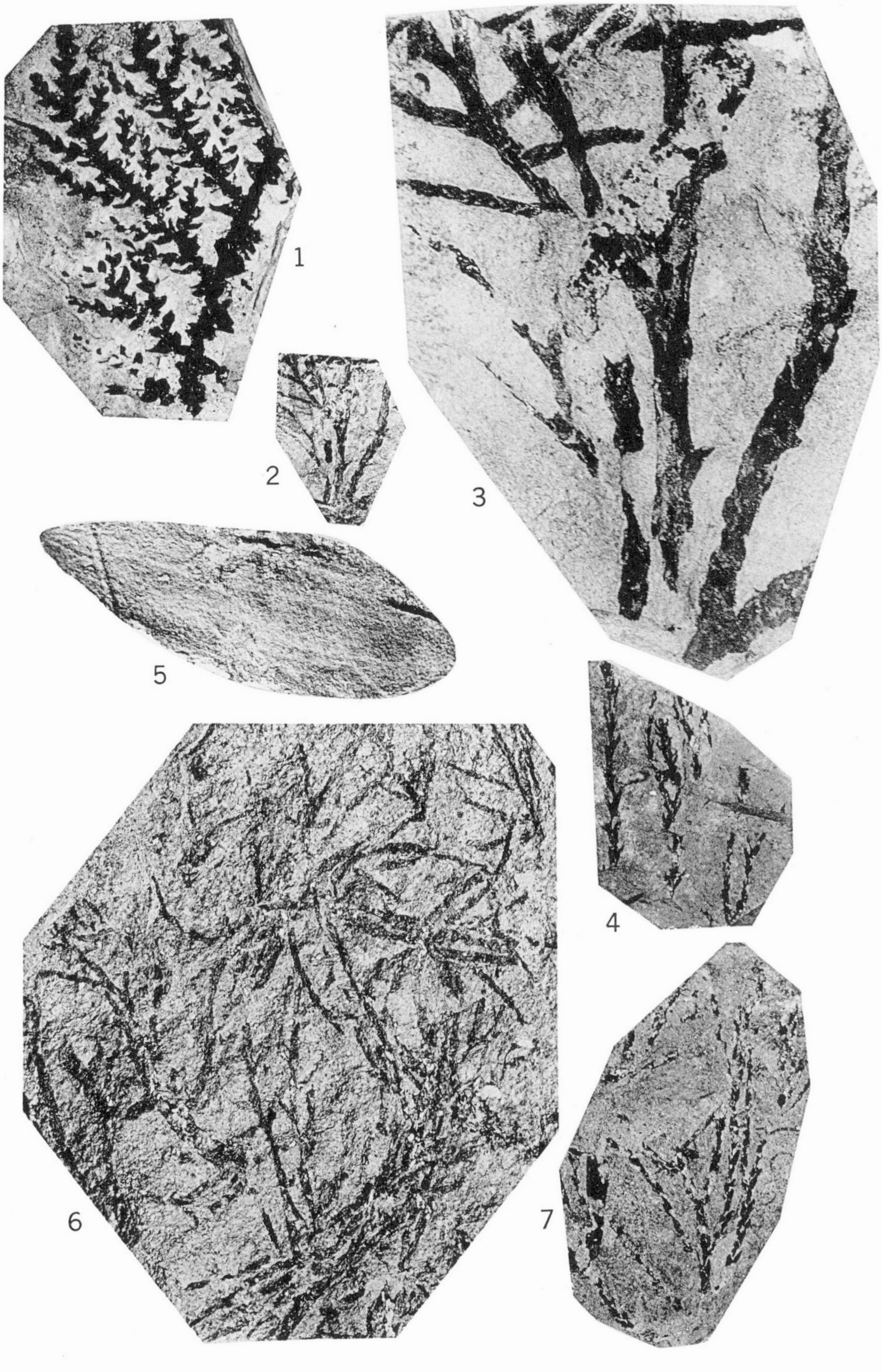

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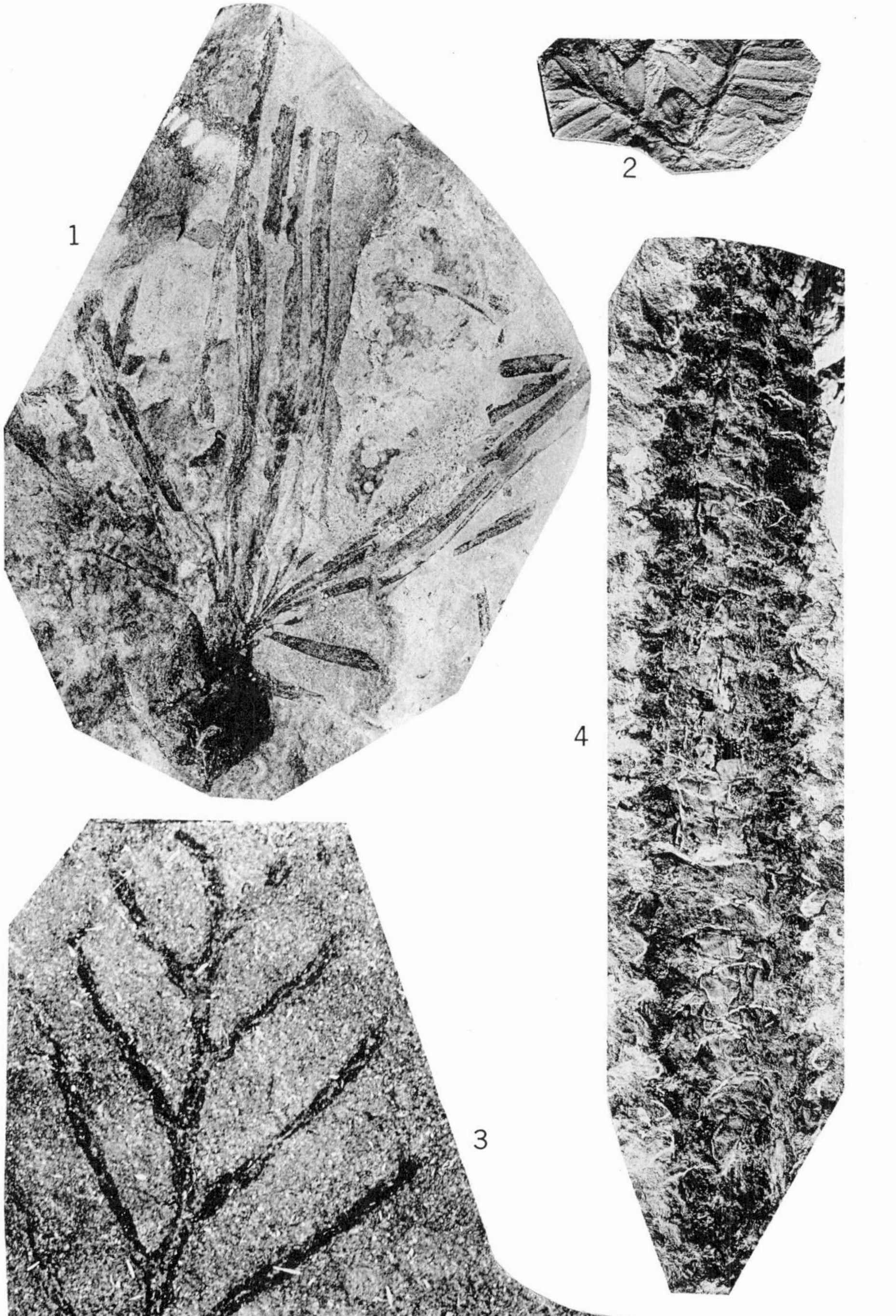

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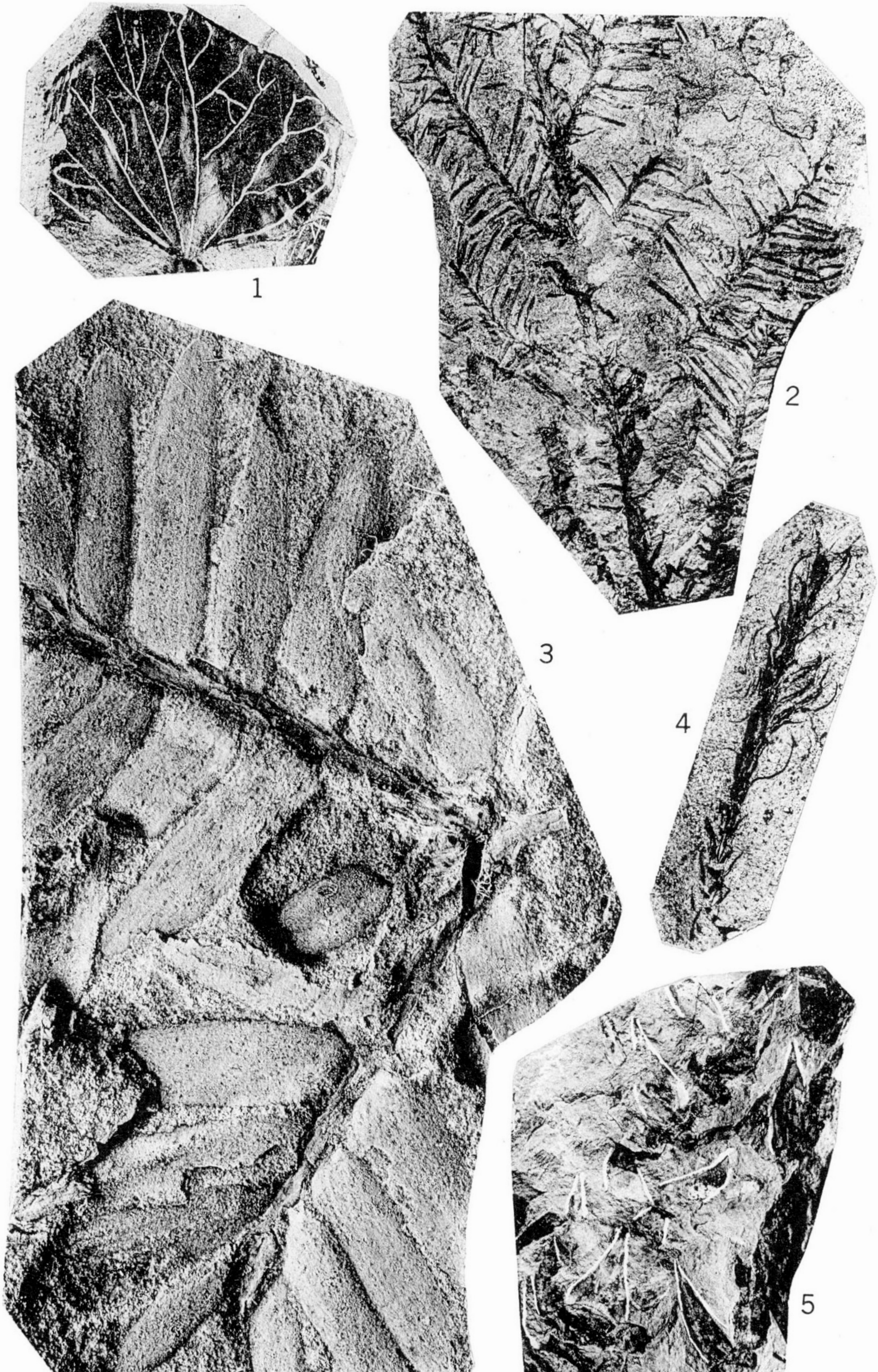

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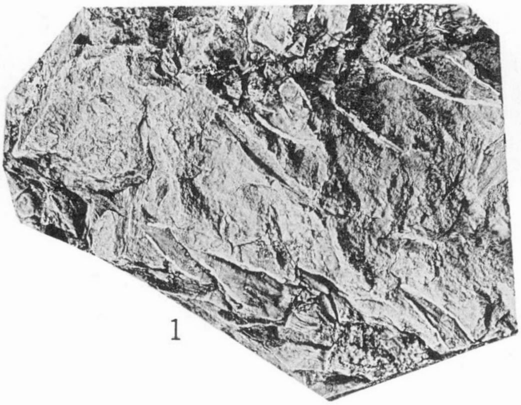

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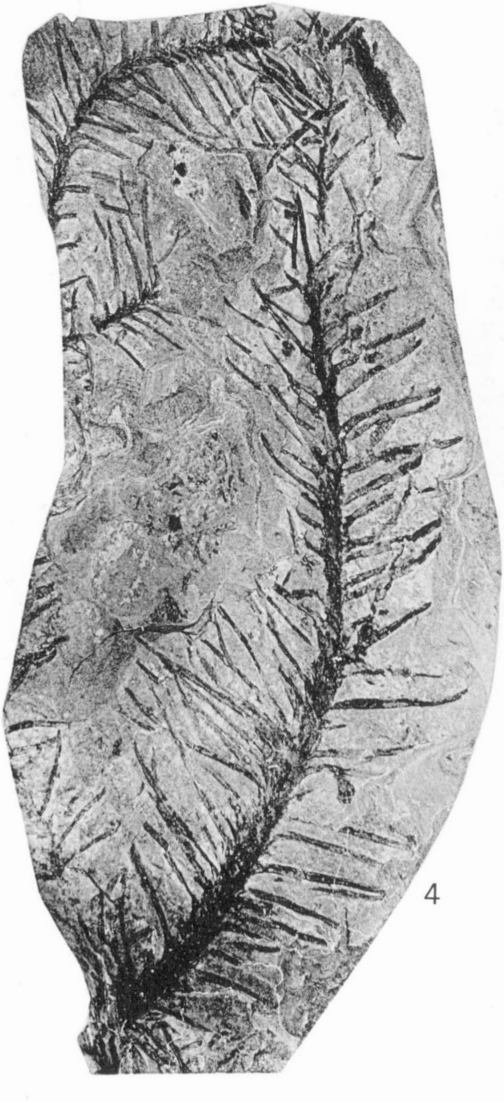

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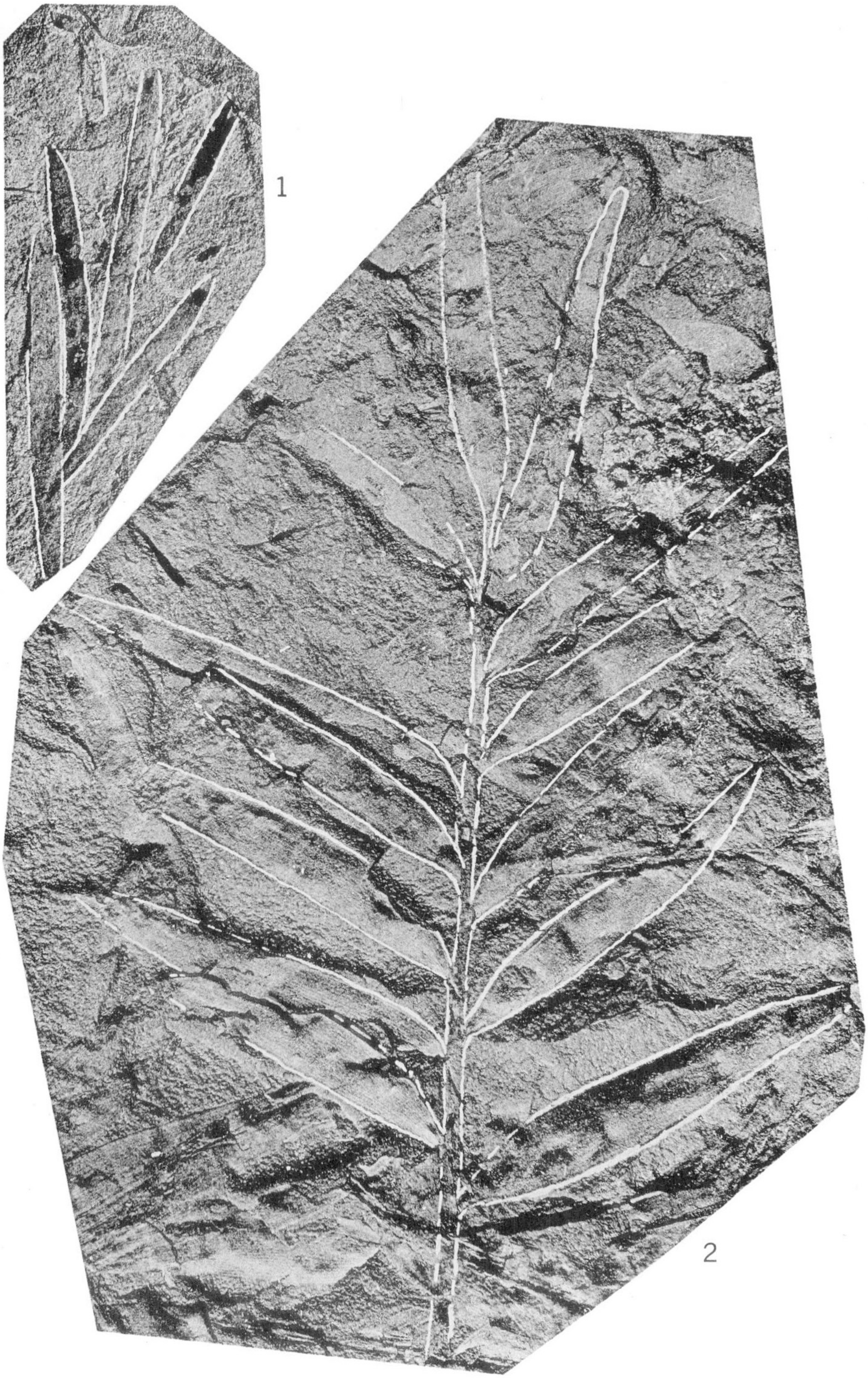

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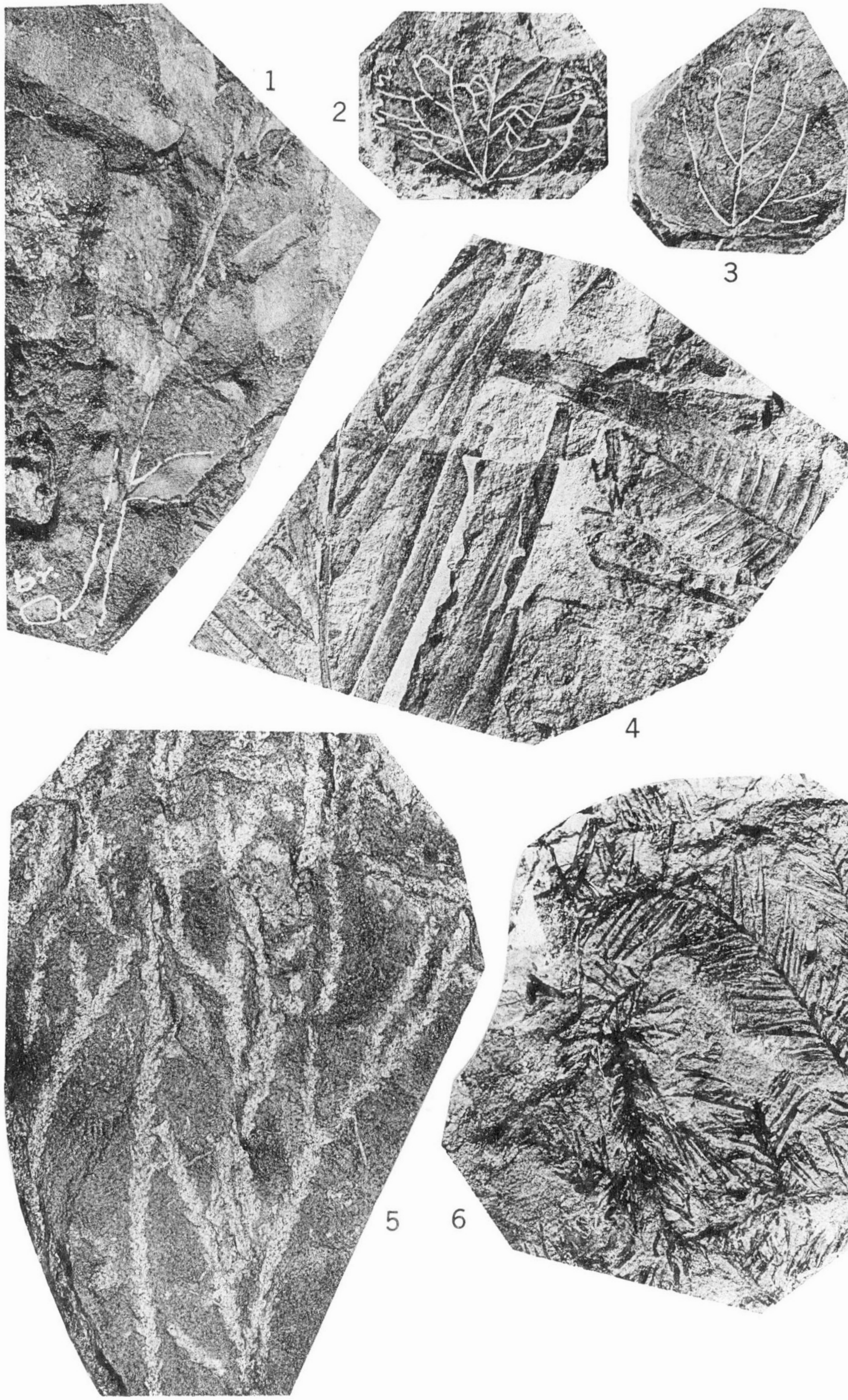

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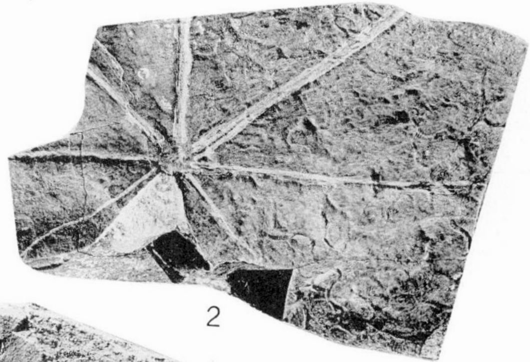

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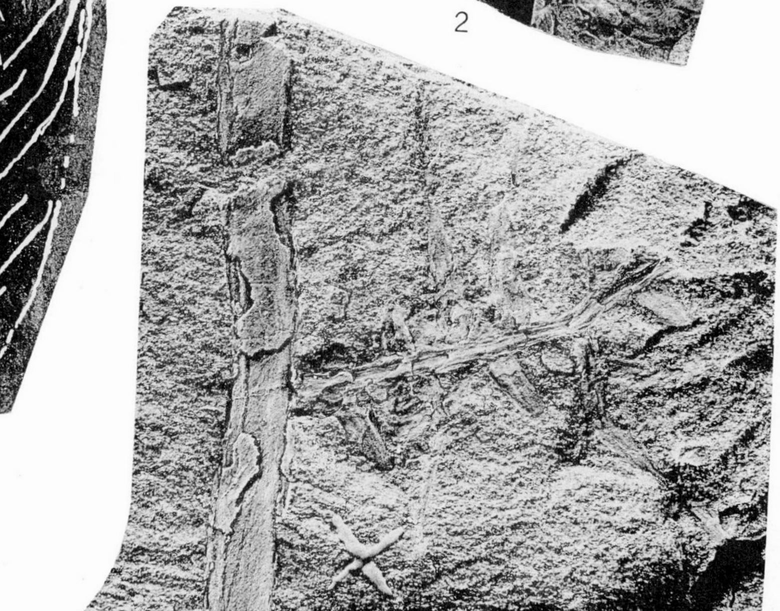

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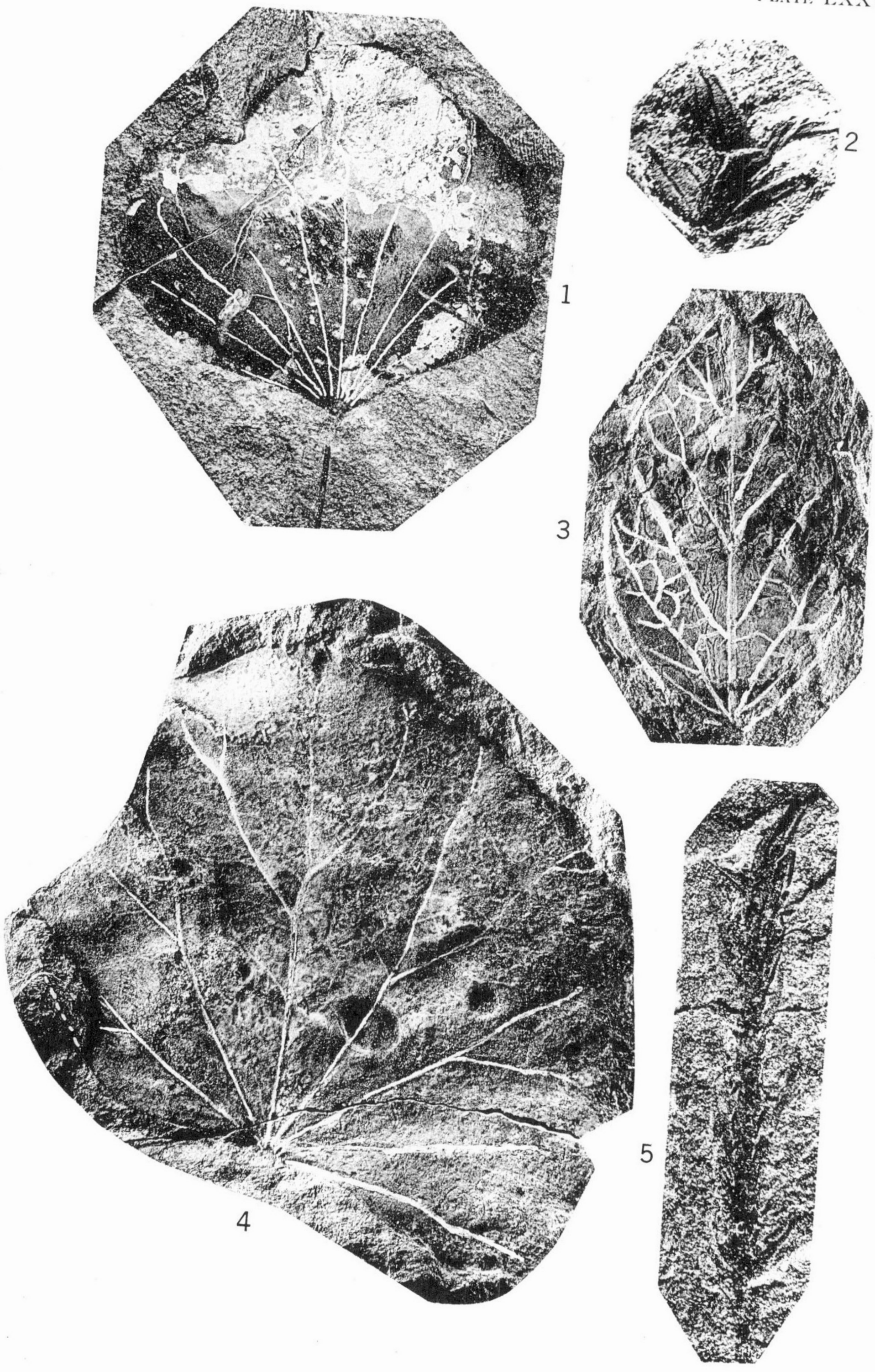

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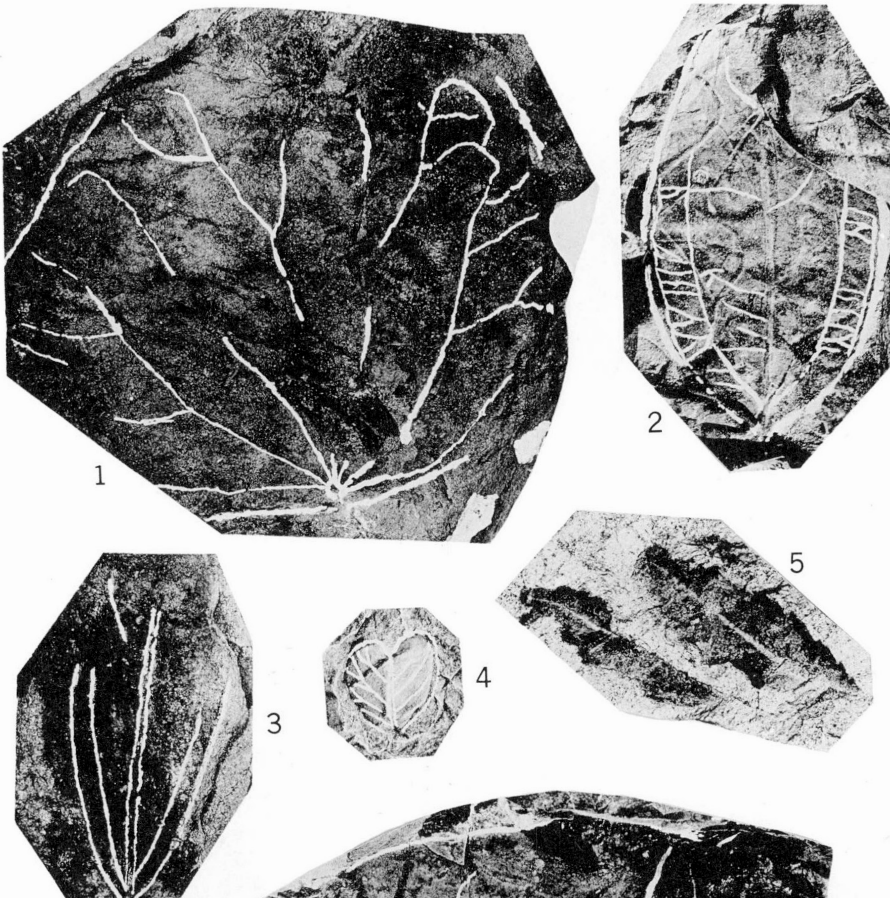

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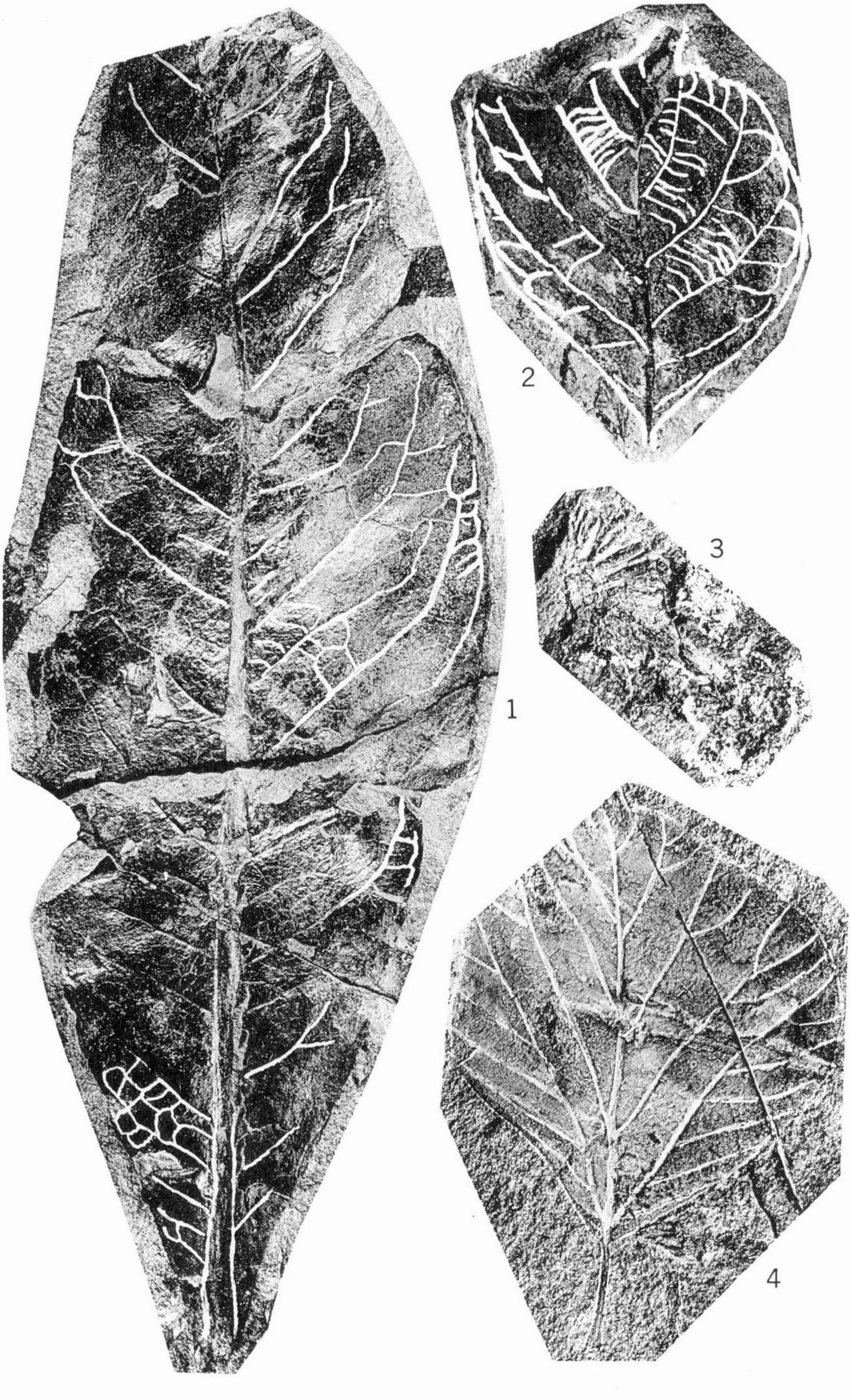

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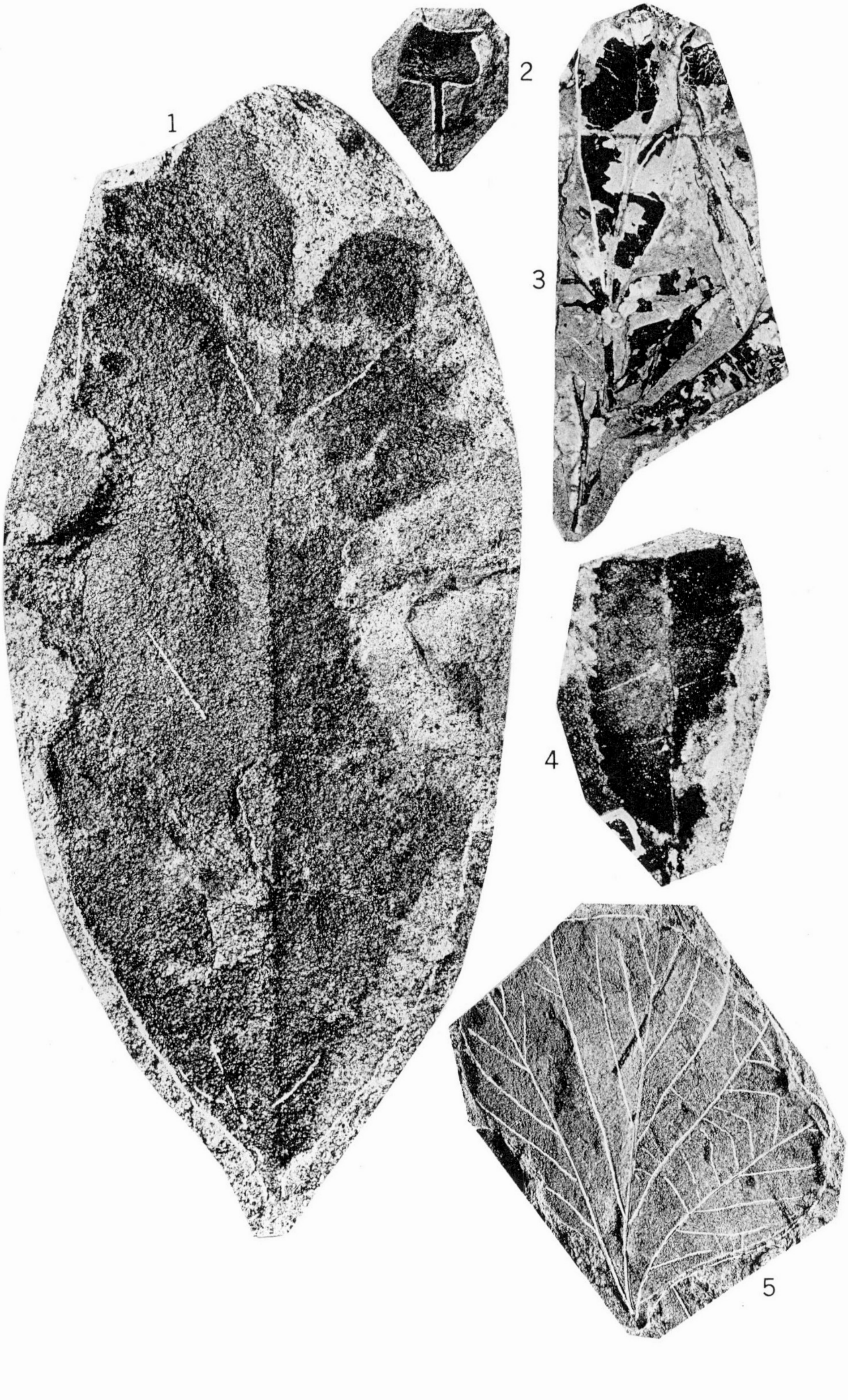

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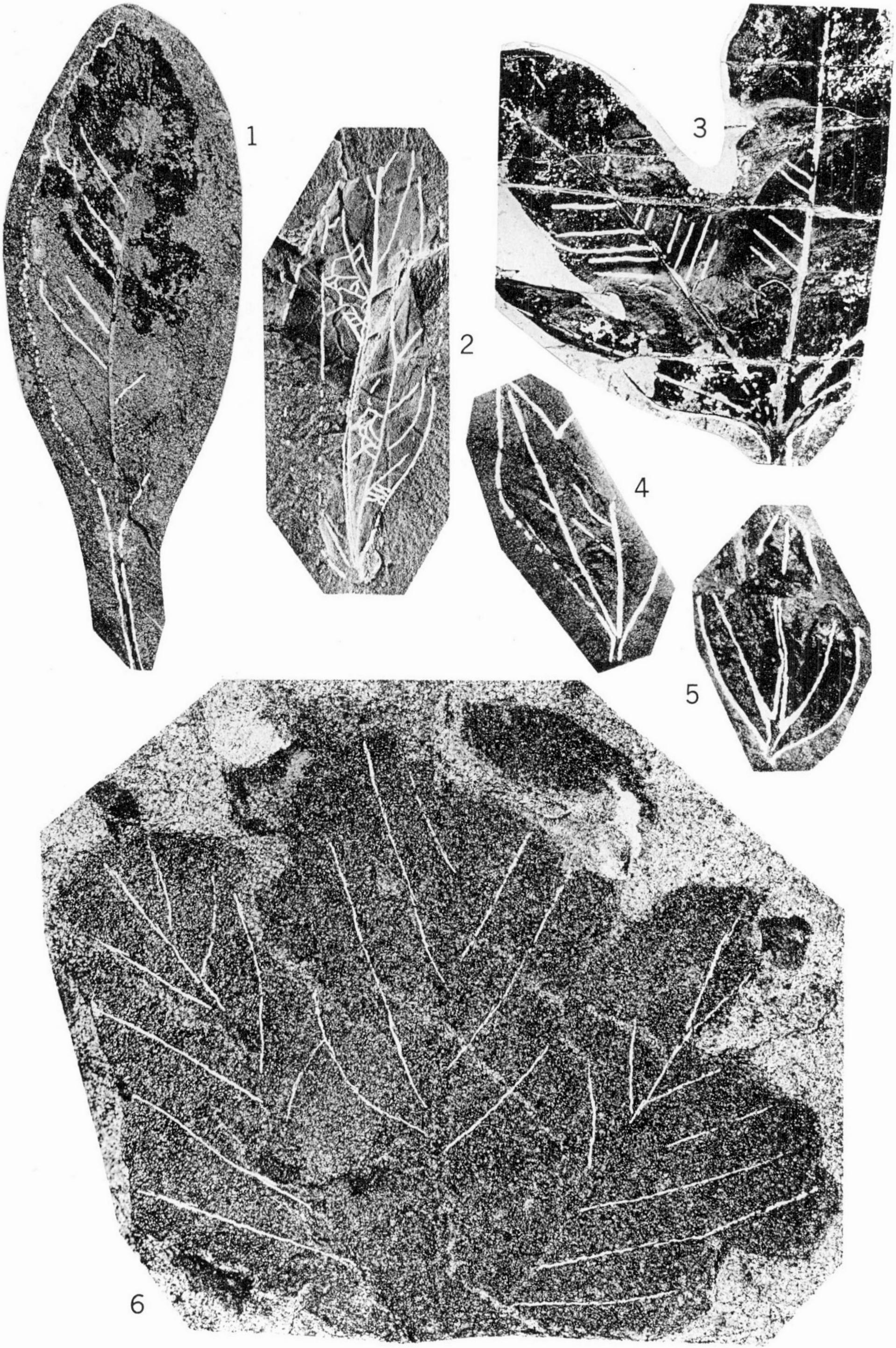

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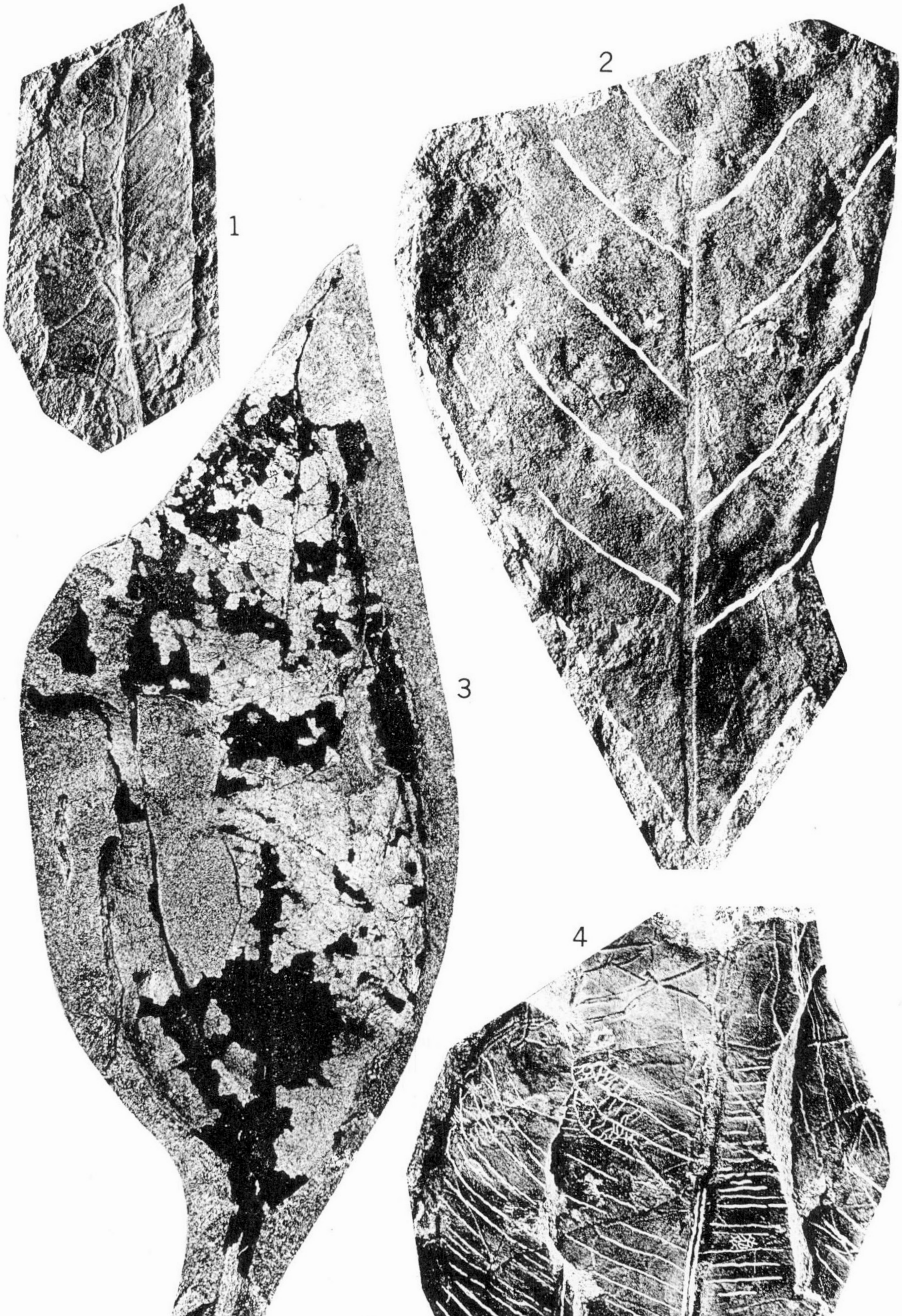

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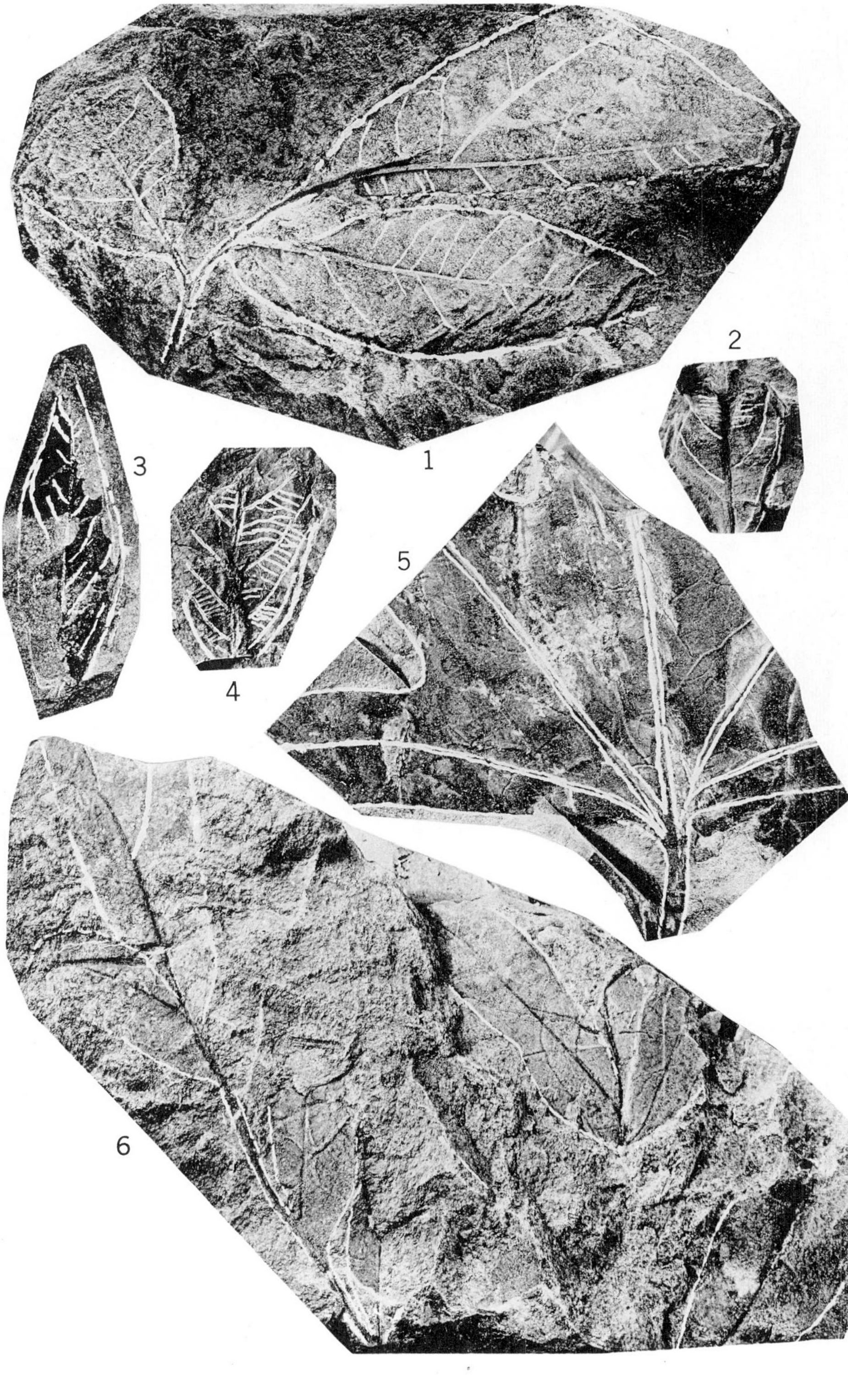

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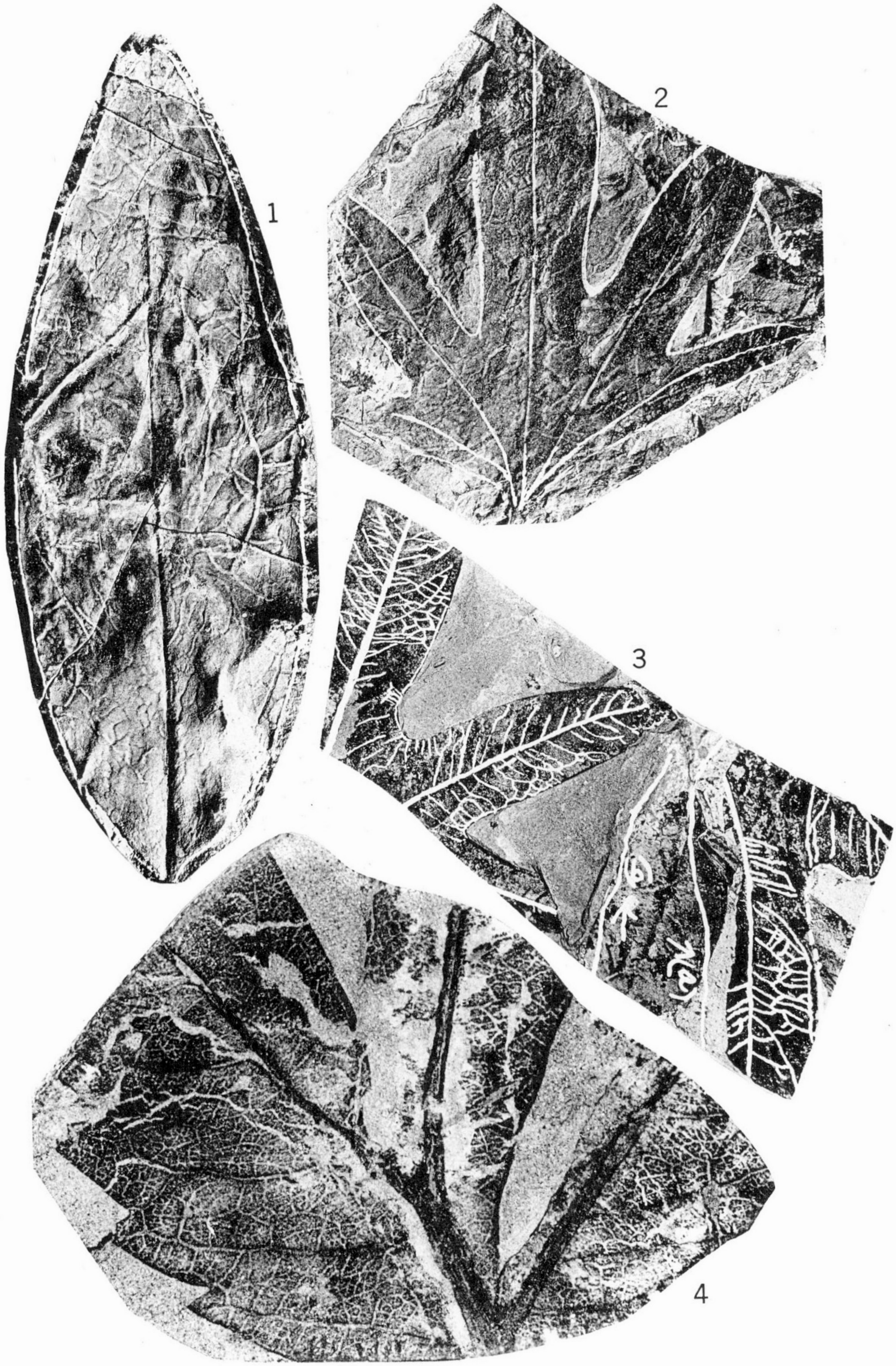

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