GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

BULLETIN 94

UPPER CRETACEOUS FLORAS OF THE DUNVEGAN, BAD HEART, AND MILK RIVER FORMATIONS OF WESTERN CANADA

W. A. Bell

Price, $3.00

1963

UPPER CRETACEOUS FLORAS OF THE DUNVEGAN, BAD HEART, AND MILK RIVER FORMATIONS OF WESTERN CANADA

2,500-1962-1982

GEOLOGICAL SURVEY
OF CANADA

BULLETIN 94

UPPER CRETACEOUS FLORAS OF THE DUNVEGAN, BAD HEART, AND MILK RIVER FORMATIONS OF WESTERN CANADA

By
W. A. Bell

DEPARTMENT OF
MINES AND TECHNICAL SURVEYS
CANADA

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1963

Price $3.00 Cat. No. M42-94

PREFACE

This report is the outcome of many years of study of the Upper Cretaceous floras of the Rocky Mountains and Foothills. In it the author offers his final conclusions on the age of these floras and their relationship to fossil floras of similar age in the United States.

Many new species are described and the report presents much needed clarification of some long standing taxonomic uncertainties.

J. M. HARRISON,
Director, Geological Survey of Canada

OTTAWA, June 7, 1962

Bulletin 94 — Die Oberkreide-Flora der **Dunvegan-**, **Bad Heart-** und **Milk River - Formationen** im westlichen Kanada.
Von W. A. Bell

Бюллетень 94 — Верхне-меловые флоры формаций Данвеган, Бэд Харт и Милк Ривер в Западной Канаде.
Автор: В. А. Белл.

CONTENTS

PAGE

CHAPTER I

Plant-bearing formations 1
Dunvegan Formation 1
Bad Heart Formation 2
Milk River Formation 3

CHAPTER II

Age relationships 4
Introduction 4
Dunvegan flora 4
Dakota Formation 6
Bingen Formation 6
Woodbine Formation 7
Tuscaloosa Formation 7
Eutaw Formation 7
Black Creek Formation 7
Magothy Formation 7
Raritan Formation 8
Melozoi Formation 8
Kaltag Formation 8
Atane beds 8
Patoot beds 9
Conclusions 9
Bad Heart flora 10
Milk River flora 11

CHAPTER III

Description of species 14
Summary list 14
Detailed description 16

Index to locality numbers 65

References 70

Index to fossils .... *Following plate section*

Illustrations

Plates I to XLII. Illustrations of fossils .... *Following p. 76*

UPPER CRETACEOUS FLORAS OF THE DUNVEGAN, BAD HEART, AND MILK RIVER FORMATIONS OF WESTERN CANADA

Abstract

This report describes and figures forty-two named megaplants from the Dunvegan Formation, including six new species; three named plants from the Bad Heart Formation, including one new species; and fifteen named plants from the Milk River Formation, including two additional new species. Age relationships of the three floras are discussed.

The close similarity of the Dunvegan flora with those of Woodbine, Tuscaloosa, Dakota, Raritan, and Magothy floras makes an Albian age of the Dakota plant-bearing beds of Kansas, and an Albian age of the Melozoi and Kaltag Formations of Alaska inexplicable anomalies. On the other hand an Albian age for plant-bearing beds of the Nulato Formation of Alaska is supported by the composition of its florule. The inferred ages of the floras of the Dunvegan, Bad Heart, and Milk River Formations are in general agreement with those inferred from the succession of marine faunas in the Alberta Group.

Résumé

Le présent rapport décrit et représente quarante-deux mégaplantes désignées qui proviennent de la formation Dunvegan, dont six nouvelles espèces; trois plantes désignées de la formation Bad Heart, dont une nouvelle espèce; et quinze plantes désignées de la formation Milk River, dont deux autres espèces nouvelles. L'auteur étudie les relations d'âge qui existent entre les trois flores.

La très grande similarité entre la flore de la formation Dunvegan et les flores des formations Woodbine, Tuscaloosa, Dakota, Raritan et Magothy fait qu'on se trouve en face d'anomalies inexplicables lorsqu'on attribue un âge albien aux couches plantifères de la formation Dakota, du Kansas, et un âge albien aux formations Melozoi et Kaltag, de l'Alaska. D'autre part, l'âge albien attribué aux couches plantifères de la formation Nulato, de l'Alaska, s'explique par la composition de sa florule. Les âges attribués par déduction aux flores des formations Dunvegan, Bad Heart et Milk River sont en général conformes à ceux qui ont été attribués aux faunes marines du groupe Alberta.

Chapter I

PLANT-BEARING FORMATIONS

The megaplant remains that are the subject of this report were derived mostly from the Dunvegan and Milk River Formations, the former underlying a large area in the Rocky Mountain Foothills and adjacent plains of northwestern Alberta and northeastern British Columbia, the latter a smaller area in the plains of southern Alberta. Both formations are highly important in exploring for oil and gas, for they are two of the thickest and most prominent arenaceous units in an otherwise thick sequence of shales deposited in early and mid-upper Cretaceous time. A few additional plants came from the Bad Heart Formation, a thinner arenaceous formation, intercalated in part of the Smoky shales, occupying a stratigraphic position between the Dunvegan Formation below and arenaceous beds that are equivalent in large part to the Milk River Formation of southern Alberta. A brief description of these formations, extracted from or based upon published reports, is given below.

Dunvegan Formation

G. M. Dawson (1881, p. 116) who made the first important collection of megaplants from the formation, designated by him 'Dunvegan sandstones', gave a brief description of this unit, which was stated to lie above 'Fort St. John Shales' and 'Smoky River shales'. M. Y. Williams and J. B. Bocock (1932, p. 212) gave a fuller account of the formation in the area examined by Dawson, as follows:

> The strata consist generally of an alternating series of sandstones and shales with all gradations between the two. The formation is characterized by heavy (*sic*) beds of medium-grained, light coloured, crossbedded, massive sandstone which occur in the lower 300 feet, and by the succession of thin bedded sandstone and arenaceous shale strata which occur above them. In the northwest and west, grits and fine conglomerates were found whose coarseness increases to the west. Clay ironstone concretions, large plant stems and tree trunk imprints and casts, ripple markings, worm borings, and casts perhaps of vertical rootlets are common phenomena, particularly in the northwestern and northern portions of the Block (Dominion), indicating shallow water conditions. The sands generally show carbonaceous fragments, and coal seams up to 23 inches in thickness occur in different localities and in different horizons in the formation from very near the base to the extreme top. Lenses of limestone, probably of fresh water origin and showing cone-in-cone formation, were seen on Peace and Kiskatinaw rivers.

F. H. McLearn (1945, p. 2) stated that the Dunvegan fauna recorded both marine and nonmarine environments, and that the sediments were deposited apparently on a marginal, alluvial or deltaic plain flooded at times by a sea that had open connections with the western interior of the United States.

C. R. Stelck (1955) in a careful analysis of the significance of a disconformity he detected in the upper part of the Cardium sandstone formation (which in the

Wapiti River area occupies a stratigraphic position several hundred feet below the Bad Heart sandstone) concluded that shallowing seaways of Cardium time "were actively involved in regional tilting towards the southeast from actual uplift of the Cassiar batholith and southeastern McKenzie Mountains area" (p. 272), and that "the northern end of the delta (Dunvegan delta) near Liard River, was uplifted an effective gross of 1,000 feet . . . . This amount of erosion or missing stratigraphic interval seems to have eliminated in the Liard area, all of the upper Dunvegan strata, all of the Kaskapau formation, and all of the Lower Cardium equivalents" (p. 268).

The passage from Fort St. John shales to the Dunvegan is gradational, and the contact is drawn by D. F. Stott (1961, p. 3) below the lowest siltstone bed. The upper passage to Kaskapau beds of the Smoky Group is also transitional, and was drawn by Stott at the top of massive sandstone or siltstone. The formation is well developed in the Fort St. John and Peace River areas, but southeasterly, sandstone grades laterally into siltstone and siltstone into shales of the Blackstone Formation of the Alberta Group.

Bad Heart Formation

The Bad Heart Formation, as noted above, is an arenaceous unit holding an intermediate position in the Smoky shales above the Dunvegan and below a higher arenaceous group that is equivalent, stratigraphically, to the Milk River Formation. It is of more local occurrence than the previously deposited somewhat older Cardium Formation. It was first differentiated by McLearn (1919) as a well-defined stratigraphic unit in the Smoky shales of Lower Smoky River, and was defined by him as follows:

> The Bad Heart sandstone member consists of 10 to 25 feet of coarse sandstone, weathering reddish brown . . . . This member is abundantly fossiliferous.

The fossils mentioned by McLearn are all marine, and he gives no indication of recognizable plant remains in the formation.

Stelck (1955, p. 271) recorded a thickness of 30 feet for the Bad Heart in the Belcourt Creek district. Belcourt Creek in British Columbia near Alberta boundary is a tributary of Wapiti River and lies at least 50 miles westward from McLearn's type locality of the Bad Heart.

Stott (1960, p. 16) stated that "the Bad Heart formation consists of a relatively thick basal marine sandstone that is overlain by carbonaceous shale and sandstone carrying abundant plant fragments, the whole sequence reaching up to 85 feet thick". The megaplants described in this report and attributed to the Bad Heart Formation presumably came from the upper beds, for the locality is close to that where Stelck (*see above*) recorded 30 feet of sandstone which is apparently the basal sandstone mentioned by Stott.

Milk River Formation

The Milk River is predominantly a sandstone unit lying between Alberta Group shales below and marine shale of the Pakowki Formation above. The formation forms the surface bedrock for nearly 40 miles along the International Boundary in the plains of southern Alberta, where it has been divided into two members, almost of formational rank, designated Lower and Upper Milk River. It crosses the border into Montana where it is known as the Eagle Sandstone Formation, of which a basal part, equivalent to the Lower Milk River member, is termed the Virgelle Sandstone.

The Lower Milk River succeeds the Alberta shale through a transitional zone of sandy shale and shaly sandstone, the contact being placed in well sections at the top of a white speckled shale in the Alberta Group. The contact with the Pakowki shale seems to be a plane of denudation (Russell and Landes, 1940, p. 33), which is marked commonly by a bed in the Pakowki that carries chert pebbles.

The Lower Milk River consists typically of massive, medium-grained sandstone, the Upper Milk River comprises generally finer grained sandstone and more argillaceous beds. It is characterized also by the common occurrence of carbonaceous matter and of streaks of impure lignite.

No fossil flora or fauna has been found in the Lower Milk River in Canada, but a fauna in the Virgelle beds of Montana is indicative of a Santonian age. The megaplants described in this report were collected from beds of the Upper Milk River.

Chapter II

AGE RELATIONSHIPS

Introduction

The ages of the Dunvegan, Bad Heart, and Milk River Formations in terms of the standard European chronology have been well established within limits set by evidence provided by marine fossils occurring in underlying and overlying formations. In the Dunvegan, complementary evidence has been obtained from study of marine invertebrates collected from the formation itself.

Megaplant remains in dominantly a sandstone formation would not be expected ordinarily to yield floras adequate for refined age determinations or intercontinental correlation. Such assemblages must be meagre representatives of the total flora of the time within the region, comprising generally only remains of organs that could survive the hazards of transportation and burial in a porous clastic medium. Microfossil plant remains, particularly spores or pollen, might be expected to furnish a much fuller representation of the flora. Nonetheless, the megaplant remains in the various sandstone formations should prove very useful to the stratigraphic geologist for recognizing and correlating these stratigraphic units where other fossil evidence is scanty or lacking. They should also assist the palynologist to correlate his form genera with those based upon megascopic remains preserved in homotaxial rock-units.

The age relationships of Cretaceous floras of Canada to those of Europe are not discussed in this report. So little recent work has been published on much needed revisions of many European Cretaceous megafloras, that the writer could add little or nothing to E. W. Berry's masterful treatment of the subject (Berry, 1911, pp. 99-151; 1916, pp. 133-313). On the other hand, much recent paleobotanical work on Cretaceous floras has been done in the U.S.S.R., and it is evident from published illustrations of the megascopic forms that a close relationship exists between their Cretaceous floras and those of Canada. It is unfortunate, therefore, that lack of translations of the relevant Russian text precludes comparisons at this time. Consequently, the following section of this chapter deals only with the relationships of the Canadian floras concerned to those of the United States and Greenland.

Dunvegan Flora

Composition

Filicales

Onychiopsis sp. cf. *O. psilotoides* (Stokes and Webb)

Saccoloma? sp.

Tapeinidium? undulatum (Hall) (Knowlton)
Sphenopteris stricta (Newberry)
Sphenopteris (Dennstaedtia?) burlingi Bell
?*Cladophlebis arctica* (Heer)
Cladophlebis sp. cf. *C. virginiensis* Fontaine
Cladophlebis simplicima n. sp.
Filicites sp.

Lycopodiales
Isoetites horridus (Dawson) Brown

Gymnospermae
Baiera sp. cf. *B. furcata* (Lindley and Hutton) Braun
Ginkgo sp.
Pseudocycas unjiga (Dawson)
Pseudoctenis latipennis (Heer) Seward
Dammarites robinsi (Dawson) Bell
Brachyphyllum (*Athrotaxites*?) *douglasi* n. sp.
Torreyites dicksonioides (Dawson) n. comb.
Cephalotaxopsis heterophylla Hollick
Sequoiites sp. cf. *Geinitzia formosa* Heer
Metasequoia cuneata (Newberry)
Elatocladus sp. cf. *Sequoia major* Velenovsky and Viniklar
Widdringtonites reichii (Ettingshausen) Heer
Protophyllocladus polymorpha (Lesquereux)

Angiospermae
Dryophyllum gracile Debey
Ficus glascoeana Lesquereux
Ficus daphnogenoides (Heer) Berry
Ficus? sp.
Nymphaeites exemplaris Hollick
Castaliites cf. *C. cordatus* Hollick
Palaeonuphar nordenskiöldi (Heer) n. comb.
Trochodendroides (*Cercidiphyllum*?) *potomacensis* (Ward)
Menispermites reniformis Dawson
Magnolia magnifica Dawson
Magnolia boulayana Lesquereux
Magnolia lacoeana Lesquereux
Magnolia rhamnoides n. sp.
Magnolia sp. cf. *M. rotundifolia* Newberry
Magnolia hollicki Berry
Liriodendron giganteum Lesquereux pars
Laurophyllum flexuosum (Newberry) n. comb.
Cinnamomum heeri Lesquereux
Platanus williamsi n. sp.
Platanus newberryana Heer
Platanus latiloba Newberry
Platanus affinis Lesquereux
Credneria macrophylla Heer
Credneria truncatodenticulata n. sp.

Ampelophyllites attenuatus (Lesquereux) Knowlton
Protophyllum multinerve? Lesquereux
Pseudoprotophyllum boreale (Dawson) Hollick
Aspidiophyllum dentatum? Lesquereux
Pseudoaspidiophyllum latifolium Hollick
Hymenaea fayettensis Berry
Bauhinia? *cretacea*? Newberry
Dalbergia hyperborea Heer
Leguminosites spatulatus n. sp.
Sterculia aperta? Lesquereux
Araliaephyllum rotundiloba (Newberry) Fritel
Araliaephyllum groenlandica? Heer
Aralia sp. cf. *A. parvidens* Hollick
Hedera sp. cf. *H. cretacea* Lesquereux
Andromeda? *spatula* n. sp.
Diospyros lesquereuxi Knowlton and Cockerell
Dicotylophyllum sp. A
Dicotylophyllum sp. B
Carpites sp.

Dunvegan species that occur in formations in the United States of America are as follows:

Dakota Formation

Ficus daphnogenoides (Heer) Berry	— Kans.
Ficus glascoeana Lesquereux	— Kans.
Magnolia boulayana Lesquereux	— Kans.
Magnolia lacoeana Lesquereux	— Kans.
Liriodendron giganteum Lesquereux pars	— Kans.; Iowa
Laurophyllum flexuosum (Newberry) n. comb.	— Kans.; Nebr.
Cinnamomum heeri Lesquereux	— Kans.
Platanus newberryana Heer	— Nebr.; Colo.
Platanus latiloba Newberry	— Nebr.; Kans.
Platanus affinis Lesquereux	— Nebr.; Kans.
Ampelophyllites attenuatus (Lesquereux) Knowlton	— Kans.
Araliaephyllum rotundiloba (Newberry) Fritel	— Kans.
Diospyros lesquereuxi Knowlton and Cockerell	— Kans.

In addition to the above thirteen species the following species may occur in the Dunvegan Formation:

Protophyllum multinerve Lesquereux	— Kans.
Aspidiophyllum dentatum Lesquereux	— Kans.
Sterculia aperta Lesquereux	— Kans.; Colo.
Araliaephyllum groenlandica Heer	— Kans.

Bingen Formation

Sphenopteris stricta (Newberry)	— Ark.
Ficus daphnogenoides (Heer) Berry	— Ark.
Laurophyllum flexuosum (Newberry) n. comb.	— Ark.

Woodbine Formation

Ficus daphnogenoides (Heer) Berry	— Texas
Magnolia boulayana Lesquereux	— Texas
Magnolia lacoeana Lesquereux	— Texas
Cinnamomum heeri Lesquereux	— Texas
Platanus latiloba Newberry	— Texas

Tuscaloosa Formation

Sphenopteris stricta (Newberry)	— Ala.
Geinitzia formosa Heer	— Ala.
Widdringtonites reichii (Ettingshausen) Heer	— Ala.
Ficus daphnogenoides (Heer) Berry	— Ala.
Magnolia boulayana Lesquereux	— Ala.
Magnolia hollicki Berry	— Ala.
Laurophyllum flexuosum (Newberry) n. comb.	— Ala.
Cinnamomum heeri Lesquereux	— Ala.
Platanus latiloba Newberry	— Ala.
Platanus affinis Lesquereux	— Ala.
Hymenaea fayettensis Berry	— Ala.
Diospyros lesquereuxi Knowlton and Cockerell	— Ala.

Also, in addition to above twelve species, possibly

Bauhina cretacea Newberry	— Ala.

Eutaw Formation

Magnolia boulayana Lesquereux	— Ga.
Laurophyllum flexuosum (Newberry) n. comb.	— Ga.
Cinnamomum heeri Lesquereux	— Tenn.
and possibly *Bauhinia cretacea* Newberry	— Ga.

Black Creek Formation

Ficus daphnogenoides (Heer) Berry	— N.C.
Cinnamomum heeri Lesquereux	— N.C.

Magothy Formation

Geinitzia formosa Heer	— N.J.; Del.
Widdringtonites reichii (Ettingshausen) Heer	— Md.; N.J.; D.C.; Mass.
Ficus daphnogenoides (Heer)	— N.J.; Md.; N.Y.
Magnolia boulayana Lesquereux	— Md.; N.Y.
Magnolia lacoeana Lesquereux	— Md.; Mass.
Magnolia hollicki Berry	— Md.; N.Y.; Mass.
Laurophyllum flexuosum (Newberry) n. comb.	— N.C.; Md.; N.Y.; R.I.; Mass.
Cinnamomum heeri Lesquereux	— N.J.; Mass.
Credneria macrophylla Heer	— N.J.; Md.; N.Y.
Diospyros lesquereuxi Knowlton and Cockerell	— Del.; Md.; N.J.; N.Y.

Also, in addition to the above ten species, possibly

Araliaephyllum groenlandica Heer	— N.J.; Md.; Mass.

and a closely allied or conspecific species:

Isoetites horridus (Dawson) Brown	— Md.

Raritan Formation

Sphenopteris stricta (Newberry)	— N.J.
Geinitzia formosa Heer	— N.J.
Widdringtonites reichii (Ettingshausen) Heer	— N.J.; N.Y.
Ficus daphnogenoides (Heer) Berry	— N.J.; N.Y.
Magnolia boulayana Lesquereux	— N.J.
Magnolia lacoeana Lesquereux	— N.J.
Magnolia hollicki Berry	— N.J.
Laurophyllum flexuosum (Newberry) n. comb.	— N.J.; N.Y.
Cinnamomum heeri Lesquereux	— N.J.
Platanus newberryana Heer	— N.Y.
Dalbergia hyperborea Heer	— N.Y.
Araliaephyllum rotundiloba (Newberry) Fritel	— N.J.

And in addition to the above twelve species, possibly the following:

Protophyllum multinerve Lesquereux	— Md.; D.C.
Bauhinia cretacea Newberry	— N.J.
Araliaephyllum groenlandica Heer	— N.J.

Melozoi Formation

Ficus daphnogenoides (Heer) Berry	— Alaska
Menispermites reniformis Dawson	— Alaska
Magnolia lacoeana Lesquereux	— Alaska
Platanus newberryana Heer	— Alaska
Pseudoprotophyllum boreale (Dawson) Hollick	— Alaska
Pseudoaspidiophyllum latifolium Hollick	— Alaska

Kaltag Formation

Cephalotaxopsis heterophylla Hollick	— Alaska
Nymphaeites exemplaris Hollick	— Alaska
Platanus latiloba Newberry	— Alaska
Pseudoprotophyllum boreale (Dawson) Hollick	— Alaska
Pseudoaspidiophyllum latifolium Hollick	— Alaska
Cassia alaskana Hollick	— Alaska

Dunvegan species that occur in formations in Greenland.

Atane Beds

Widdringtonites reichii (Ettingshausen) Heer
Pseudocycas unjiga (Dawson) (as *P. insignis* Nathorst)
Pseudoctenis latipennis (Heer) Seward
Palaeonuphar nordenskiöldi (Heer) n. comb.
Laurophyllum flexuosum (Newberry) (as *Laurus plutonia*)
Platanus affinis Lesquereux (as *P. heeri*)
Dalbergia hyperborea Heer

Patoot Beds

Cladophlebis arctica (Heer)
Widdringtonites reichii (Ettingshausen) Heer
Platanus affinis Lesquereux
Platanus newberryana Heer

Conclusions

It may be seen from the above record of species of the Dunvegan flora and its distribution in Cretaceous floras of the United States, exclusive of Alaska, that the largest number of common species occur in floras of the Dakota, Woodbine, Tuscaloosa, Raritan, and Magothy. The Woodbine is the most important for correlation with the European chronology, for its age is established as Cenomanian on the basis of marine fossils present in underlying beds of the Washita Group. Like the Dunvegan, the basal beds may not be earliest Cenomanian as they are unconformably above the Washita. For the area of Woodbine, it has been stated that "considerable difference of opinion exists as to the magnitude of the hiatus represented by this unconformity; if the contention of several authorities that the upper part of the underlying Washita Group is of Cenomanian age is correct, the break cannot be of major importance, for there is a consensus of opinion that the Woodbine is also Cenomanian." (Stephenson, *et al.*, 1942, p. 440.)

Although the Woodbine flora has only five species in common with the Dunvegan, all five are elements of the Tuscaloosa flora, which supports a Cenomanian age assigned to the Tuscaloosa by Stephenson, *et al.* (op. cit., Chart No. 9). A Cenomanian age is also designated by these authors for the greater part of the Raritan, an assignment likewise supported by the megaplants here under consideration, for of twelve species of Dunvegan flora that occur in the Tuscaloosa flora, eight occur also in the Raritan flora of New Jersey. It may be significant that the species of *Magnolia* held in common by the Woodbine and Raritan make their first appearance in the middle part of the Raritan, and occur also in the Magothy. The Magothy, which has ten species in common with the Dunvegan flora, has been allocated a Coniacian-early Santonian age by Stephenson, *et al.* (op. cit., Chart No. 9). Four species of Dunvegan flora are common to Magothy and Woodbine, six to Magothy and Tuscaloosa, and six to Raritan of New Jersey.

On comparative floral evidence Dorf (1952, pp. 2161-2184; fig. 4, p. 2181) ably presented the case for a Cenomanian age of the Raritan flora, and pointed out the close relationships existing between it and the Tuscaloosa. Only five species of the Raritan flora occur in the Lower Cretaceous Potomac Group, and of these *Sequoia reichenbachi* is a generalized form of little value for refined correlation and *Sphenopteris johnstrupi* may be discounted as having no specific status. In Western Canada, only *Trochodendroides potomacensis* and *Menispermites reniformis* occur in both Dunvegan and Albian floras (upper flora of Blairmore Group, floras of Kingsvale Group and of Commotion Formation), and two additional forms, *Onychiopsis* sp. cf. *O. psilotoides* and *Cladophlebis* sp. cf. *C. virginiensis* are seemingly hold-overs from Lower Cretaceous. Otherwise, the Dunvegan flora is as well differentiated from Albian floras as the Raritan is from the Potomac.

The total number of unquestioned species of the Dunvegan flora in the Cretaceous floras of the United States, exclusive of Alaska, is twenty, and the species most abundantly distributed are *Geinitzia formosa, Widdringtonites reichii, Ficus daphnogenoides, Magnolia boulayana, Magnolia lacoeana, Laurophyllum flexuosum, Cinnamomum heeri, Platanus newberryana,* and *Platanus latiloba,* which were seemingly at their acme in the early Upper Cretaceous. All seven of these dicotyledons occur in the Dakota flora of Kansas which has six additional species in common with the Dunvegan. Cobban and Reeside (1952, p. 1031) are of the opinion that the marine fauna of the Omadi sandstone of the type Dakota Group of Nebraska is of Albian age. The writer is not competent to discuss the relation of the marine beds to the plant-bearing beds carrying the Dakota flora in Kansas and parts of Nebraska. This flora has one more species in common with the Dunvegan than even the Tuscaloosa flora, and the megaplants would certainly in the writer's opinion preclude an Albian age for the plant-bearing beds.

The floras of the Melozoi and Kaltag rock-units present a peculiar anomaly, for both suggest strongly a Cenomanian correlation. The Melozoi has six species in common with the Dunvegan and the Kaltag has four, and species held in common between the Melozoi and Kaltag include *Ficus daphnogenoides, Magnolia lacoeana, Platanus newberryana,* and *Platanus latiloba,* which are among the group of species of wide distribution in Cenomanian floras of North America. Yet the Melozoi Formation is supposed to lie conformably below the marine Nulato Formation, for which an Albian age, based on ammonoids, must be accepted. The small number of Nulato plants having an outside distribution certainly do not militate against an Albian age. On the contrary, such an age is supported by the occurrence of *Cladophlebis oerstedti* (Heer), and the lack of typical forms of the *Platanus-Credneria-Protophyllum-Pseudoprotophyllum-Aspidiophyllum plexus* of Cenomanian floras. Among dicotyledons of the Nulato, *Menispermites uniformis* occurs in Western Canada in both Albian and Cenomanian floras. The remaining species are mostly new, but there is a notable lack of Cenomanian species that occur in both the Melozoi and Kaltag. Supposedly the stratigraphic succession from Melozoi at base through Nulato to Kaltag was based upon reconnaissance observations. It seems possible that the plant-bearing beds of the Melozoi at least may be found eventually to belong to a group that includes the Kaltag and to lie stratigraphically above the Nulato.

Bad Heart Flora

Composition

Filicales

Cladophlebis arctica (Heer)

Gymnospermae

Dammarites robinsi (Dawson)

Sequoiites sp. cf. *Geinitzia formosa* Heer

Angiospermae

Trochodendroides (*Cercidiphyllum*?) *arctica* Heer

Zizyphus mcgregori n. sp.

Vitis sp.

Occurrence elsewhere of identified species

Cladophlebis arctica as stated under discussion of that species (p. 21), has little or no value for refined age correlation, because megascopically, it is indistinguishable from some variants of *Cladophlebis virginiensis* Fontaine from Lower Cretaceous formations.

Dammarites robinsi occurs in the Nanaimo Group, British Columbia, and in a lower part of the Allison Formation, Alberta (as *Zamites albertensis* Berry) accompanied there by a few other megaplants. Berry (*in* F. H. McLearn, 1929, p. 67) considered this meagre Allison flora to be equivalent in age to that of a lower part of the Montana Group.

Trochodendroides arctica in number of specimens is the most abundant plant in existing collections from the Bad Heart Formation. It occurs as well in the Nanaimo Group of British Columbia (Bell, 1957, p. 45). Both occurrences contain leaves comparable in size and variation with specimens from formations of Paleocene and Eocene ages in North America, Greenland, Europe, and Asia.

Zizyphus mcgregori is a new species seemingly closely allied to *Zizyphus electilis* Hollick from the Chignik Formation of Alaska, considered to be Santonian-Campanian (Imlay and Reeside, 1954, Chart 10d).

Although the known florule from the Bad Heart Formation comprises far too few species for refined age correlation, it indicates definitely an age equivalent to that of the upper part of the Colorado Group or the lower part of the Montana Group of the western interior of the United States. A more refined age has been set on evidence of marine fossils in overlying and underlying shales of the Smoky Group, as early Santonian (Jeletzky *in* Stott, 1961, Fig. 2).

Milk River Flora

(Including an upper part of Eagle sandstone in adjacent Montana)

Composition

Filicales

Onoclea hebridica (Forbes)

Saccoloma gardneri (Lesquereux) Knowlton

Tapeinidium undulatum (Hall) Knowlton

Sphenopteris (*Dennstaedtia*?) *burlingi* Bell

Cladophlebis simplicima n. sp.

Articulatae

Equisetum sp.

Gymnospermae

Dammarites robinsi (Dawson) Bell

Brachyphyllum (*Athrotaxites*?) *douglasi* n. sp.

Geinitzia formosa Heer
Metasequoia cuneata (Newberry)
Elatocladus sp. cf. *Sequoia major* Velenovsky and Viniklar
Elatocladus albertaensis Bell
Protophyllocladus polymorpha (Lesquereux)

Angiospermae

Alnus perantiqua (Dawson) Bell
Ficus missouriensis Knowlton
Ficus trinervis Knowlton
Trochodendroides (*Cercidiphyllum*?) *arctica* (Heer) Berry
Trochodendroides dorfi n. sp.
Menispermites sp. (Knowlton) n. comb.
Menispermites sp.
Populites wickendeni n. sp.
Magnolia? *coalvillensis* Knowlton
Laurophyllum sp.
Cassia alaskana Hollick
Ilex? *mammillata* n. sp.
Celastrinites sp.
Cornus ceterus Hollick
Dicotylophyllum sp. B

Age

Twenty species of the Milk River flora and of its Eagle equivalent occur in other Upper Cretaceous formations of North America and Greenland. These comprise the following:

Onoclea hebridica: Nanaimo Group, British Columbia

Saccoloma gardneri: Nanaimo Group, British Columbia

Tapeinidium undulatum: Frontier Formation, Wyoming; Dunvegan Formation, British Columbia

Sphenopteris burlingi: Wapiti Group, Alberta and British Columbia

Cladophlebis simplicima: Dunvegan Formation, British Columbia

Cladophlebis arctica: Bad Heart Formation, British Columbia; Eagle Formation, Montana; Patoot beds, Greenland

Dammarites robinsi: Dunvegan Formation, British Columbia; Bad Heart Formation, Alberta; Eagle Formation, Montana

Brachyphyllum douglasi: Dunvegan Formation, British Columbia

Geinitzia formosa: Mesaverde Group, Wyoming and Colorado; Fruitland Formation, New Mexico; Montana Group, Utah and Montana; Ripley Formation, Tennessee

Metasequoia cuneata: Nanaimo Group, British Columbia; Judith River Formation, Montana; Dunvegan Formation, British Columbia

Elatocladus albertaensis: Belly River Group, Alberta

Protophyllocladus polymorpha: Dunvegan Formation, British Columbia; Nanaimo Group, British Columbia; Eagle Formation, Montana; Livingston Formation, Montana

Alnus perantiqua: Nanaimo Group, British Columbia

Ficus trinervis: Medicine Bow Formation, Wyoming and Colorado; Fruitland and Kirkland Formation, Colorado; Vermejo Formation, Colorado and New Mexico

Nymphaeites exemplaris: Upper Cretaceous, Upper Yukon River region, Alaska

Trochodendroides arctica: Nanaimo Group, British Columbia; Bad Heart Formation, Alberta; Lance Formation, Wyoming

Trochodendroides dorfi: Eagle Formation, Montana; Medicine Bow Formation (lower part), Wyoming and Colorado

Magnolia? coalvillensis: Montana Group, Utah

Cassia alaskana: Kaltag Formation, Alaska

Cornus ceterus: Chignik Formation, Alberta

Of the above species *Tapeinidium undulatum, Cladophlebis simplicima, Dammarites robinsi, Brachyphyllum douglasi, Metasequoia cuneata, Protophyllocladus polymorpha* occur also in the Dunvegan flora, and, consequently, are long-ranging. To these may be added *Cassia alaskana,* which occurs in the Kaltag Formation of Alaska in association with species characteristically Cenomanian.

Trochodendroides arctica makes its first known appearance in Canada in the Bad Heart Formation, stratigraphically older than the Milk River, and assigned a late Coniacian or Santonian age. *Zizyphus mcgregori* also occurs in the Bad Heart.

Cladophlebis arctica is an unsatisfactory species for refined age correlation, because it is difficult megascopically to differentiate it from the long-ranging *Cladophlebis virginiensis. Elatocladus albertaensis* too, although considered in this report to be conspecific with material from the Belly River Group, is identified wholly on appearance of vegetative shoots.

Species that may be considered of much greater value for age correlation are: *Onoclea hebridica, Saccoloma gardneri, Geinitzia formosa, Alnus perantiqua, Ficus trinervis, Trochodendroides dorfi, Magnolia coalvillensis,* and *Cornus ceterus.*

Onoclea hebridica and *Saccoloma gardneri,* more characteristically Paleocene species, make an appearance in the Nanaimo Group of probable Campanian age. *Alnus perantiqua* is a form only previously known from the Nanaimo Group. *Ficus trinervis* in the sense used by E. Dorf, ranges from Mesaverde (Campanian) to Paleocene. *Trochodendroides dorfi* occurs in the Eagle Formation of northern Montana; *Magnolia coalvillensis* in Montana Group of Utah, and *Cornus ceterus* in the Chignik Formation of Alaska (late Coniacian to late Santonian and possibly early Campanian).

Hence species of the Milk River flora not known at present to occur in formations of earlier age than that of the Bad Heart point definitely to an age of some part of the Montana Group, and more particularly to a late Santonian-Campanian age. This is consonant with the evidence of the marine faunas of the Cretaceous Alberta Group, for the age of the Milk River Formation is considered to be early Campanian.

Chapter III

DESCRIPTION OF SPECIES

Summary List

Phylum Pteridophyta
- Order Filicales
  - *Onychiopsis* sp. cf. *O. psilotoides* (Stokes and Webb)
  - *Onoclea hebridica* (Forbes)
  - *Saccoloma gardneri* (Lesquereux) Knowlton
  - *Saccoloma*? sp.
  - *Tapeinidium*? *undulatum* (Hall) Knowlton
  - *Sphenopteris stricta* (Newberry)
  - *Sphenopteris* (*Dennstaedtia*?) *burlingi* Bell
  - *Cladophlebis arctica* (Heer)
  - *Cladophlebis* sp. cf. *C. virginiensis* Fontaine
  - *Cladophlebis simplicima* n. sp.
  - *Filicites* sp.
- Order Lycopodiales
  - *Isoetites horridus* (Dawson) Brown
- Order Equisetales
  - *Equisetum* sp.

Phylum Spermatophyta
- Order Ginkgoales
  - *Baiera* sp. cf. *B. furcata* (Lindley and Hutton) Braun
  - *Ginkgo* sp.
- Orders Bennettitales and Cycadales
  - *Pseudocycas unjiga* (Dawson)
  - *Pseudoctenis latipennis* (Heer) Seward

Class Gymnospermae
- Order Coniferales
  - *Dammarites robinsi* (Dawson) Bell
  - *Brachyphyllum* (*Athrotaxites*?) *douglasi* n. sp.
  - *Torreyites dicksonioides* (Dawson) n. comb.
  - *Cephalotaxopsis heterophylla* Hollick
  - *Geinitzia formosa* Heer
  - *Sequoiites* sp. cf. *Geinitzia formosa* Heer
  - *Metasequoia cuneata* (Newberry)
  - *Elatocladus* sp. cf. *Sequoia major* Velenovsky and Viniklar
  - *Widdringtonites reichii* (Ettingshausen) Heer
  - *Elatocladus albertaensis* Bell
  - *Protophyllocladus polymorpha* (Lesquereux)

Class Angiospermae
- Subclass Dicotyledones
  - *Alnus perantiqua* (Dawson) Bell

Dryophyllum gracile Debey
Ficus glascoeana Lesquereux
Ficus daphnogenoides (Heer) Berry
Ficus missouriensis Knowlton
Ficus trinervis Knowlton
Ficus? sp.
Nymphaeites exemplaris Hollick
Castaliites sp. cf. *C. cordatus* Hollick
Palaeonuphar nordenskiöldi (Heer) n. comb.
Trochodendroides (*Cercidiphyllum*?) *arctica* (Heer) Berry
Trochodendroides (*Cercidiphyllum*?) *potomacensis* (Ward)
Trochodendroides dorfi n. sp.
Menispermites reniformis Dawson
Menispermites sp. (Knowlton) n. comb.
Menispermites sp.
Populites wickendeni n. sp.
Magnolia magnifica Dawson
Magnolia boulayana Lesquereux
Magnolia lacoeana Lesquereux
Magnolia? *coalvillensis* Knowlton
Magnolia rhamnoides n. sp.
Magnolia sp. cf. *M. rotundifolia* Newberry
Magnolia hollicki Berry
Liriodendron giganteum Lesquereux pars
Laurophyllum flexuosum (Newberry) n. comb.
Laurophyllum sp.
Cinnamomum heeri Lesquereux
Platanus williamsi n. sp.
Platanus newberryana Heer
Platanus latiloba Newberry
Platanus affinis Lesquereux
Credneria macrophylla Heer
Credneria truncatodenticulata n. sp.
Ampelophyllites attenuatus (Lesquereux) Knowlton
Protophyllum multinerve? Lesquereux
Pseudoprotophyllum boreale (Dawson) Hollick
Aspidiophyllum dentatum? Lesquereux
Pseudoaspidiophyllum latifolium Hollick
Cassia alaskana Hollick
Hymenaea fayettensis Berry
Bauhinia? *cretacea*? Newberry
Dalbergia hyperborea Heer
Leguminosites spatulatus n. sp.
Ilex? *mammillata* n. sp.
Celastrinites sp.
Zizyphus mcgregori n. sp.
Vitis sp.
Sterculia aperta? Lesquereux
Araliaephyllum rotundiloba (Newberry) Fritel

Araliaephyllum groenlandica? Heer
Aralia sp. cf. *A. parvidens* Hollick
Hedera sp. cf. *H. cretacea* Lesquereux
Cornus ceterus Hollick
Andromeda? *spatulatus* n. sp.
Diospyros lesquereuxi Knowlton and Cockerell
Dicotylophyllum sp. A
Dicotylophyllum sp. B
Carpites? sp.

Detailed Descriptions

Onychiopsis sp. cf. *O. psilotoides* (Stokes and Webb)

Plate I, figures 1, 3

Description. Penultimate pinnae, incomplete; summit, acutely deltoid; rachis, very slender. Ultimate pinnae, elongate-lanceolate, up to 2.5 cm or more by 3.5 mm wide; summit acuminate; rachis, like parent, distally winged, owing to basal coalescence and decurrence of pinnules. Pinnules, alternate, elongate-elliptical, reaching length of at least 4 mm and width of 1 mm, highly ascending, contracted to decurrent base and above to acutely pointed apex, the largest with about two pair of forwardly directed, acutely pointed teeth, which result in a mere notching of the margin; a conspicuous, slender midrib enters each pinnule and sends off simple lateral, highly ascending branches to each tooth.

Remarks. Only fragments of terminal parts of penultimate pinnae are to hand, which, except for more slender rachides, are practically indistinguishable from *Onychiopsis psilotoides* (Stokes and Webb).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3330.

Types. GSC No. 1302.

Onoclea hebridica (Forbes)

Plate I, figure 2; Plate II, figures 1, 3, 5, 6; Plate III, figure 6

Onoclea sensibilis Dawson, B.N.A. Boundary Comm., Rept. Geol. 49th Parallel, p. 328 (1875).
Onoclea sensibilis Dawson, Roy. Soc. Can., Trans. 1885, vol. 3, sec. 4, p. 21 (1886); Geol. Surv., Canada, Ann. Rept., n. s., vol. 2, pt. E, p. 136 (1887).
Onoclea sensibilis Penhallow, Rept. Tertiary Plants, British Columbia, p. 64 (1908).
Onoclea sensibilis fossilis Berry, Geol. Surv., Canada, Mem. 182, p. 16, pl. 1, figs. 2, 3; pl. 2, fig. 1 (1935).
Onoclea hebridica Bell, Geol. Surv., Canada, Bull. 13, p. 40, pl. 20, fig. 5; pl. 24, figs. 3, 5; pl. 25, fig. 2 (1949).
Onoclea hebridica Bell, Geol. Surv., Canada, Mem. 293, p. 22, pl. 3, figs. 2, 4; pl. 4, fig. 10 (1957).

Remarks. GSC No. 1177 (Pl. II, fig. 5) comprises a broadly winged rachis (R), curved at the summit, to which are attached the remains of four pinnatifid pinnae (1-4), or alternatively 4 and 4A may represent dichotomous divisions of the main rachis at its summit. The pinnae are decurrent, with or without a descending foliar lobe along the parent rachis. Pinna No. 2 in 1177 has four pair of irregular, broad, pinnule-like lobes, which become more and more united towards apex of the pinna, together with a fifth pair that form basal lobes to the terminal leaflet. A conspicuous decurrent midrib enters each lobe, and gives off rather highly ascending, nearly straight, commonly once, or more rarely, twice divided laterals among which no anastomoses were seen, although poor preservation may conceal any union. Specimen 1179 (Pl. II, fig. 3) is a very small part of a main rachis in which basal lobes of an attached pinna has a venation similar to that of No. 1171 and likewise obscure. Specimen No. 1176 (Pl. III, fig. 6), however, has a foliar lobe on the main rachis opposite the basal part of an attached pinna, and the veins in this lobe are clearly loosely anastomosing; areolae adjoining the main rachis are elongated, being parallel with this rachis precisely as in *Onoclea hebridica*. Venation of the lobes in the opposite pinna is poorly preserved, and no union of the nerves was detected. Associated with other specimens in same bed are a few disconnected lobes or pinnules that have a loosely anastomosing venation similar to that in specimen 1176. Specimen No. 1268 (Pl. II, fig. 1) reveals the union of veins much more clearly. It is a fragment of a pinna with alternate, suboval pinnules, elongated parallel with the rachis, which are basally united by a wing along the rachis; being constricted at the base on the catadromous side, they are separated by narrowly rounded sinuses; the margins are entire, slightly undulating or have one or two incipient lobes. A strongly ascending vein enters a pinnule near the lower part of its base, and divides moderately by successive dichotomies, resulting in a fanwise radiation. Anastomoses are rare except immediately adjoining the parent rachis where union of the veins forms a row of areolae elongated parallel with the rachis throughout the base of a pinnule and of their basally connective tissue.

The robust habit of the species, the irregular, pinnule-like lobes united to a greater or lesser degree on a broadly winged rachis, together with their undulating or in some instances irregularly toothed margins, in conjunction with the variation from few to plentiful anastomosing veins, leads to the conclusion that these forms are only variants of *Onoclea hebridica* (Forbes), with rare or moderately abundant anastomoses, those with few unions of the veins, comparable to the living *Onoclea sensibilis* var. *obtusilobatus* Torrey.

Occurrence. Milk River Formation (upper part), Alberta; GSC locality 3934.

Types. Hypotypes, GSC Nos. 1176, 1177, 1178, 1179, 1268, 1270.

Saccoloma gardneri (Lesquereux) Knowlton

Plate II, figures 2, 4

Pteris (*Oleandra*) *glossopteroides* Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 24, Pl. 4, fig. 16 (1883).
Saccoloma gardneri Bell, Geol. Surv., Canada, Mem. 293, p. 20, pl. 1, figs. 6, 8 (1957).

Remarks. The two specimens figured, GSC Nos. 1173 and 1174 (Pl. II, figs. 2, 4), although mere fragments, exhibit the characteristic venation of the species, viz., a conspicuous channeled midrib running to the apex from which diverge numerous laterals, which, high ascending at origin, rather abruptly curve outwards to the margin. The laterals bifurcate two or three times and are joined by two or three oblique anastomoses. The margin of the leaf is deeply and irregularly undulate as in Lesquereux's type specimen.

Both specimens are considered to be fertile. GSC No. 1173, a remnant of an apex of a leaf, is mainly an imprint in which the veins and a narrow marginal band are strongly carbonized compressions. The marginal band, which is coalized, simulates a marginal vein, having about half the width of the midveins; it is interpreted to be the remains either of an indusium or of an infold of the margin over a sporiferous band. Specimen No. 1174 has a similar apex to that of No. 1173, but abruptly expands downward to a width of three centimetres comparable to that of the larger of the two leaves figured by Lesquereux (1878, Pl. 4, fig. 2); the margin of this specimen is mostly obscure, but in the apical region shows traces of a marginal band.

Occurrence. Milk River Formation (upper part), Alberta; GSC locality 3888.

Types. Hypotypes, GSC Nos. 1173, 1174.

Saccoloma? sp.

Plate III, figures 3, 4

Remarks. Leaf, elongate-lanceolate, subfalcate, entire, about 6 cm long by 1 cm wide; at base leaf is cuneate, contracting to little more than width of the midrib, but attachment to the axis is not preserved. Midrib is strong, gently curved, and runs to the apex, which is narrowly rounded or bluntly pointed; laterals are delicate, strongly ascend from point of origin, near which they bifurcate, beyond they curve gently outward, each arm commonly dividing again not far from midlength and divisions reaching the margin at rather open angles.

Marginal characters are not sufficiently clear for a positive assignment of this specimen to *Saccoloma* to be possible, but the veins may be traced clearly to a slightly elevated carbonized ridge and a visible carbonized margin about 0.5 mm broad. This may have resulted from an infolding of the margin, but is suggestive of the submarginal spore-bearing band, such as occurs in *Saccoloma gardneri.* Otherwise, the specimen resembles rather closely *Asplenium hurleyensis* Berry from the Lower Wilcox Group (Berry, 1916, p. 168, Pl. 10, fig. 1) differing mainly in a twofold division of the veins.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4194.

Types. GSC No. 1107.

Tapeinidium? *undulatum* (Hall) Knowlton

Plate III, figures 1, 2, 5

Remarks. The following description of this species, given by F. H. Knowlton (1917, p. 80), applies equally well to specimens from Alberta and British Columbia:

> Outline and habit of whole frond not known but presumed to be simply pinnate, lanceolate in outline, gradually narrowed to the apex (base not seen); rachis strong, ridged, in places slightly winged; pinnae numerous, at right angles to the rachis, sessile, linear in general outline, sharp-pointed at apex, cut in varying degree into numerous rounded, slightly oblique or fanshaped lobes which are entire or slightly erose-dentate; the lobes decrease in size apically becoming merely undulations, the tip being almost or quite entire; upper pinnae reduced in size, with undulate or almost entire margins; nervation of pinnae consisting of a very strong, grooved midvein, the lobes provided with a thin, delicate midvein and usually about three pairs of once-forked veins.

The largest of Knowlton's figured specimens (op. cit., Pl. 28, figs. 1-4) has a penultimate rachis about 2 mm wide. A specimen from Alberta, viz., GSC No. 5157 (Pl. III, fig. 1) has a rachis 4 mm wide, and the basal parts of its pinnae have pinnules bearing several pairs of rounded marginal lobes.

The veins in Canadian specimens are commonly not preserved or are obscured by the imprint of a fine network of elongated, epidermal cells. GSC No. 5159 (Pl. III, fig. 2), the pinnae of which have pinnules or lobes basally united for about half their length, shows the venation clearly; a single vein enters each lobe at an acute angle and highly ascends for about the height of the lobe before being lost in the fanwise radiation of the several dichotomies; the first divisions commonly appear as branches from its abaxial side. A like venation is shown by Knowlton's specimen illustrated in his Plate 28, figure 2a (op. cit.).

Occurrence. Milk River Formation, Alberta, GSC localities ?845, 852, 1273, 2148; Dunvegan Formation, British Columbia, GSC localities 4203, 5135.

Types. Hypotypes, GSC Nos. 1054, 5157, 5159.

Sphenopteris stricta (Newberry)

Plate IV, figures 1-3; Plate V, figures 1, 3; Plate VI, figures 1-3, 5

Description. Frond, possibly ternate and primary pinnae bipinnate to tripinnate. Penultimate pinnae most commonly furnished with smooth-margined, elongated, more or less acutely pointed, highly ascending decurrent pinnules that are confluent at base by a winged rachis. Rachis of a penultimate pinna, smooth except for central chord or corresponding channel. Largest pinnules, up to 12 mm or more long and 3 mm or more wide. Margins, smooth or marked by scattered, forwardly directed, sharp teeth. Veins, delicate, all nearly straight; a single vein enters each pinnule, dividing near apex, giving off alternately several strongly ascending laterals which may be simple or once divided.

Remarks. Specimen GSC No. 1048 (Pl. IV, fig. 3) may represent in its entirety a primary pinna or alternatively may consist of three primary pinnae that were attached to a common rachis, because the actual union of the basal lateral pinnae was not seen. Each of the basal pinnae exposed has on its inferior basal side a lateral subordinate segment attached at a more open angle than the remaining distal segments, and each is so deeply dissected into pinnule-like lobes as to represent a pinna of a lower order. GSC No. 1108 (Pl. VI, fig. 1) likewise suggests a ternary division of a petiole (?) into three primary pinnae, the segment on the right being bipinnate. Moreover, the disposition of pinnae in GSC No. 1051 (Pl. VI, fig. 5), might be interpreted as a result of ternary division of a frond but the basal parts of the rachides marked R^{-1} and R^{-2} are not preserved; in this rock the fragments marked R^{-2} are the obverse of GSC No. 1108 (Pl. VI, fig. 1). Pinnae are obliquely attached to R^{-2} but those of R^{-1} are attached almost at a right angle. Newberry (1895, p. 38), in describing his species, stated that the frond is ternate, but in the specimen illustrated in his figure 2, Plate 3, the two pinnae shown may have lateral opposite attachments to a common parent rachis.

Anemia stricta Newberry (=*Sphenopteris stricta*) has been considered by American authors to be synonymous with *Dicksonia groenlandica* Heer (1882, p. 23, Pl. 35, fig. 8) from the Patoot beds of Greenland. This may well be so, but Heer's species was founded upon too small a fragment for adequate specific diagnosis, and the retention of Newberry's species is considered by the writer to be preferable. A. C. Seward (1926, p. 84), for instance, combined *Dicksonia groenlandica* Heer with *Sphenopteris* (*Onychiopsis*?) *johnstrupi* Heer from Kome beds, and at same time stated that the latter might be, in part at least, conspecific with *Sphenopteris psilotoides* (Stokes and Webb), a species well differentiated from *Sphenopteris stricta* (Newberry) or from *Dicksonia groenlandica* Heer.

Sphenopteris mclearni Bell (1956, p. 73, Pl. 23, fig. 3; Pl. 24, fig. 3) may eventually be proved to be conspecific with the Dunvegan form here assigned to *S. stricta,* its chief distinction lying in its being much less robust.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3351, 4192, 4193, 5188, 5252.

Types. Hypotypes, GSC Nos. 1046, 1047, 1048, 1049, 1050, 1051, 1108, 1110, 1285.

Sphenopteris (*Dennstaedtia*?) *burlingi* Bell

Pate VI, figure 4

Sphenopteris (*Dennstaedtia*?) *burlingi* Bell, Geol. Surv., Canada, Bull. 13, p. 39, Pl. 2, figs. 2, 3; Pl. 14, figs. 1, 2, 4 (1949).

Remarks. A few fragments, rather poorly preserved, occur in collections from the

Milk River Formation. They agree in all essentials with *Sphenopteris burlingi* from the Wapiti Formation.

Occurrence. Milk River Formation, Alberta; GSC locality 3934.

Type. Hypotype, GSC No. 1291.

Cladophlebis arctica? (Heer)

Plate V, figure 2; Plate VII, figure 2

Remarks. The writer, after comparing Heer's figures of *Osmunda arctica* (= *Cladophlebis arctica*) (Heer, 1883, p. 7, Pl. 49, figs. 4-7; Pl. 50, figs. 6, 8) with specimens of *Cladophlebis virginiensis* occurring in the Lower Cretaceous beds of Western Canada, was unable to find satisfactory megascopic characters that would separate the two forms, and admits that assignment of the Upper Cretaceous specimens here under consideration to Heer's, rather than to Berry's species, is based upon their younger age. GSC No. 1053 (Pl. V, fig. 2), representing an apical part of a pinna, closely resembles *Cladophlebis virginiensis* forma *fisheri* (Bell, 1956, Pl. 6, fig. 3), whereas GSC No. 1113 (Pl. VII, fig. 2), which is like other specimens of *C. arctica* figured by Heer (op. cit., Pl. 49, figs. 5, 6; Pl. 50, figs. 6, 7), just as clearly resembles *Cladophlebis virginiensis* forma *acuta* (*see* Bell, 1956, Pl. 5, figs. 1, 2; Pl. 6, figs. 4, 5). Accordingly, specimens assigned to one or the other species have little value for refined age correlation. However, the much greater abundance of *Cladophlebis* of this form, in Lower than in Upper Cretaceous formations, has apparently some value in age interpretations.

Occurrence. ?Dunvegan Formation, British Columbia, GSC locality 4195; Bad Heart Formation, British Columbia, GSC locality 5188.

Types. Hypotype?, GSC No. 1113; hypotype?, GSC No. 1053.

Cladophlebis sp. cf. *C. virginiensis* Fontaine

Plate VII, figure 3

Remarks. The material is too scanty and specimens too poorly preserved to be worth more than a record of occurrence in the Dunvegan Formation of a species of *Cladophlebis* that closely resembles some specimens of *C. virginiensis* forma *acuta* (Bell, 1956, Pl. 7, fig. 4). Marginal denticulations occur in the distal parts of some pinnules. Such specimens approach, in form of pinnules, shorter pinnuled forms of *Pteris frigida* Heer (=*Cladophlebis frigida*) e.g., specimens figured in *Flora Fossile Arctica,* vol. 6, part 2 (1882, Pl. 10, fig. 13 and Pl. 12, fig. 2).

Occurrence. Dunvegan Formation, British Columbia; GSC localities 4193, 4194.

Types. GSC No. 1114.

Cladophlebis simplicima n. sp.

Plate VII, figures 1, 4-6

Description. Ultimate pinnae, closely spaced, lanceolate, 3 cm or more long by 1 cm or more wide; rachis, winged. Pinnules, obliquely attached by whole base, triangular-ovate, bluntly pointed to more rounded, 8 mm or so long by 3 mm or so wide; towards apex of pinna they are united for more and more of their length. Terminal leaflet, relatively much larger than those preceding it, is marginally lobate for half or more of its length, owing to coalescent pinnules. Veins, delicate; midrib, commonly slightly decurrent, running to apex or near it; laterals, simple or a basal one or two may be once divided, commonly about three opposite pairs, highly ascending and curving inward so as to meet margin almost tangentially.

Remarks. Although represented by only a few fragments, the venation is unlike any described Cretaceous species known to the writer. The terminal leaflet, as may be expected from the coalescence of segments has alternate lateral veins that are each provided with opposite ascending simple branches.

Occurrence. Dunvegan Formation, British Columbia, GSC locality 5254; Milk River Formation, Alberta, GSC locality 3934.

Types. Holotype, GSC No. 1271; paratypes, GSC Nos. 1111, 1112.

Filicites sp.

Plate VIII, figures 1, 2

Description. Penultimate pinna, inequilaterally (?) pinnate, at least 5 cm long; rachis, slender (about 1 mm wide). The single imperfect specimen to hand consists of rachis, having preserved at its summit basal parts of a terminal, and of a lateral segment close to it on one side only. The specimen is an imprint except for carbonized rachis and veins. Terminal leaflet, apparently suboblong, constricted gently to a cuneate and slightly decurrent base; midrib (about 0.3 mm wide) is straight, well marked, and gives off at very open angles threadlike, straight, lateral veins which are about 0.5 mm apart in midregion; they divide, mostly at, or near point of origin, terminating and uniting 1 mm or less from margin in a straight or minutely crenulated, well-defined, submarginal vein; very rarely the divisions of the lateral veins anastomose tangentially. The upper part of the base of the lateral segment (which is sessile) is not preserved, but apparently was free from the terminal segment; the lower part of the base, where the segment has contracted gradually to about half of its width, like the terminal segment is slightly decurrent on the rachis; the venation, including character of submarginal vein, is precisely like that of the terminal segment.

Remarks. Little doubt exists that this is a fragment of a fern and not of a dicotyledon. Except for the presence of a submarginal vein and the extremely rare anastomoses, the venation is much like that of *Saccoloma gardneri* (Lesquereux) (Knowlton, 1930, p. 26, Pl. 3, figs. 3-8), or may be compared with the non-anastomosing veins of *Allantodiopsis erosa* (Lesquereux) (*see* Knowlton, 1930, Pls. 4, 5).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4193.

Types. GSC No. 1070.

Isoetites horridus (Dawson) Brown

Carpolithus horridus Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21, Pl. 1, figs. 3, 3a (1883).
Antholithes horridus Dawson, Roy. Soc. Can., Trans. 1885, vol. 3, sec. 4, p. 7 (1886).
Isoetites horridus Brown, Washington Acad. Sci. J., vol. 29, p. 268 (1939).
Isoetites horridus Bell, Geol. Surv., Canada, Mem. 285, p. 78, Pl. 50, figs. 1, 3 (1956).

Remarks. This species was described by Bell and Dawson's type specimens illustrated in above reference. No additional specimens were found in material collected from the Dunvegan Formation.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4207.

Types. Holotype, GSC No. 5388.

Equisetum sp.

Plate VIII, figures 3, 4; Plate IX, figures 2, 4

Remarks. A few isolated sheaths of an *Equisetum* in the collections range from 8 to 10 mm high by 4 or 5 mm wide. One sheath is fused for about half its length, and is then divided into six or more free, acicular, sharply pointed, narrow segments (0.5 to 1 mm wide), each with a median groove. The length of internodes on the parent axes is not known.

Associated in the same beds as the sheaths are numerous costated axes, e.g., specimen GSC No. 1275 (Pl. IX, fig. 4), which have several internodes, 1 to 1.5 cm long, and upon these nodes are traces of circular scars; these axes evidently represent tuber-bearing rhizomes, and are inferred to belong probably to the same species as the sheaths. What seem to be tubers are shown by specimen No. 1276 (Pl. IX, fig. 2); they are more or less oval in outline, and about 2 cm long by 1 cm wide, but whether they were attached to a common axis is not revealed.

Occurrence. Milk River Formation, Alberta; GSC locality 3934.

Types. GSC Nos. 1272, 1274, 1275, 1276.

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

Plate IX, figure 1

Baiera sp. cf. *B. furcata* Bell, Geol. Surv., Canada, Mem. 285, p. 84, Pl. 38, figs. 4, 7 (1956).

Description. Leaf, petiolate, bifurcated into two main divisions, each of which is laciniated by four or more dichotomies, resulting in relatively long filiform ultimate segments, about 0.5 mm wide. Length above first division 4 cm or more.

Remarks. A comparison of cuticular characters would be necessary to distinguish this Dunvegan form from that occurring in the Kootenay Formation (above reference), for the two on megascopic characters alone cannot be specifically separated. A similar form in the Stockholm Museum derived from Atane beds of Greenland was designated by A. C. Seward *Baiera* sp. cf. *B. lindleyana* (Schimper) (Seward, 1926, p. 96, Pl. 10, fig. 101).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 5649.

Types. GSC No. 1189.

Ginkgo sp.

Plate IX, figure 3

Remarks. Were it not for the extreme rarity of *Ginkgo* leaves in early Upper Cretaceous deposits of North America, the occurrence of a single poor specimen in Dunvegan collections would hardly be worthy of note. The specimen is only an imprint of a broken leaf, which precludes comparison with described species from other formations. About one centimetre of a slender petiole remains, from the top of which the blade diverges at an angle of about 90 degrees. From the nature of the imprint it cannot be determined how much of the apparent lobing (expressed by at least two deep sinuses reaching into the basal part of the leaf) was original and how much due to tear during transportation of the specimen. The summit is lacking and the length of blade remaining is about 1.5 cm.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4193.

Types. GSC No. 1292.

Pseudocycas unjiga (Dawson)

Plate VIII, figure 5; Plate IX, figures 6, 7

Cycadites unjiga Dawson, Roy. Soc. Can., Trans. 1882-83, sec. 4, p. 20, Pl. 1, figs. 2, 2a, 2b (1883).

?*Pseudocycas* sp. A cf. *P. unjiga* (Dawson), Bell, Geol. Surv., Canada, Mem. 285, p. 98, Pl. 44, fig. 2; Pl. 45, fig. 3; Pl. 46, fig. 2; Pl. 47, fig. 4 (1956).

Description. Fronds reaching lengths of more than 25 cm and width of 12 cm or more. Pinnae generally closely spaced to touching, commonly inclined around 40 degrees to rachis, linear, parallel-sided, contracting acuminately near apex to a sharp, spine-like termination that may be 4 mm long. Mean width of pinnae 2 to 2.5 mm but up to 3 mm; undersurface marked by a medial narrow groove that on imprints appears as a narrowly rounded vein-like ridge bordered by two depressed lines.

Remarks. The species is closely allied in megascopic characters to both *P. insignis* Nathorst and *P. pumilio* Nathorst (1907, pp. 4, 7; Pl. 1, figs. 1-7). Nathorst himself noted the possibility that the last mentioned was a young frond of *P. insignis,* and, owing to their association in same beds, this may well be so. Most fronds of *P. unjiga* collected from the Dunvegan Formation are 4 to 10 cm broad and have rachides less than 5 mm wide. GSC No. 5393 (Dawson, op. cit., Pl. 1, fig. 2a), one of Dawson's syntypes, with a rachis 4 mm wide, exhibits dissymmetry, having pinnae on one side farther apart than on other and attached at more open angles to rachis. Thus, it may be inferred from this specimen alone that spacing of pinnae and their obliquity of insertion varies within a single species. Yet, the fact remains that all specimens of *P. insignis* figured by Nathorst have pinnae more spreading and farther apart than most specimens of *P. unjiga.* More precise knowledge of the relations of the two species to one another will have to await establishment of cuticular characters of Dawson's species, if this be possible, and this applies also to the true relationships of the stratigraphically older *Pseudocycas* sp. A Bell cf. *P. unjiga,* which occurs in upper part of Lower Cretaceous beds in Alberta.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 285, 1672, 3218, 3232, 3483, 3628, 3629, 3780, 3784, 4144, 4193, 5108, 5138, 5254.

Types. Syntypes, GSC Nos. 5125, 5393; hypotype, GSC No. 1183.

Pseudoctenis latipennis (Heer) Seward

Nilssonia lata Dawson, pars, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 24, Pl. 4, fig. 15 bis (*non* fig. 15a) (1883).

Pseudoctenis latipennis (Heer) Bell, Geol. Surv., Canada, Mem. 293, p. 26, Pl. 7, fig. 7; Pl. 8; Pl. 9; Pl. 10, fig. 3 (1957).

Remarks. A single fragmentary part of a leaf occurs in collections from the Dunvegan Formation. The pinnae are about 1 cm broad and have about eight veins at the origin, some of which bifurcate at or close to the base; beyond are a few dichotomies, and one or two anastomoses seem to occur, although too obscurely to be certain. On the whole, the specimen is comparable to some of those occurring in the Nanaimo Group (Bell, Pls. 8, 9 of above reference).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 5256.

Types. Hypotype, GSC No. 1277.

Dammarites robinsi (Dawson) Bell

Plate X, figure 5

Phragmites cordaiformis Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 26, Pl. 5, fig. 22 (1883).
Noegerathiopsis robinsi Dawson, op. cit., Trans. 1893, vol. 11, sec. 4, p. 56, Pl. 6, fig. 7 (1894).
?*Dammarites dubius* Dawson, op. cit., Trans. 1893, vol. 11, sec. 4, p. 56, Pl. 6, fig. 8 (1894).
Zamites albertensis Berry, Geol. Surv., Canada, Mus. Bull. 58, p. 68, Pl. 11, figs. 1, 2 (1929).
Dammarites robinsi (Dawson) Bell, Geol. Surv., Canada, Mem. 293, p. 33, Pl. 19, figs. 2, 4, 6 (1957).

Remarks. This species, as it occurs in Nanaimo Group, Vancouver Island, was described and figured by the writer (above reference). Specimens, which occur rather rarely in Dunvegan, Bad Heart and Milk River Formations are fragmentary, but agree in all essential characters with those from the Nanaimo Group and Allison Formation.

Occurrence. Dunvegan Formation, British Columbia, GSC localities 4193, 4194, 4196; Bad Heart Formation, GSC locality 5188; Eagle Sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Types. Hypotype, GSC No. 1188.

Brachyphyllum (*Athrotaxites*?) *douglasi* n. sp.

Plate XI, figure 3; Plate XIII, figures 2, 5; Plate XIV, figure 5

Description. Ultimate twigs, branching alternately to opposite at angles commonly 30 to 60 degrees, the branching being fairly regular and presenting a distichous arrangement. Somewhat thicker axes are commonly unbranched for several centimetres. Leaves, small, triangular-ovate, commonly about 2 mm long by 0.75 mm wide, acute at apex, appressed to axis or apically free, uninerved, with keel on lower surface.

Remarks. The ultimate twigs are generally more slender than those of *Athrotaxites berryi* Bell (1956, p. 115, Pl. 58, fig. 5; Pl. 61, fig. 5; Pl. 62, figs. 2, 3; Pl. 64, fig. 1; Pl. 65, fig. 7), and the leaves of all axes are stouter. A single fragment of a cylindrical cone (Pl. XI, fig. 3) that apparently belongs to the species occurs associated in same bed with sterile specimens; the cone is incomplete, about 2.5 cm long by about 6 mm wide; it forms the terminal organ of a narrow axis only several millimetres of which is preserved and which has traces of short leaves.

The species is named after its collector R. J. W. Douglas of the Geological Survey of Canada.

Occurrence. Milk River Formation (upper part), Alberta, GSC locality 3934; Dunvegan Formation, British Columbia, GSC locality 5114.

Types. Holotype, GSC No. 1160; paratypes, GSC Nos. 1161, 1163; ?paratype, GSC No. 1164.

Torreyites dicksonioides (Dawson) n. comb.

Plate XIV, figure 1

Torreya dicksonioides Dawson 1883, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21, Pl. 2, fig. 4.
Tumion dicksonioides (Dawson) Knowlton 1898, U.S. Geol. Surv., Bull. 152, p. 234; 1919, Bull. 696, p. 631.

Description. Axis of sterile shoot, stout, about 3.5 mm wide, much roughened by bases of leaves. Leaves, spirally disposed, non-distichous, decurrent, only slightly constricted at base, attached obliquely, but some curved or bent abruptly to a position almost normal to axis, rectangular-linear, obtusely rounded at summit or, if possessing mucronate points, the latter are concealed in the matrix by upward curvature, about 2.5 cm long by 3 mm wide; lower surface, convex, with traces of a medial, narrow ridge that in most of the exposed leaves is bordered on each side by a furrow of about equal breadth to the ridge, possible loci of stomata. The surface of a leaf has crowded transverse wrinkles that might well conceal additional traces of stomatal bands, if such were present.

Remarks. The single specimen available is inferred to be a strongly carbonized compression, with the lower surfaces of the leaves exposed. An assignment to *Torreyites* rather than to *Taxites* or *Cephalotaxites* is based on resemblances in habit to *Torreyites tyrrelli* (Dawson) (Bell, W. A., 1949, p. 45, Pl. 7, figs. 3, 4; Pl. 8, figs. 1, 4). The leaves are similarly non-distichous, flatly triangular or plano-convex in cross-section, obliquely ascending or spreading to positions nearly normal to the axis. The apparent midrib is comparable to the narrowly rounded median keel of *T. tyrrelli.* The leaves, however, differ markedly from that species in their elongate-spatulate contour. The writer thinks they may possess upturned mucronate tips, but this was not determined because further clearing of the leaves from the rock matrix might result in the destruction of their summits.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 287.

Types. Holotype, GSC No. 5127.

Cephalotaxopsis heterophylla Hollick

Plate X, figure 6; Plate XV, figure 3

Description. Sterile, leafy shoots, with linear-lanceolate, acuminate leaves (up to 12 mm long by 1 mm wide in specimens to hand), spirally disposed, pseudo-distichous, widely oblique or at right angles with axis. Base of leaves contracted and well rounded to midwidth distally, less contracted proximally, resulting in appearance of a very short, stout, decurrent foot-stalk. Midrib, commonly well defined, broad.

Remarks. A narrow furrow on each side of midvein may be seen on surface of some leaves, which may represent stomatal grooves, and, if so, the species would probably be more closely related to *Torreya* than to *Cephalotaxus.* If it were combined without committal with the more comprehensive form genus *Elatocladus,* however, a new specific name would be necessary, owing to the different pre-existing *Elatocladus heterophylla* Halle, a Jurassic form.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3228, 3781. 5649, 5692.

Types. Hypotypes, GSC Nos. 1169, 1170.

Geinitzia formosa Heer

Plate XI, figures 4, 5; Plate XII, figures 2, 3, 5

Sequoia reichenbachii Dawson (non Heer), Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21.
Geinitzia formosa Berry, Geol. Surv., Canada, Mus. Bull. 58, p. 69 (1929).

Description. Sterile shoots, sparingly to moderately branched. Leaves spirally disposed, acicular-lanceolate, variable, nearly straight or slightly curved to sub-falcate or falcate, up to 1.5 cm long and 1.5 mm wide at base, tetragonal in cross-section, with median keel on under surface, uninerved. Associated, but unattached, female cones, cylindrical, reaching length of more than 4 cm and width of 2 cm; scales, peltate, expanded, distal, exposed surface more or less hexagonal, having central scar from which radial costae diverge, commonly up to 6 or 7 mm greatest diameter; total length of scale 5 or 6 mm, the pedicles contracting cuneately to about 1 mm at point of attachment.

Remarks. The Canadian specimens agree well with Heer's types (Heer, 1871, p. 6, Pl. 1, figs. 9, 10; Pl. 2, figs. 1-6). Although the leaves vary from nearly straight to falcate, they are not interspersed with scale leaves as noted by Berry (above reference); the appearance of scale leaves is probably given by exposed obovate bases of leaves that are buried in matrix or, on older stems, by scars on the axis left by fallen leaves.

Specimen GSC No. 1118 (Pl. XI, fig. 4) has one branch terminating in three minute club-shaped organs that appear more like male cones than foliar buds; they are 2 mm long by 1 mm wide at upper end.

Sterile shoots of *G. formosa* resemble those of *Elatides curvifolia* (Dunker), although in the latter falcate leaves generally are much more predominant.

Occurrence. Milk River Formation (upper part), Alberta; GSC localities 844, 1271, 1282, 1619, 3618, 3934.

Types. Hypotypes, GSC Nos. 1116, 1117, 1118, 5150.

Sequoiites sp. cf. *Geinitzia formosa* Heer

Plate XII, figures 4, 6

Remarks. From the Dunvegan and younger Bad Heart Formations have been derived a few conifer twigs that, for lack of attached or closely associated cones, cannot be assigned reliably to a particular genus. The best specimen to hand from the Bad Heart Formation, GSC No. 1166 (Pl. XII, fig. 6) resembles closely some specimens of *Geinitzia formosa* from the Milk River Formation (*see* Pl. XI, figs. 4, 5 of this report), as well as specimens of *Sequoia concinna* Heer (1883, p. 13, Pl. 49, fig. 8b; Pl. 51, fig. 9; Pl. 52, figs. 1-3) from Patoot beds of Greenland. The same observation applies to GSC No. 1079 (Pl. XII, fig. 4) from the Dunvegan formation. The taxonomic position of these forms must await discovery of fertile specimens, and until then they may be considered to have little value for refined age correlation.

Occurrence. Dunvegan Formation, British Columbia, GSC localities 4197, 4208, 5649, 5656; Bad Heart Formation, British Columbia, GSC locality 5188.

Types. GSC Nos. 1079, 1166.

Metasequoia cuneata (Newberry)

Plate X, figures 1, 2, 3

Taxodium cuneatum Newberry, Boston J. Nat. Hist., vol. 7, p. 517 (1863).
Sequoia langsdorfii Heer pars, All. Schweiz. Gesallschaft, Soc. Helv. neue Denksch., Bd. 21, p. 6, Pl. 1, figs. 2, 3(?), 4(?), 5(?) (*non* fig. 1) (1865).
Taxodium cuneatum Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 25 (1883).
Torreya densifolia Dawson, op. cit., p. 25, Pl. 5, figs. 20, 20a (1883).
Taxodium sp. Dawson, op. cit., p. 56, fig. 10 (1894).
Sequoia cuneata Newberry, U.S. Geol. Surv., Mon. 35, p. 18, Pl. 14, figs. 3-4 (1898).
Tumion densifolium (Dawson) Knowlton, U.S. Geol. Surv., Bull. 152, p. 234 (1898).
Metasequoia cuneata Chaney pars, Amer. Phil. Soc. Trans. 1950, n.s., vol. 40, pt. 3 (1951).

Remarks. No diagnostic characters could be found to separate specimens from the Dunvegan and Milk River Formations from type specimens from the Nanaimo Group. Specimen No. 1180 (Pl. X, fig. 3) illustrates a fragment of a single detached cone, which the author thinks may be reasonably assigned to the species.

Occurrence. Dunvegan Formation, British Columbia, GSC localities 3218, 3351, 3618, 3783, 4192, 4193, 4194, 4197, 4198, 5114; Milk River Formation (upper part), Alberta, GSC locality 1622.

Types. Hypotypes, GSC Nos. 1095, 1167, 1168, 1180.

Elatocladus sp. cf. *Sequoia major* Velenovsky and Viniklar

Plate X, figure 4; Plate XI, figures 1, 2

Description. Sterile shoots, branching rather profusely at narrowly acute angles, so that divisions may be subparallel (Pl. X, fig. 4); axes, rigid; where leaves are lacking the axis is longitudinally finely costate. Leaves rather distant, spirally disposed, elongate-acicular, straight, highly ascending, strongly decurrent by whole base, keeled (at least on one side), up to 7 mm long by 0.5 to 0.7 mm broad.

Remarks. Lack of attached or associated cones precludes assignment of the species definitely to *Sequoia*. Yet the sterile characters are so like those of *Sequoia major* (Velenovsky and Viniklar, 1926, p. 39, Pl. 1, figs. 1-3; Pl. 6, figs. 6-8) that the material may well belong to that species. Hollick (1906, p. 43, Pl. 3, fig. 6) figured a sterile fragment of a conifer, collected from Upper Cretaceous beds of Long Island, New York, as *Sequoia* sp.; its mode of branching and lineation of naked parts of an axis are similar to that of the forms under discussion, and it is possible that it too may be conspecific; unfortunately the characters of the leaves in Hollick's specimen are not well represented.

Occurrence. Milk River Formation (upper part), Alberta, GSC locality 3934; ? Dunvegan Formation, British Columbia, GSC localities 3911, 5692.

Types. GSC Nos. 1153, 1156, 1157.

Widdringtonites reichii (Ettingshausen) Heer

Plate XII, figure 1; Plate XIII, figures 1, 4

Glyptostrobus gracillimus Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21 (1883).

Remarks. Specimen GSC No. 1158 (Pl. XII, fig. 1) shows the typical branching habit and the small elongated appressed leaves, with or without the pointed apices free from the axis. GSC No. 1069 (Pl. XIII, fig. 1) shows that the larger axes are provided with longer, ascending leaves (about 5 mm), straight except for the apices that are slightly falcate, and free from the axis for a greater part of the length. Berry (1919, p. 68, Pl. 8, fig. 2) noted some dimorphism of this type on specimens assigned by him to *Widdringtonites subtilis* Heer. Heer's types of the latter species (Heer, 1874, p. 101, Pl. 28, figs. 1, 1b) are very fragmentary and based on his diagnosis the species differs from *Widdringtonites reichii* only in the leaves of the larger or older axes being somewhat falcate. Whether this is a valid distinction between the two species is somewhat questionable.

Glyptostrobus gracillimus Dawson (op. cit. above), is represented by GSC No. 5395a, which comprises sterile, profusely branching, slender twigs with spirally disposed, upright, ovate, apically pointed leaves, appressed to axis or only apically free, comparable to other specimens of *Widdringtonites reichii* from the Dunvegan Formation.

Specimen GSC No. 1165 (Pl. XIII, fig. 4) has a coalized or strongly carbonized fragment that seemingly belongs to a four-valved cone, but connection with one of the nearby leafy shoots could not be proved.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 287, 3623, 3781, 3782, 3783, 3911, 4192, 4193, 4194, 5627, 5656.

Types. Hypotypes, GSC Nos. 1069, 1158, 1165, 5395.

Elatocladus albertaensis Bell

Plate XIII, figure 3; Plate XIV, figures 4, 6

Picea albertensis Penhallow, Ottawa Naturalist, vol. 22, p. 82 (1908).
Elatocladus albertaensis Bell, Geol. Surv., Canada, Mus. Bull. 49, p. 26, Pl. 13 (1928).

Remarks. (Part of a sterile shoot.) Leaves crowded, linear, acutely pointed, about 3 cm long by 1 to 1.5 cm wide, oblique, slightly curving upward distally, spirally disposed, ventrally keeled, attached by whole base and decurrent, uninerved. Differs from *Geinitzia formosa* Heer in greater length of leaves, which are much more crowded and more uniform in breadth from basal attachment to near apex.

Picea albertensis Penhallow, GSC No. 5007 (Pl. XIV, fig. 6) from Belly River Group was unfigured and given no description beyond the stated length and breadth of the fragment preserved, which was wrongly considered to be a longitudinal section of a cone. The leaves are 1.5 cm long, about the length of those of the largest leaves of *Geinitzia formosa,* although more crowded than those of the latter species.

Occurrence. Milk River Formation (upper part), Alberta; GSC localities 1282, 1619.

Types. Hypotypes, GSC Nos. 1115, 1151, 5007.

Protophyllocladus polymorpha (Lesquereux)

Plate IX, figure 5

Adiantites praelongus Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 25, Pl. 5, fig. 19 (1883); op. cit., Trans. 1893, vol. 11, sec. 4, p. 55, Pl. 6, fig. 6 (1894).
Salisburia baynesiana Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 25, Pl. 5, fig. 21 (1883).
Proteoides major Dawson, Roy. Soc. Can., Trans. 1893, vol. 11, sec. 4, p. 61, Pl. 12, fig. 54.
Protophyllocladus polymorpha Bell, Geol. Surv., Canada, Mem. 293, p. 35, Pl. 19, fig. 5; Pl. 20, figs. 1, 2, 4; Pl. 21, figs. 1, 3, 5; Pl. 25, fig. 4 (1957).

Remarks. A specimen occurring in collections from the Dunvegan Formation, is an incomplete leaf (or phylloclade), about 10 cm long by 1.5 cm wide at widest part, contracting to about 1 mm at base where it forms a narrow wing to a well-defined midrib; midrib runs nearly to the exposed summit where it is very thin. Lateral 'veins' are strong, highly ascending to the margin, parallel, having between them up to four or five parallel somewhat weaker striae. Margin of leaf is obscurely preserved, but is seemingly regular or with wide undulations.

Occurrence. Dunvegan Formation, British Columbia, GSC locality 5692; Milk River Formation, Alberta, GSC locality 845.

Types. Hypotype, GSC No. 1187.

Alnus perantiqua (Dawson) Bell

Plate XIV, figure 2

Betula perantiqua Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 27, Pl. 7, fig. 27 (1883).
Ulmus dubia Dawson, ibid, p. 27, Pl. 7, fig. 29 (1883).
Alnus perantiqua (Dawson) Bell, Geol. Surv., Canada, Mem. 293, p. 38, Pl. 21, figs. 2, 4, 6; Pl. 22, figs. 1-4 (1957).

Description. Leaf, petiolate, subelliptical, with the greatest width in the midregion, contracting to a cuneate base with an included angle of about 90 degrees, and more so to an acute apex; margin denticulate well above entire base. Venation, craspedodromous, pinnate, six or seven pair of nearly straight or slightly upwardly curved secondaries, which with one or two short distal branches on abaxial side enter the teeth; secondaries are alternate or subopposite and leave midveins at angles 35 to 50 degrees. Tertiary veins, where preserved, simple and percurrent, at right angles or nearly so to secondaries.

Remarks. A single leaf of the species is comparable to a specimen from the Comox Formation (Nanaimo Group) illustrated by Bell (Pl. 21, fig. 4, of above reference). Superficially it resembles *Dryophyllum protofagus* Berry (1925, Pl. 5, figs. 4, 5), but differs in possessing one or two short distal branches from the secondaries that likewise enter teeth.

Occurrence. Milk River Formation, Alberta, GSC localities 1271, 3934.

Types. Hypotype, GSC No. 1264.

Dryophyllum gracile Debey

Plate XIV, figure 3

Description. Leaf, oblong-lanceolate, incomplete, probably 12 or 13 cm long, 2.5 cm wide; margin, regularly serrate, with points of teeth directed forwards. Midrib, stout, very slightly curved. Secondaries, about fifteen pair preserved, mainly alternate, inclined 50 or more degrees to midrib, curving regularly upward to end in teeth, spaced 5 to 8 mm apart; intercalary secondaries, common, slightly zig-zag, situated about midway between adjacent pair of main secondaries and extending up to half the distance to the margin until cut by tertiaries. Main secondaries have rarely an abaxial branch that ends in an intercalary tooth. Tertiaries, mainly percurrent, making 90 degrees or slightly more to secondaries, mostly 2 or 3 mm apart. Nervilles, not preserved.

Remarks. The leaf has characters in common with *Dryophyllum gracile* Berry (1919, p. 75, Pl. 32, fig. 2) from the younger Ripley Formation.

Occurrence. Dunvegan Formation, British Columbia, GSC locality 4195.

Types. Hypotype, GSC No. 1080.

Ficus glascoeana Lesquereux

Plate XIV, figure 7; Plate XXI, figure 4

Description. Leaf, oblong-subelliptical, up to 20 cm long by 5 cm wide, contracting to narrowly rounded or bluntly pointed apex and more abruptly to a cuneate base. Margin, entire. Nervation, camptodromous; midrib, moderately stout (1 to 1.5 mm wide), straight or slightly curved; secondaries, numerous, commonly 2 to 3 mm apart, subparallel, nearly straight, rarely distally bifurcated, uniting by abrupt upward curvature along a nearly straight almost marginal line that simulates a marginal vein.

Remarks. The type specimens figured by Lesquereux (1892, p. 76, Pl. 13, figs. 1, 2) have secondaries 50 to 60 degrees to midrib, as does GSC No. 1066 (Pl. XIV, fig. 7). A smaller leaf from the Dunvegan GSC No. 1071 (Pl. XXI, fig. 4) has more spreading secondaries, lying about 70 degrees to midvein. This is considered a normal variation, not ranking specific separation.

Occurrence. Dunvegan Formation, British Columbia, GSC locality 4196.

Types. Hypotypes, GSC Nos. 1066, 1071.

Ficus daphnogenoides (Heer) Berry

Plate XV, figures 1, 2; Plate XVI, figures 4, 5

Laurophyllum debile Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 22, Pl. 22, figs. 7, 7a (1883).

Description. Leaves, elongate, ovate-lanceolate, entire, contracting from greatest breadth, which is generally below the midlength, to an acuminate summit and less gradually to a narrow, cuneate base; up to 11 cm or more long and 2 to 3.5 cm broad; petiole, about 2 mm broad and probably not much over 1 cm long. Venation, camptodromous; midvein, moderately thick, commonly curved; secondaries, fairly numerous, leaving midvein at angles of 40 to 50 degrees, curving distally rather strongly upwards to a position about parallel with margin, near which they unite with secondaries above; secondaries in basal region leave midrib at more acute angles (about 30 to 35 degrees); tertiaries, rarely preserved; where seen are simple and percurrent and at right angles or nearly so to midvein.

Remarks. Laurophyllum debile Dawson (Pl. XV, fig. 2) lacks much of the upper half of the leaf; its secondaries are thin and those seen obscure; no tertiaries forming a reticulated network like that figured by Dawson could be observed. Nonetheless, the basal characters of the leaf, as well as those secondaries that are preserved, are comparable to those of GSC specimen No. 1242, which is almost complete.

It is questionable whether all the leaves that have been assigned to this species are actually conspecific. Those from the Dunvegan Formation hereby identified with it, agree in all essential characters with the following figured specimens: (1) *Ficus* *proteoides* Lesquereux (1892, Pl. 12, fig. 2), which has an acuminate summit, greatest width below the midlength and insertion of secondary veins on the midvein at angles of about 40 degrees; (2) *Proteoides daphnogenoides* Hollick (1894, Pl. 177, fig. 1); *Ficus daphnogenoides* Berry (1916, Pl. 58, fig. 3). There is much less correspondence between the Dunvegan leaves and narrower ones with sharply pointed apices figured by Newberry (1895, Pl. 17, figs. 8, 9; Pl. 32, figs. 13, 14; Pl. 33, fig. 33).

Occurrence. Dunvegan Formation, British Columbia; GSC localities 284 (4204), 1197, 3351, 3352, 3664, 3784, 4193, 4194, 4195, 5135.

Types. Hypotypes, GSC Nos. 1073, 1074, 1242, 1294, 1296, 5390 (*Laurophyllum debile* Dawson).

Ficus missouriensis Knowlton

Plate XVI, figures 1, 2

Original description. "Leaf, thick, elliptical in outline, slightly inequilateral, apparently broadest at or a little above the middle, rounded rather abruptly below, apex not preserved; midrib, very thick, straight; secondaries, very numerous, thin, emerging at an obtuse angle, camptodrome, anastomosing well within the margins with the secondary next above; intermediate secondaries, numerous, passing nearly or quite half the distance to the margin, then vanishing; other venation not preserved." (Knowlton, 1900, p. 12.)

Remarks. Although even more fragmentary than the Knowlton's type, one specimen (Pl. XVI, fig. 2) from the Eagle Formation of Montana, collected by an officer of the Geological Survey of Canada, agrees so closely with the type specimen (Pl. 1, fig. 5 of above reference), that little doubt is entertained of its specific identity. A few tertiary veins, mostly percurrent and at right angles to the secondaries are preserved.

Occurrence. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A.; GSC locality 1621.

Types. Hypotypes, GSC Nos. 1257, 5054.

Ficus trinervis Knowlton

Plate XVI, figures 3, 6; Plate XVII, figure 1

Description. Leaf, entire, broadly ovate-lanceolate, contracting rather abruptly to a well-rounded and basally decurrent base and to obtuse summit that may have a somewhat extended apex or a blunt tip. Venation, trinerved-palmate, camptodromous; lateral primaries originate well down on petiole alongside midrib, whence they ascend at angles of about 20 degrees to latter, curve slightly inwards to a position nearly parallel with it, and distally more abruptly where they unite seemingly with the lowest of two or three pair of opposite or subopposite secondaries. Each lateral has about five branches on its abaxial side, which are camptodromous well within the margin.

Remarks. The leaf agrees in all essential characters with four of the types of *Ficus praetinervis* Knowlton (1917b, p. 263, Pl. 41, figs. 1-3; *non* fig. 3; Pl. 42, fig. 1), a species that was justifiably united by E. Dorf to *Ficus trinervis* Knowlton.

Occurrence. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621; Milk River Formation, Alberta, GSC locality 845.

Types. Hypotypes, GSC Nos. 5067, 5068, 5069.

Ficus? sp.

Plate XVII, figure 5

Remarks. A single specimen, much too imperfect for adequate diagnosis, is noted here only for comparison in the event that better material with similar form and venation should be found in the future. The leaf is entire-margined, ovate, with inequilateral base, one side being rounded-truncate at a very open angle to the midvein, whereas the other is narrowly acute and decurrent on midvein, which is relatively broad (about 2 mm wide at base) in lower half of leaf, thinning rapidly above. Presumably there were about ten pair of alternate, camptodromous secondaries, of which six or seven are preserved, making angles of 30 to 35 degrees to midvein. The two lowermost pair are differentiated from the remainder, owing to a slight downward curvature, the rest being curved upwards, slightly in lower part of course, then abruptly distally where they probably unite with secondary above. No tertiaries are preserved.

The venation resembles rather closely that of *Ficus martini* Knowlton (1930, p. 69, Pl. 40, fig. 5) from the much younger Denver Formation of Colorado. It resembles, too, that of *Dicotylophyllum* sp. B (GSC No. 5047) from the Milk River Formation (*see* p. 63) differing mainly in the less spreading upper secondaries.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 5135.

Types. GSC No. 1279.

Nymphaeites exemplaris Hollick

Plate XVII, figures 2, 4

Description. (Founded upon several incomplete specimens.) Leaf, suborbicular, with cuneate base; margin, entire, undulate or undulo-crenate. Nervation, palmate, from top of petiole (2 mm broad). Primary veins, all of equal or subequal size, comprising a central vein ('midrib') with four or five on each side, each bifurcating rather freely within upper three fourths of their length, their divisions and terminations merging into the network of tertiary veins, resulting in a fine network of irregularly shaped polygonal, elongated, rhombic areoles.

Remarks. Hollick (1930, p. 75, Pl. 40) founded his species upon a single specimen, so that the variation in the number of primary veins is not known. The writer thinks that variation in this respect is most likely, and that the number is not of specific importance.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3780, 4198.

Types. Hypotypes, GSC Nos. 1075, 1222.

Castaliites sp. cf. *C. cordatus* Hollick

Plate XVII, figures 3, 6; Plate XVIII, figure 1

Description. Leaf, reniform, about 6 cm long by 8 cm broad; base is lacking, but presumably was broadly rounded-truncate. Upper margin, where intact, regularly dentate, with triangular creno-serrate teeth. Venation, palmate from top of petiole; seven primaries are preserved and an additional two apparently missing on one side. Midrib is scarcely differentiated, if at all, from the other primaries, all of which radiate from top of petiole and bifurcate several times in upper part of leaf, the more distal bifurcations connected by strong tertiary veins resulting in a loose network of areoles well within the leaf margin; ultimate divisions enter the teeth; tertiaries in lower half or so of leaf are curved, simple and percurrent and transverse or broadly oblique to the primaries.

Remarks. *Castaliites* as defined by Hollick differs apparently from *Menispermites* in lacking a clearly differentiated midrib, the primaries being branched or forked as in some nymphaeaceous genera. If this be an acceptable criterion, the form here under consideration would fall under Hollick's genus rather than under *Menispermites.* Additional material indeed may prove its identity with *Castaliites cordatus* Hollick (1930, p. 76, Pl. 41, fig. 6). Its toothed margin is much like that species, and the number of primary veins is presumably the same.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3629, 3664, 3936.

Types. GSC Nos. 1147, 1218, 1219.

Palaeonuphar nordenskiöldi (Heer) n. comb.

Plate XVIII, figures 2, 4

Remarks. Seward (1927, p. 117, text-fig. 23) combined *Apeibopsis nordenskiöldi* Heer (1874, p. 23, Pl. 3, fig. 6) with *Menispermites,* including as a synonym *Pterospermites cordifolius* Heer (1882, p. 94, Pl. 27, figs. 2, 3). Fritel (1914a, pp. 277-297) previously had combined the latter species with *Nuphar,* and included the former somewhat doubtfully in the same genus.

Palaeonuphar nordenskiöldi is represented in collections from the Dunvegan Formation by a single imperfect specimen that shows well a strong basal emargination, the sinus being 3 cm deep and 1 cm wide; the basal lobes are well rounded. The midrib is stout, about 2 mm wide, and branching from it are preserved four pair of rather strong secondaries of equal strength (0.5 mm wide) at angles of 65 to 120 degrees respectively from uppermost to the lowest; an additional pair of thinner downwardly directed basal veins run from the top of the petiole, into the basal lobes. Two abaxial branches are preserved on one of the lowest secondaries and a single one on the secondary next above. In places tertiary percurrent veins, nearly normal to the secondaries, are preserved, as well as nervilles transverse to them and forming a more or less quadrangular network.

The Dunvegan specimen is undoubtedly conspecific with *Pterospermites cordifolius* Heer (*see* especially Pl. 27, fig. 2 of above reference), as well as with specimens of *Menispermites nordenskiöldi* figured by Seward. Heer's drawings of both *Apeibopsis nordenskiöldi* and *Pterospermites cordifolius* show more or less distal bifurcations of the secondaries, and one such division is shown in one of Seward's figures; this is a common character in leaves assigned to *Menispermites*. On the other hand, the species lacks some of the diagnostic characters of that genus enumerated by Lesquereux (1874, p. 94), e.g., more or less distinct trilobing and plamate venation, and generically falls within the diagnosis of *Palaeonuphar* Hollick (1930, p. 35).

Occurrence. Dunvegan Formation, British Columbia; localities 1197, 3664.

Types. Hypotypes, GSC Nos. 1221, 1240.

Trochodendroides (*Cercidiphyllum*?) *arctica* (Heer) Berry

Plate XVIII, figure 3; Plate XIX, figures 1-4

Populus protozadachii Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 26, Pl. 7, fig. 25 (1883).

Populus arctica Dawson, op. cit., Trans. 1886, vol. 4, sec. 4, p. 27, Pl. 1, fig. 9 (1887); Trans. 1889, vol. 7, sec. 4, p. 71, Pl. 10, figs. 2-4 (1890).

Populus hookeri Dawson, op. cit., Trans. 1889, vol. 7, sec. 4, p. 71, Pl. 10, fig. 5 (1890).

Populus obtrita Dawson, op. cit., Trans. 1890, vol. 8, sec. 4, p. 82, text-fig. 12 (1891).

Menispermites sp. Dawson, op. cit., Trans. 1893, vol. 11, sec. 4, p. 62, Pl. 11, fig. 50 (1894).

Trochodendroides arctica Berry, Geol. Surv., Canada, Mus. Bull. 42, p. 109, Pl. 13, figs. 1-4 (1926).

Trochodendroides speciosa Berry, Geol. Surv., Canada, Mus. Bull. 63, p. 22, Pl. 5, fig. 8 (1930).

Trochodendroides cuneata Berry, Geol. Surv., Canada, Mus. Bull. 63, p. 20, Pl. 5, figs. 2, 3 (1930); Mem. 182, p. 34, Pl. 6, figs. 1-6 (1935).

Grewiopsis mclearni Berry, Geol. Surv., Canada, Mem. 182, p. 50, Pl. 12, fig. 3; Pl. 14, fig. A (1935).

Trochodendroides arctica Bell, Geol. Surv., Canada, Bull. 13, p. 56, Pl. 4, fig. 2; Pl. 9, fig. 4; Pl. 20, fig. 3; Pl. 44, fig. 2; Pl. 45, figs. 1, 2; Pl. 46, figs. 1-3 (1948); Mem. 293, p. 45, Pl. 35, fig. 2 (1957).

Remarks. Typical large leaves of this species with very variable forms occur in collections from the Bad Heart Formation (Pl. XIX, figs. 1, 3, 4). Only two specimens were collected from the younger Milk River Formation, both small and more difficult to evaluate. One of these, GSC No. 1259 (Pl. XIX, fig. 2) is ovate, with summit narrowly contracted to a moderately extended apex, a broadly cordate base and cuneate margin. It closely resembles one of the types of *Populus potomacensis* (= *Trochodendroides potomacensis*) figured by Berry (1911, Pl. 81, fig. 1C). The second specimen, GSC No. 1260 (Pl. XVIII, fig. 3), is orbicular, has a truncate base, slightly cuneate on petiole, and a creno-dentate margin, quite comparable to certain small leaves of *Trochodendroides arctica* e.g., those from the younger Edmonton Formation figured by Bell (1949, Pl. 4, fig. 2; Pl. 9, fig. 4). Both specimens were collected from the same beds at the same locality, and, in consideration of the extreme variability in leaves of *T. arctica* and its known appearance in the older Bad Heart Formation of the region, it is highly probable that both Milk River specimens belong to that species. This assumes that *Trochodendroides potomacensis* itself is not conspecific with *T. arctica,* an assumption based mainly on present lack of any typical large leaves of *T. arctica* or of its inferred fruits, *Jenkinsella arctica* (Heer), in beds of Albian or Cenomanian age.

Occurrence. Bad Heart Formation, British Columbia, locality 5188; Milk River Formation, Alberta, locality 3934.

Types. Hypotypes, GSC Nos. 1085, 1259, 1260, 1261, 1262, 1263.

Trochodendroides (Cercidiphyllum?) potomacensis (Ward)

Plate XIX, figure 5

Trochodendroides (Cercidiphyllum?) potomacensis (Ward) Bell, Geol. Surv., Canada, Mem. 285, p. 127, Pl. 71, fig. 2; Pl. 74, figs. 2, 3 (1957).

Remarks. Two specimens from beds of Albian age in Alberta and the Kingsvale Formation in British Columbia, and one from the Dunvegan Formation were illustrated in the above reference. The largest leaves occurring in collections from the Dunvegan Formation are about circular in outline with diameter of 5 cm; their margins except for short distances where the base is cordate are marked by closely spaced, subequal crenulae. Specimen GSC No. 1224 (Pl. XIX, fig. 5) is the smallest leaf from the Dunvegan; unlike the transversely suboval, small specimen from the Kingsvale Group, it is elongate-elliptical, about 2 cm long by 1.3 cm wide, and is illustrated here enlarged to show the characteristic *Trochodendroides* venation. Orbicular to elliptical variation in outline occurs also among the larger leaves.

Occurrence. Dunvegan Formation, British Columbia; localities 3784, 4195.

Types. Hypotypes, GSC Nos. 1085, 1224.

Trochodendroides dorfi n. sp.

Description. Leaf, variable, but prevailingly ovate-triangular, with broadly obtuse or more or less truncated base and acute, commonly slightly extended apex; margin serrate to crenate-dentate. Venation similar to that of *Trochodendroides arctica* (Heer), but veins all or predominantly craspedodromous.

Types. Holotype, No. 1337, U.C. Mus. Palaeobot. (Dorf, 1938, Pl. 11, fig. 1); paratypes, Nos. 1336, 1338, 1339 (ibid, Pl. 11, figs. 4, 6, 7).

Trochodendroides dorfi? n. sp.

Plate XXI, figure 2

Remarks. A single fragment of a leaf from the Milk River equivalent of Eagle sandstone is seemingly conspecific with the above-mentioned species, differing mainly in the suprabasal position of the inner pair of lateral primaries.

Occurrence. Eagle sandstone equivalent of the Milk River Formation, Montana; GSC locality 1621.

Types. Hypotype, GSC No. 5050.

Menispermites reniformis Dawson

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

Menispermites reniformis Bell, Geol. Surv., Canada, Mem. 285, p. 128, Pl. 77, fig. 4; Pl. 78, fig. 1 (1956).

Remarks. The type of this species was refigured by Bell, 1956 (Pl. 77, fig. 4 of above reference). It is very rare in recent collections from the Dunvegan Formation and is represented only by several fragments.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 290 (type specimen), 3664.

Types. Holotype, GSC No. 5134.

Menispermites sp. (Knowlton) n. comb.

Plate XX, figure 4

Remarks. A single specimen, although fragmentary, has a cordate base and venation comparable with one of the two specimens of *Pterospermites* sp. from the Kirtland Formation of New Mexico figured by Knowlton (1916, p. 341, Pl. 90, fig. 1). The petiole is thick and six strong principal veins radiate from it, the mid-vein being the largest. The species resembles likewise some forms of *Menispermites,* e.g., a specimen assigned by Dorf (1942, p. 143, Pl. 10, fig. 11) to *M. knightii* Knowlton (1900, Pl. 15, fig. 2).

Occurrence. Eagle sandstone equivalent of Milk River Formation, Montana; GSC locality 1622.

Types. GSC No. 1220.

Menispermites sp.

Plate XX, figure 3

Remarks. The specimens, which show only a basal part of the leaf, are much too fragmentary for any other purpose than to note the occurrence of another species of the genus in the Milk River Formation. Four more or less flexuous lateral primary veins are underlain by a pair of thinner basilar veins directed downwards, one in each lobe of an asymmetrical cordate base of the leaf. A petiole, the upper part of which is shown in a second unfigured specimen, is stout, nearly 2 mm thick.

Occurrence. Milk River Formation, Alberta; GSC localities 844, 845.

Types. GSC No. 1255; hypotype, GSC No. 1256.

Populites wickendeni n. sp.

Plate XX, figure 2; Plate XXI, figure 3

Description. Leaf, slightly inequilateral, suborbicular, with broadly rounded summit, and base truncated to a cuneate union with petiole. Venation, craspedodromous, pinnate, obscurely subpalmate; midvein, moderately thick in lower half, thinning rapidly above, nearly straight; four or five alternate, nearly straight, pairs of secondaries leave midvein at angles 30 to 50 degrees, more or less branched on abaxial side; the lowest underlain by two opposite or subopposite pairs of more spreading secondaries, inserted about 60 degrees to midvein, that run about parallel with the basal margins; the upper of these on one side of the leaf has several abaxial branches. Few tertiaries are preserved; those seen are transverse to the secondaries, simple and percurrent or once divided.

Remarks. The generic assignment of this leaf is based mainly on its resemblance to some forms of the comprehensive genus *Populites,* particularly to *Populites litigiosus* (Heer) Lesquereux from the Dakota Group (Capellini and Heer, 1867, p. 13, Pl. 1, fig. 2; Lesquereux, 1892, p. 46, Pl. 7, fig. 7; Pl. 8, fig. 5; Pl. 46, fig. 6; Pl. 47, fig. 1), but it may also be compared with some forms assigned to *Protophyllum,* e.g., *Protophyllum crednerioides* Lesquereux (1883, p. 90, Pl. 2, figs. 1-3).

The species was named after its collector, R. T. D. Wickenden, of the Geological Survey of Canada.

Occurrence. Milk River Formation (upper part), Alberta; GSC locality 3934.

Types. Holotype, GSC No. 1247; paratype, GSC No. 1248.

Magnolia magnifica Dawson

Plate XX, figure 1; Plate XXI, figure 5; Plate XXII, figure 3

Magnolia magnifica Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 22, Pl. 3, fig. 11 (1883); Bell, W.A., Geol. Surv., Canada, Mem. 285, Pl. 79, fig. 1 (1956).
Ficus maxima Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21, Pl. 2, fig. 5.
Ficus dawsoni Knowlton and Cockerell, U.S. Geol. Surv., Bull. 696, p. 275.

Description. Leaf, large, oblong-elliptical-lanceolate, 20 cm or more long by 6 to 8 cm broad, contracted to cuneate base, which is decurrent on thick petiole. Nervation, camptodromous; midvein, thick (3.5 mm broad), secondaries, strong, numerous, unevenly spaced, in lower part of leaf decurrent to midrib, subparallel for most part, leaving midrib at angles commonly 50 to 60 degrees, nearly straight or distally more or less abruptly curved or bifurcate, united inside margin by simple looping or bifurcation; an intercalary secondary nearly as strong as the others occurs commonly in the space between adjacent secondaries, and may extend halfway to the margin. Tertiaries, commonly well preserved and strong, mixed simple percurrent and once divided, nearly straight to strongly flexed, some at right angles, others oblique to secondaries; where oblique in distal parts of secondaries they may appear as short branches of the latter. Transverse nervilles between the tertiaries result in a network of mainly quadrangular areoles; tertiaries transverse to the loops in marginal area commonly lie in a single series, looping together very close to the leaf margin.

Dawson's figure of *Magnolia magnifica* much over emphasized the thickness of the secondaries in the type specimen, which is refigured on Plate XXI, figure 5 of this report.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 290.

Types. Holotype, GSC No. 5133; hypotypes, GSC Nos. 5128 (*Ficus maxima* Dawson), 5133a.

Magnolia boulayana Lesquereux

Plate XXII, figure 2; Plate XXIII, figure 3

Remarks. All the leaves included here lack the apical region. They are entire, coriaceous, oblong-subelliptical, with sides parallel or nearly so, curving somewhat abruptly to a cuneate attachment on a petiole of moderate thickness. The midvein is straight or slightly curved, and the blade may be clearly inequilateral to it. Only some of the lateral veins are preserved; where seen, they are rather evenly spaced, numerous, attached at angles of about 40 degrees, running nearly straight to a rather abrupt curvature to a position near to, and subparallel with the margin. No loops or other tertiary veins are preserved. In outline the leaves are most comparable with that of a specimen figured by A. Hollick (1906, Pl. 20, fig. 6) as *Magnolia glaucoides,* which has been considered conspecific with *Magnolia boulayana* Lesquereux.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 4195, 4197, 5144.

Types. Hypotypes, GSC Nos. 1063, 1065.

Magnolia lacoeana Lesquereux

Plate XXII, figure 1

Remarks. This species is represented by several fragments that show the characteristic suborbicular form and spreading secondaries, a few of which bifurcate distally and loop together not far from the margin. One specimen has a few tertiaries preserved, which are percurrent, simple or more rarely once divided, and nearly at right angles to the secondaries.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3664.

Types. Hypotype, GSC No. 1234.

Magnolia? *coalvillensis* Knowlton

Plate XXI, figure 1; Plate XXIII, figure 2

Description. Leaf, ovate, well rounded at base to low, cuneate junction with petiole. Venation, camptodromous. Midrib, moderately stout, straight or slightly curved. Secondaries, mostly alternate, eight to ten pair, originating at angle of about 55 degrees, curving gently upward to a more abrupt course paralleling the margin before uniting with the secondary above. Very few tertiary veins are preserved and those observed are oblique to the secondaries.

Remarks. Specimen GSC No. 5063 (Pl. XXIII, fig. 2) agrees very well in dimensions and other characters with the type specimens (Knowlton, 1900, p. 55, Pl. 14, fig. 1) that was first assigned to *Magnolia tenuinervis* Lesquereux and subsequently named *Magnolia*? *coalvillensis* (Knowlton, 1917a, p. 312, footnote 3). Specimen GSC No. 5064 (Pl. XXI, fig. 1) is a smaller leaf with similar diagnostic characters.

Occurrence. Milk River Formation (upper part), Alberta; GSC localities 845, 1622.

Types. Hypotypes, GSC Nos. 5063, 5064.

Magnolia rhamnoides n. sp.

Plate XXIII, figures 1, 4; Plate XXIV, figures 1-4

Description. Leaf, petiolate, entire, subelliptical, contracted to cuneate or slightly auriculate base and more gradually to a narrowly rounded, or bluntly acute apex. Nervation, pinnate. Midrib, moderately broad, straight or commonly curved to an apex turned to one side. Laterals, about twelve pair, alternate, the basal two or three subopposite and attached to midvein at more acute angles than the remainder, which are spreading, attached at angles of 50 to 80 degrees, and rather irregular in degree of curvature and spacing; distally they curve abruptly to a course nearly parallel with the margin to union with the secondary above or with a short branch of the latter formed by distal bifurcation. Tertiaries, not many of which are generally preserved due to the coriaceous nature of the leaf, lie at very open angles, more rarely at right angles, to the secondaries, simple and percurrent or more rarely once divided.

Remarks. A common curvature of the leaf, and lateral veins which unite after curving upward subparallel with the margin, are characters like those of *Rhamnites eminens* (Dawson) (Bell, 1957, p. 62, Pls. 44, 46-50, 56), although the more irregular disposition of these veins is more *Magnolia*-like.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 287, 3201, 3292, 4193, 4194, 4196.

Types. Holotype, GSC No. 1067; paratypes, GSC Nos. 1059, 1060, 1064, 1233, 5397.

Magnolia sp. cf. *M. rotundifolia* Newberry

Plate XXVII, figure 4

Description. Leaf, subelliptical, contracted to a rounded, nearly right-angled summit, and apparently about equally contracted to base, although the latter is missing in the single specimen to hand. Margin, entire. Venation, pinnate, camptodromous. Midvein, straight, moderately strong (1.5 mm wide near base). Secondaries, relatively thin, six or seven alternate pair, irregularly spaced; upper ones much more strongly curved than lower, making angles of 50 to 60 degrees to midrib, distally united by tertiary branches in a festoon. At least one, and probably two pair of thinner basilar veins, lie below the secondaries, making more open angles to midrib than the secondaries above and becoming more or less horizontal. A few tertiaries, simple, and percurrent, or once divided, gently curved or strongly flexed, making open angles to a right angle with secondaries, are preserved.

Remarks. In the comparatively delicate, irregularly spaced secondaries, and pattern of venation the form resembles *Magnolia rotundifolia* Newberry (1898, p. 95, Pl.

59, fig. 1) from the Paleocene(?) beds of Colorado. The secondaries of the Dunvegan form are, however, more spreading.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3780.

Types. GSC No. 1236.

Magnolia hollicki Berry

Plate XXV, figure 1

Description. (Of specimen lacking upper part.) Leaf, ovate, markedly cordate, with sides of sinus well rounded to lateral margin. Venation, pinnate, camptodromous, probably seven or eight alternate secondaries in complete leaf, leaving midvein at about 50 degrees, curving gently upwards to loop together near margin; lowest laterals, subopposite, with tertiary looped branches forming a festoon on abaxial side. A few curved percurrent tertiary veins preserved, but mostly they are minutely flexuous and irregularly disposed, forming with nervilles an irregular fine network of quadrangular and polygonal areoles.

Remarks. The best preserved fragment on which the above description was based is about the size of a specimen from the Magothy Formation of Maryland figured by E. W. Berry (1916, Pl. 69, fig. 3). That specimen also has five secondaries preserved, which leave midrib at about 50 degrees and loop inside margin in the same manner as the Dunvegan specimen here under discussion.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3780, 4195.

Types. Hypotype, GSC No. 1068.

Liriodendron giganteum Lesquereux pars

Plate XXV, figure 3; Plate XXVI, figure 5

Liriodendron praetulipiferum Dawson, Roy. Soc. Can., Trans. 1893, vol. 11, sec. 4, p. 63, Pl. 8, fig. 27 (1894).
Liriodendron giganteum Bell, Geol. Surv., Canada, Mem. 293, p. 47, Pl. 32, fig. 3 (1957).

Remarks. The Dunvegan specimen GSC No. 1185 (Pl. XXV, fig. 3) agrees perfectly with type of *L. praetulipiferum* Dawson from the Nanaimo Group, except that the lateral sinuses of the leaf blades penetrate relatively deeper towards the midrib. Both specimens have lobes truncated by a flat arc, and in this respect, as well as in the narrower apical sinus, they depart from types of Lesquereux, and may be designated forma *subrectangulare.* Specimen GSC No. 1184 (Pl. XXVI, fig. 5) exhibits the same form of leaf as that which may be inferred by reconstruction of the first type figured by Lesquereux (1874, Pl. 22, fig. 2) as well as with two of his subsequently figured types (Lesquereux, 1892, Pl. 26, fig. 5; Pl. 27, fig. 1). All these leaves have a broad base, where this is preserved, almost at right angles to the midrib, the blade being slightly decurrent or cuneate on the petiole.

The writer, therefore, would be inclined to combine another specimen illustrated by Lesquereux (op. cit., Pl. 25, fig. 1) with *Liriodendron meekii* Heer.

K. K. Shaparenko (1937, p. 167) considered *L. praetulipiferum* to be a synonym of *L. meekii* Heer, a combination, except for the single specimen of Lesquereux noted above, that has little to support it. The same author combined *L. giganteum* with the Tertiary species *L. procaccinii* Unger, a procedure that the writer, because of tangible differences, considers a retrograde step in stratigraphic practice. The basal margin of the leaf blade and the basal pair of lateral lobes in *L. procaccinii* are indeed similar to those of *L. praetulipiferum* (= *L. giganteum* forma *subrectangulare*), but the outline of the blade of the former in its totality is transversely, not dorsoventrally suboblong, the terminal lobes are relatively smaller than the basal ones and much less differentiated by segmentation, and the lobes are commonly more pointed.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3353, 3623, 3664.

Types. Hypotypes, GSC Nos. 1184, 1185.

Laurophyllum flexuosum (Newberry) n. comb.

Plate XXV, figures 2, 4

Proteoides longus Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 22, Pl. 2, fig. 8 (1883).

Description. Leaf, petiolate, elongate-lanceolate, tapering from middle region acuminately to apex and decurrent-cuneate to base, up to 13 cm long and 1.7 cm wide; margin, entire. Venation, camptodromous. Midrib moderately strong, commonly slightly curved; secondaries, moderately well spaced, thin, commonly poorly preserved, if at all, leaving midvein at 35 to 45 degrees, ascending with slight upward curvature to position very close to margin, where they probably unite; tertiaries, very rarely preserved; where seen they are oblique to secondaries and by anastomoses form a network of irregular-shaped areoles.

Remarks. The tertiary venation where preserved closely resembles that of a specimen of *Laurophyllum plutonium* (Heer) figured by A. C. Seward (1927, p. 121, text-fig. 27) as well as that of one of Heer's types of *Laurus plutonia* (1882, Pl. 20, fig. 6). It lacks a pattern of percurrent, transverse, tertiary veins exemplified in leaves assigned to *Salix lesquereuxi* Berry, a species which, when the venation is not preserved or obscure, may commonly be separated from *Laurophyllum flexuosum* by its more ovate-acuminate outline, the greatest breadth of the leaves lying more definitely below the midlength. On account of the close similarities in nerve pattern the writer considers *Laurus plutonia* Heer (1882, p. 73, Pl. 19, figs. 1d, 2, 3, 4; Pl. 20, figs. 3a, 4, 5(?), 6; Pl. 24, fig. 6b; Pl. 28, figs. 10, 11) conspecific with, or at least macroscopically inseparable from, *Salix flexuosa* Newberry (1878, Pl. 1, fig. 4; 1898, Pl. 2, fig. 4; Pl. 13, figs. 3, 4; Pl. 14, fig. 1). The specimen of *Laurus plutonia* Heer illustrated on Plate 20, figure 5 has an outline more characteristic of *Salix lesquereuxi,* although its secondary veins are less spreading than those of the latter, as in Seward's specimen of *Laurophyllum plutonium.* Seward united *Proteoides longus* Heer to *Laurophyllum plutonium* (Heer), but the secondary venation of one of Heer's original types (1875, Pl. 31, fig. 4) of the former species has more spreading secondary veins than those of *L. plutonium,* and this character is shown also in a specimen of *Myrica longa* Heer (1882, Pl. 18, fig. 9b), Heer's new combination for his *Proteoides longus.* Possibly, *Myrica longa* Heer includes more than one species, one of which may be referable to *Salix lesquereuxi.*

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3213, 4191, 4192, 4193, 4194, 4195, 4205 (290), 5182, 5656.

Types. Hypotypes, GSC Nos. 5396 (*Proteoides longus* Dawson), 1072.

Laurophyllum sp.

Plate XXVI, figures 1-4

Description. Leaf, petiolate, with petiole at least 1.5 cm long, entire margined, elongate ovate-lanceolate, contracting gently from greatest width of 3 to 3.5 cm (seemingly about midlength) to an acute apex and more rapidly to a cuneate base. Total length probably 10 cm or more. Venation, camptodromous. Midrib, moderately broad to delicate, nearly straight; secondaries, fairly numerous, alternate to subopposite, leaving midrib at angles of about 45 degrees, gently curving upwards to near margin, and uniting by a few tertiary branches in a simple festoon. Tertiaries, openly oblique or nearly at right-angles to secondaries, simple and percurrent, or a lesser number divided, sparingly preserved.

Remarks. The species is represented only by a few fragments, and, although these are of fair size, it would be futile, considering lack of preservation of finer nervation, to attempt reliable identification with previously described species, the more so because similarly shaped leaves with comparable venation have been variously assigned to *Laurus, Laurophyllum, Ficus, Rhamnus, Diospyros, Daphnophyllum,* etc.

Occurrence. Milk River Formation (upper part), Alberta; GSC localities 1271, 1282, 3934.

Types. GSC Nos. 1289, 5056, 5057, 5058.

Cinnamomum heeri Lesquereux

Plate XXVII, figure 1 (pars)

Remarks. An incomplete leaf, although lacking most of the margin, was evidently ovate with greatest width below the middle, and had a tapering apex and broadly rounded base, similar to the specimen from the Dakota Group of Kansas figured by Lesquereux (1891, best description Lesquereux 1883, p. 54, Pl. 15, fig. 1), but unlike specimens from the younger Puget Group figured by Newberry (1898, Pl. 17, figs. 1-3).

The venation, too, of the Dunvegan specimen is comparable to that of Lesquereux's specimen, comprising suprabasal primary laterals that curve inwards and ascend into apical region; the first pair of secondaries are remote from the lateral primaries, curve inwards and ascend parallel with the midvein; a basal part of a higher secondary lying distally above the first pair, and traces of simply looped outside branches of the lateral primaries occur precisely as in the Dakota leaf.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 5250.

Types. Hypotype, GSC No. 1286.

Platanus williamsi n. sp.

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

Description. Leaf, large, suborbicular to semiorbicular-cuneate, with greatest width above middle, commonly somewhat dissymmetric, non-lobate or slightly lobed owing to extensions at ends of main secondaries. Margin, prominently serrate; teeth, broadly based, relatively large, those at the ends of secondaries larger than the rest, the teeth beginning mostly at the same distance from petiolar base. Venation, trinerved-pinnate, craspedodromous; primary laterals, opposite or subopposite, strong, inserted 30 to 40 degrees to midrib, nearly straight or slightly flexuous, giving off up to seven or eight, rather unevenly spaced branches from the abaxial side, mostly inserted at rather open angles; upper ones curved upwards; lowest branches camptodromous, paralleling the untoothed basal margin. Remaining secondaries, opposite to alternate, about five pair, mostly curved upwards, particularly the upper ones which ascend to a position subparallel with midvein; lower secondaries have a branch or two on the abaxial side. Tertiary veins, percurrent or united by bifurcation, nearly straight or slightly curved, at right angles or nearly so to secondaries and their branches.

Remarks. The species is named after M. Y. Williams who contributed much to our knowledge of the Dunvegan Formation. It is apparently closest to *Platanus asperaeformis* Berry (1919, p. 83, Pl. 16, fig. 1) from the Tuscaloosa Formation of Alabama. The teeth are more regularly serrate, lacking the aquiline shape stressed by Berry; as in Berry's species, however, those at the ends of the secondaries are larger (*see* Pl. XXX, fig. 2, of this report); extensions of the margin at the ends of lateral primaries in *P. asperaeformis* result in a trilobed appearance, whereas, in *P. williamsi* less conspicuous extensions may occur as well in other secondaries, or the terminations of all the main veins may be marked only by broader and longer teeth. *P. williamsoni* may also be compared with a specimen described by Lesquereux (1892, p. 73, Pl. 9, fig. 3) as *Platanus primaeva* var. *sub-*

integrifolia in which, however, the lateral veins are given off at more open angles, and the upper secondaries are more nearly parallel with the others and not so strongly ascending.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3780, 4193, 4196, 4197.

Types. Holotype, GSC No. 1098; paratypes, GSC Nos. 1204, 1207, 1393.

Platanus newberryana Heer

Plate XXVIII, figures 1, 2; Plate XXXIII, figure 2

Remarks. The species is represented only by fragments, several of which show a trilobed upper part and a cuneate to truncate-cuneate base, the leaf blade being decurrent on the upper part of petiole. The main character of the species is the acute angles made by the secondaries on the midrib (30 to 40 degrees) and by the branches of the secondaries (generally around 30 degrees to parent), which imparts to the venation a *Viburnum*-like appearance. Marginal teeth, triangular and sharply pointed, begin at a distance from the petiolar base, the narrow area with entire border being supplied by one or two camptodromous veinlets. The primary laterals have about seven pair of branches on the abaxial side and commonly one or two distal ones on the adaxial side, all nearly straight or slightly curved to their termination in the teeth; the lower branches, terminating in teeth, may have several branches, likewise given off at acute angles. The tertiary veins are at right angles or nearly so to the secondaries and their branches and are simple and percurrent or once-branched; the nervilles, where preserved, form an open quadrangular network.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3200, 3206, 3592, 4194, 4195, 4197.

Types. Hypotypes, GSC Nos. 1101, 1202, 1203.

Platanus latiloba Newberry

Plate XXXI, figure 2

Remarks. GSC No. 1245 (Pl. XXXI, fig. 2) is about as wide as long; insertion of blade on petiole is lacking, but other specimens show a slight decurrence. The margin is undulating-crenate, venation pinnate-palmate, craspedodromous. The primary laterals, inclined 40 to 70 degrees to midrib are subopposite, slightly curved upwards, with six or seven branches on abaxial, and two to four on adaxial side. The secondaries on the whole are rather distant, four or five alternate or subopposite pair, commonly slightly curved upwards. Tertiaries are mainly percurrent, straight or flexed, at right angles or nearly so to secondaries and their branches. The best specimen is that figured, which is closely comparable in form and venation to the type of Newberry (1878, Pl. 2, fig. 4; 1898, Pl. 1, fig. 4).

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3624, 3664, 5514.

Types. Hypotype, GSC No. 1245.

Platanus affinis Lesquereux

Plate XXXII, figure 1

Platanus primaeva? Dawson (non Lesquereux), Roy. Soc. Can., Trans. 1893, vol. 11, sec. 4, p. 59, Pl. 8, fig. 29 (1894).

Platanus affinis Lesquereux 1873 (non *Cissites* Lesquereux 1876), Bell, Geol. Surv., Canada, Mem. 293, p. 52, Pl. 37, fig. 5; Pl. 39, figs. 1, 4, 5; Pl. 42, fig. 6 (1957).

Remarks. Specimen GSC No. 1091 (Pl. XXXII, fig. 1) is in all essential characters comparable to a specimen from the younger Comox Formation of Vancouver Island (Bell, Pl. 39, fig. 4 of above reference).

Occurrence. Dunvegan Formation, British Columbia; GSC localities 4196, 4197, 5514.

Types. Hypotype, GSC No. 1091.

Credneria macrophylla Heer

Plate XXXI, figure 1

Description. Leaf, large, orbicular, 18 or 19 cm long, by 17.5 cm wide in its midsection. Margin, entire, rounded-truncate at base; apex is missing. Nervation, pinnate, camptodromous. Midvein, thick, straight. Basal pair of secondaries, opposite, suprabasal, simulating primary laterals, about 45 degrees to midrib, only slightly flexuous, each giving off from abaxial side in its distal half at least one strong branch, which distally is linked to its parent by wide inner loops and smaller outward loops nearer the margins. Remaining secondaries, four or five alternating, strong pairs, inserted 45 to 55 degrees to midrib, the upper secondaries being at more open angles than the lower and more strongly curved upwards. A pair of thin basilar veins lie below the primary laterals, attached to midrib at angles 45 to 50 degrees, but curving downwards a short distance beyond to a subhorizontal position. Tertiary veins between the secondaries, mostly curved or bent, some simple and percurrent, others once divided, producing an open network.

Remarks. The figured leaf (Pl. XXXI, fig. 1) corresponds fairly closely with Heer's type (Heer 1869, p. 16, Pl. 4), except that the midrib is less robust, and less distance separates the lowest pair of secondaries from those next above. In both respects the specimen agrees with *Ficus alabamensis* Berry (1919, p. 82, Pl. 14, fig. 5) from the Tuscaloosa Formation, which the writer regards as synonymous with *Credneria macrophylla* Heer, and with a specimen assigned to Heer's species illustrated by A. Hollick (1912, p. 168, Pl. 170, fig. 4).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4193.

Types. Hypotype, GSC No. 1078.

Credneria truncatodenticulata n. sp.

Plate XXIX, figure 1

Description. Leaf, truncate-subovate, somewhat dissymmetric; base, subcordate; apex, truncate nearly at right angle to midvein; margin serrate for three-fifths length from summit. Venation, trinerved-pinnate; primary laterals, suprabasal, inserted 30 to 35 degrees to midvein, nearly straight or curved, provided with six or seven branches on abaxial side, which are inserted at about 50 degrees, upper ones ending in teeth; lower ones, camptodromous. Succeeding secondaries, about four pair, alternate, lowest pair subparallel with primary ones, upper ones at more open angles and strongly curved upwards, terminating in teeth; lower ones may have a branch on abaxial side. Basal veinlets below primary laterals, two or three pair, nearly at right angles to midrib. Tertiary veins percurrent, simple or once divided.

Remarks. The species is very close to *Credneria denticulata* Zenker (1833, p. 18, Pl. 2, fig. E; Stiehler, 1958, Pl. 9, fig. 6) from Quedlinburg beds of Saxony, differing mainly in the broad truncated apex. Remaining differences fall within the range of expected variation; in the Dunvegan species for example, the primary laterals and succeeding pair of secondaries, lacking the strongly upward curve of those of *C. denticulata,* impart to the venation a more spreading appearance; moreover, more of the margin is toothed.

C. truncatodenticulata is apparently very close also to *C. inordinata* Hollick (1930, p. 86, fig. 3; Pl. 57, figs. 2, 3) from the Melozoi Formation, differing from the latter in the same characters by which it differs from *C. denticulata,* e.g., in the less ascending lower secondaries; unlike Hollick's species it is not broadly truncate at the base, and is not toothed as far down the margin, but both species agree in being dissymmetric.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 5703.

Types. Holotype, GSC No. 1213; paratype, GSC No. 1207.

Ampelophyllites attenuatus (Lesquereux) Knowlton

Plate XXXII, figure 5; Plate XXXIII, figure 3

Original description. "Leaf broadly obovate, enlarged upward from the cuneate base, rounded at the top, entire, subcoriaceous; lateral primary nerve from a distance above the base, flexuous, branching outside and inside, ascending to the borders." (Lesquereux, 1876, p. 354.)

Remarks. Lesquereux qualified the above description in further comments by stating that the margin was "undulate by the slight protuberance of the veins". The specimens from the Dunvegan Formation, although twice as large, are similarly proportioned, with cuneate base, rounded summit, and venation of same general pattern, the primary laterals being dissymmetric. A very similar leaf, and perhaps conspecific, is *Credneria longifolia* (Hollick, 1930, p. 87, Pl. 60) from the Melozoi Formation.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 4196, 4202.

Types. Hypotypes, GSC Nos. 1093, 1097.

Protophyllum multinerve? Lesquereux

Plate XXVII, figure 2

Protophyllum rugosum Dawson (non Lesquereux), Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 23 (1883).

Remarks. A single specimen of a leaf from the Dunvegan Formation, lacks the apical region. It resembles rather closely in essential characters a specimen that J. S. Newberry (1898, p. 132, Pl. 7, fig. 4) allocated to *Protophyllum multinervis* Lesquereux (1874, p. 105, Pl. 18, fig. 1). Newberry's specimen differs from the holotype in possessing fewer basal veins below the insertion of the petiole, but this is a character of the genus that is of doubtful specific importance. Lesquereux defined the margins of his original types as slightly undulate; his figure indicates that the veins are practically craspedodromous, either reaching the margin or camptodromous extremely close to it; this feature applies as well to the Dunvegan specimen under consideration; although its margin is evidently entire, it may be infolded in part, and the veins are distally not well preserved. In disposition the venation conforms with both Lesquereux's and Newberry's types in that the upper secondaries, oblique and parallel, are discordant with the lower, which diverge from one another and are progressively more spreading, the lowermost pair being at a right angle or nearly so to the midrib near its insertion to the blade, and slightly curved downwards. The basal veins below the petiolar insertion comprise two downwardly directed pair as in Newberry's specimen.

Subsequently, Lesquereux (1892, p. 191, Pl. 48, fig. 2; Pl. 65, fig. 1) described and figured two additional examples of his species, one apparently having a coarsely dentate margin, the other entire except for minute denticulations at termini of the veins. In both the venation is definitely craspedodromous.

The Dunvegan specimen is considerably smaller than any of the above mentioned types, and unquestionable reference to the latter must await further material to provide information on the range of variation, particularly in size and marginal characters.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4205.

Types. Hypotype?, GSC No. 5135.

Pseudoprotophyllum boreale (Dawson) Hollick

Plate XXXIV, figure 3; Plate XXXV, figures 1, 4; Plate XXXVII, figure 3; Plate XXXIX, figures 3, 4

Protophyllum boreale Dawson, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 23, Pl. 41, fig. 13 (1883).
Protophyllum leconteanum? Dawson (non Lesquereux) op. cit., p. 23 (1883).

Description. Leaf, medium to large (up to 15 cm or more long), basally peltate. Margin, irregular dentate, (? rarely entire), the teeth triangular with broad bases. Venation, pinnate-palmate, craspedodromous, the lowest pair of secondaries, generally opposite or subopposite, simulating lateral primaries. Midvein, strong, much broader below the primary laterals, the latter forming angles of 30 to 50 degrees to midvein; they give off, commonly at uneven intervals, five or six simple or sparingly branched branches from abaxial side; remaining secondaries or laterals follow at variable distance from, and parallel with primary ones, the space between adjacent pairs fairly regular; distally they may give off from the abaxial side one or two branches that enter marginal teeth. Up to eight or more, rarely twelve, basal veins are given off from midrib below the primary laterals, the upper one or two on either side more or less horizontal, the remainder radially disposed; they may branch once or twice before reaching margin. Tertiaries, well marked, commonly outstanding, mainly percurrent, normal to secondaries and their branches; nervilles, also commonly well marked, flexuous, anastomosing, forming commonly quadrangular areoles.

Remarks. The leaves show variation in size (up to 15 cm or more long), toothing, spacing between primary laterals and secondaries above, disposition and branching of basal veins, distance of top of petiole from basal margin, etc. Generally the tertiary and commonly the nervilles are strongly impressed upon the rock matrix, but the degree to which they are preserved apparently depends upon accidents of preservation. The extent of variation in the characters noted above might lead to much overspeciation. A. Hollick (1930, p. 94, Pl. 63, fig. 1; Pl. 70, figs. 1, 2; Pl. 71, fig. 2; Pl. 73, fig. 2) stated that his *Pseudoprotophyllum comparabile*, from Melozoi and Kaltag Formations was probably conspecific with *P. boreale* (Dawson), and the writer would not hestitate in combining these two. In addition he would combine with *P. boreale, P. magnum* Hollick (1930, p. 95, Pl. 69, figs. 1, 2; Pl. 70, fig. 3; Pl. 72, figs. 1, 2; Pl. 73, fig. 4a), *P. venustum* Hollick (1930, p. 62, figs. 3, 4; Pl. 73, fig. 1) and probably also *P. dentatum* Hollick (1930, Pl. 65, figs. 1, 2; Pl. 66, figs. 2, 3; Pl. 67; Pl. 73, fig. 3).

Occurrence. Dunvegan Formation, British Columbia; GSC localities 287, 290 (4205), 3382, 3492, 3780, 5190.

Types. Holotype, GSC No. 5398; hypotypes, GSC Nos. 1190, 1192, 1193, 1196, 1212, 5389.

Aspidiophyllum dentatum? Lesquereux

Plate XL, figure 4

Remarks. The single specimen is too fragmentary for certain identification with *A. dentatum* Lesquereux (1892, p. 212, Pl. 39, fig. 1), mainly because it is not known whether the leaf was trilobed. The basilar shield is similarly lobed, and has a pair of nearly horizontal strong veinlets and four downwardly directed branched ones. The basal secondaries or primary laterals are inserted about 35 degrees to midrib and give off branches at angles of about 40 degrees from their abaxial side, of which the lower at least are brachiodromous; the lowermost branch has several camptodromous branches on its abaxial side, the next succeeding branch has eight brachiodromous branches in addition to two distal ones that enter low marginal cunae. Nervilles form a conspicuous network, made up largely of quadrangular areolae.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4198.

Types. Hypotype?, GSC No. 1094.

Pseudoaspidiophyllum latifolium Hollick

Plate XXXVI, figure 4; Plate XXXVIII, figures 1, 2

Original description. "Leaves palmately trilobed with a broad, truncate, peltate (?) base, about 14 centimetres in length by about 18 centimetres in width between the extremities of the lateral lobes; middle lobe large, broadly wedge shaped; lateral lobes relatively small, triangular, tapering to the blunt apices; margin triangular-dentate; teeth blunt; nervation craspedodrome; secondary nerves opposite below, becoming alternate above, sub-parallel, leaving the midrib at approximately equal angles of about 45°, curving slightly upward; lateral primaries supra-basilar, leaving the midrib at obtuse angles of divergence, widely spreading, branched on the under sides and on the upper sides toward the extremities; basilar veinlets conspicuous at right angles to the sides of the midrib." (Hollick, 1930, p. 96.)

Remarks. The above description of the types adequately describes specimens from the Dunvegan Formation. Unfortunately, no specimen shows the base of the blade below the union of the primary laterals, although GSC No. 1200 (Pl. XXXVI, fig. 4) suggests a peltate base. The primary laterals (or lateral primaries) are inserted at angles a little greater than the succeeding secondaries, 45 to 50 degrees as compared to 30 to 35 degrees. The tertiary veins are outstanding, simple or once divided.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3217, 3780. 4197, 5249.

Types. Hypotypes, GSC Nos. 1104, 1200, 1201.

Cassia alaskana Hollick

Plate XXXIII, figures 4, 5

Description. Leaflet or leaf, subovate, 5.7 cm long by 3.3 cm wide in specimen figured (Pl. XXXIII, fig. 5), inequilateral, broadest about midlength, contracting to bluntly pointed or narrowly rounded apex and to an asymmetrically cuneate base; margin, entire; petiole, short (about 4 mm). Venation, camptodromous. Midvein, relatively broad in lower half, rapidly thinning to apex, which may be curved to one side. Secondaries, about eight or nine pair, alternate, leaving midvein at angles 50 to 60 degrees, curved upwards, looping near margin. Tertiary veins mostly simple, nearly straight and percurrent, more rarely once divided, nearly at right angles to secondaries.

Remarks. The leaves, although proportionally less elongate than the types (Hollick, 1930, p. 98, Pl. 74, figs. 2, 3), are otherwise comparable to them. They resemble in some respects, particularly in venation, certain leaves of *Diospyros lesquereuxi* Knowlton and Cockerell (Lesquereux, 1892, p. 112, Pl. 17, figs. 8-11) from the Dakota Formation, but are apparently leaflets of a compound leaf. Compared with that species the leaves are marked by their dissymmetry, especially of the cuneate base, where one side tends to be decurrent on the short petiole.

Occurrence. Milk River Formation (upper part), Alberta; GSC locality 844, 1271.

Types. Hypotypes, GSC Nos. 1258, 5061.

Hymenaea fayettensis Berry

Plate XXXII, figure 2

Diospyros nitida Dawson, Roy. Soc. Can., Trans. 1882-83, sec. 4, Pl. 3, fig. 10 (1883).

Description. E. W. Berry described the foliage of this species as follows: "Leaves with a short stout petiole, compound; consisting of two ovate-lanceolate, entire margined leaflets. Leaflets sessile with a markedly inequilateral cuneate or slightly decurrent base but not noticeably inequilateral above the base; 6.5 to 8 centimetres in length, by 2 to 3 centimetres in maximum width, which is the lower half of the leaflets, tips extended, acuminate. Midribs, stout below, becoming thin above. Secondaries thin, camptodrome, numerous, seven or eight subopposite to alternate pairs in each leaflet; they branch from midrib at angles ranging from 30 to 50 degrees and curve upward, the lower being quite ascending and the angle of divergence becoming progressively greater toward the apex of the leaflets. Tertiaries, numerous, very fine, transverse. Texture less coriaceous than in most of the recent species." (Berry, 1919, p. 97, Pl. 23, fig. 2.)

Remarks. The above description adequately describes the illustrated specimens (Pl. XXXII, fig. 2) from the Dunvegan Formation. Although Dawson's specific name has priority, his description was almost meaningless, and his figure entirely misleading for subsequent identification without access to the type specimen; this figure, for instance, suggests two sessile leaves and not petiolulate leaflets of a compound leaf.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 288.

Types. Hypotype, GSC No. 5132.

Bauhinia? *cretacea*? Newberry

Plate XXXII, figure 3

Remarks. A single fragment of a suborbicular leaf with a deep median sinus at summit. This is much smaller than Newberry's types, but has a venation presumably much the same. The midrib is not preserved, and by inference must have been very thin; lacking it, the leaf cannot be definitely assigned to *Bauhinia,* for it possibly could be an aberrant leaf of a *Sassafras.*

Occurrence. Dunvegan Formation, British Columbia; GSC locality 4194.

Types. Hypotype?, GSC No. 1076.

Dalbergia hyperborea Heer

Plate XXVII, figure 3; Plate XXXII, figure 4; Plate XXXVI, figure 1

Description. Leaf or leaflets (?), entire, inequilateral, subelliptical, seemingly membranaceous, short-petiolate, gradually narrowed to truncate or slightly cordate base and rounded or broadly acute apex, up to 9.5 cm long by 4.5 cm wide; petiole missing. Venation, camptodromous, subpalmate in basal region, pinnate above. Midvein, rather broad in lower half, thinning above, slightly flexuous or curved; a pair of opposite basal veins are broadly spreading or nearly horizontal and are overlain nearly or at the same level by a pair of subopposite spreading veins that arise at acute angles and diverge so as to enclose an angle of about 80 degrees between them; remaining secondaries are few, about four pair, mostly alternate, leaving midvein at angles 35 to 45 degrees, curved inwards, especially the uppermost, and strongly ascending to a position within margin subparallel with midvein. A few abaxial branches to the lateral nerves are poorly preserved, as well as a few tertiaries transverse to the secondaries. In contrast, GSC No. 1301 (Pl. XXXVI, fig. 1), which is a carbonized compression, has a well-preserved, close network of nervilles that enclose more or less equidimensional, small areoles.

Remarks. The specimen is larger than Heer's type (Heer, 1882, p. 102, Pl. 26, fig. 4a), but the venation, being precisely similar to that shown in Heer's drawing, supports specific identification. Although doubtfully a *Dalbergia,* Heer's combination is retained to preclude the species being unrecognized, if assigned to the noncommittal *Dicotylophyllum.*

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3780.

Types. Hypotypes, GSC Nos. 1243, 1244, 1301.

Leguminosites spatulatus n. sp.

Plate XLII, figures 4, 6

Description. Leaf, coriaceous, small, up to 4 cm long by 1.5 cm wide, elliptical in upper part, contracted below to basal extension that may be almost as long. Midrib, narrow, striated, well marked. Secondaries, thin, most or all not preserved, where seen inclined about 30 degrees to midrib, apparently camptodromous.

Remarks. GSC No. 1280 (Pl. XLII, fig. 4) is highly carbonized with an upper surface shiny and finely wrinkled; the extended base is not preserved; traces of about three secondaries only may be seen. GSC No. 1281 (Pl. XLII, fig. 6) is an imprint with scattered traces of carbonized leaf substance; only the midvein is visible; it is flask-shaped with an elliptical upper part contracted to an extended linear base.

The species is seemingly very closely allied to *Leguminosites karatsheenis* Vakhrameer (1952, p. 231, Pl. 33, figs. 2-4; Pl. 34, figs. 1-4) from the Albian of western Kasakstan, U.S.S.R.; because the midvein in GSC No. 1281 may be traced throughout the basal extended part, the specimen is inferred to be part of a sessile leaf like that of *Leguminosites tuscaloosensis* Berry (1919, p. 104, Pl. 23, fig. 6).

Occurrence. Dunvegan Formation, British Columbia; GSC localities 4194, 4195.

Types. Holotype, GSC No. 1280; paratype, GSC No. 1281.

Ilex? *mammillata* n. sp.

Plate XXXV, figures 2, 3; Plate XXXVI, figure 3; Plate XXXIX, figure 2

Description. Leaf, petiolulate, subelliptical contracting to narrowly rounded or blunt apex and more abruptly to a slightly inequilateral, narrowly rounded base; margin, dentate from a short distance above base; teeth unevenly spaced, their bases broadly cuneate or unsymmetrically rounded, their apices short, spine-lines points. Venation, pinnate, mostly camptodromous; midvein, moderately thin, but in strong relief; secondaries, about five pair, the lowest opposite or subopposite, remainder alternate, rather unevenly spaced, originating at angles 35 to 40 degrees, nearly straight or slightly curved upwards for most of their course, generally distally curved near and subparallel with margin where they send off one to three short branches to the teeth, or rarely a secondary seems to enter a tooth directly; ultimately a secondary is united to the one next above; tertiaries, fairly numerous, simple percurrent or once divided, mostly openly oblique to the secondaries.

Remarks. The leaf has a querciform appearance and resembles *Rulac quercifolium* Hollick (1930, p. 100, Pl. 77, figs. 1-10), from which it differs in the more triangular form of the teeth which end in sharp points, as well as having a predominantly camptodromous venation. It may be compared with the Tertiary species *Ilex affinis* Lesquereux (1878, p. 270, Pl. 50, figs. 2, 3), from which it differs in being more markedly dentate and in less divided tertiary veins.

Occurrence. Milk River Formation (upper part), Alberta; GSC locality 3934.

Types. Holotype, GSC No. 1249; paratypes, GSC Nos. 1250, 1251, 1254.

Celastrinites sp.

Plate XLI, figure 2; Plate XLII, figure 5

Remarks. The material is too fragmentary for satisfactory specific designation. The apex is missing; otherwise, the leaf is suboblong, cuneate at base. For some distance from base margin is entire; above has rather distant, short, broadly cuneate, blunt teeth. The venation is partly camptodromous, partly craspedodromous, most, if not all, the secondaries being sub-camptodromous and sending off one to three distal branches that enter the teeth. The basal two or three pair of secondaries are more closely spaced than the others and subopposite; secondaries as a whole leave a straight or slightly curved prominent midrib at angles 40 to 50 degrees. Those tertiaries preserved are simple and percurrent, running at broad angles obliquely to the secondaries.

The leaf resembles in many respects *Pterospermites wardii* Knowlton (1900, p. 66, Pl. 15, fig. 4; Pl. 16, fig. 1), which, however, is more ovate, has a rounded base and tertiaries more nearly at right angles to the secondaries.

Occurrence. Milk River Formation, Alberta; GSC locality 1271.

Types. GSC Nos. 1282, 1283.

Zizyphus mcgregori n. sp.

Plate XLII, figures 1, 2

Description. Leaf, petiolate, ovate, contracting gradually to narrowly rounded apex, and more abruptly to cuneate base; margin, entire basally for about one quarter of its length, then crenate-serrulate, with about four teeth in three millimetres. Venation, trinerved, acrodromous. Primary laterals, slightly suprabasal, of equal strength to midvein, giving off obliquely, at open angles, 12 to 15 subparallel secondaries which for the greater part of their length are nearly straight, turning upward and looping about 1 to 1.5 mm from margin. A pair of basilar veins lie below the lateral primaries, rising, if at all, not much beyond the entire part of the margin. Tertiary veins, strong between the lateral primaries and midvein, percurrent, regular and nearly straight, about 1 to 1.5 mm apart, meeting midvein at right angle or nearly so.

Remarks. Hollick (1930, p. 103, Pl. 79, fig. 6b; Pl. 78, figs. 6, 7a; Pl. 79, figs. 3, 7) described three species of *Zizyphus,* viz., *Z. pseudomeeki, Z. varietas,* and *Z. electilis,* which differ from one another in minor characters that in the writer's opinion do not exceed a range of variation beyond what might be expected within a single species, which in this instance may be designated *Zizyphus electilis* in deference to the most complete leaf figured. *Zizyphus mcgregori* (named after D. C. McGregor of the Geological Survey of Canada), although undoubtedly closely allied to *Z. electilis* Hollick, is considered worthy of specific separation, owing mainly to its greater number of secondaries, and to possession of numerous, regular, percurrent tertiary veins, transverse to the midvein. Tertiary veins in the central region of a leaf are figured in only one of Hollick's specimens (*Z. varietas* of Pl. 78, fig. 7a, above reference); they are fewer and much less regular than those of *Z. mcgregori* and are broadly oblique to the midvein.

Occurrence. Bad Heart Formation, British Columbia; GSC locality 5188.

Types. Holotype, GSC No. 1225.

Vitis sp.

Plate XLII, figure 7

Remarks. Leaf, inequilateral, subtriangular, with truncate, slightly cordate base. Margin has two or three ascending lateral lobes and a terminal lobe, dentate, but characters of teeth obscure owing to poor condition of specimen. Nervation, trinerved from top of petiole, craspedodromous, with lateral primaries inserted 40 to 50 degrees to midrib, nearly straight, running to basal pair of lobes; they have about five branches on abaxial side and one or two on distal part of adaxial side; the lowermost pair of branches are given off at base of the parent vein. Succeeding secondaries, about three pair, each terminating in a lobe. Tertiary veins, where preserved, are about at right angles to secondaries and percurrent.

Occurrence. Bad Heart Formation, British Columbia; GSC locality 5188.

Types. GSC No. 1226.

Sterculia aperta? Lesquereux

Plate XL, figure 1

Remarks. A single specimen, much like *Sterculia aperta* Lesquereux (1883, p. 82, Pl. 10, figs. 2, 3) from the Dakota Formation of Kansas is only worthy of note as possible evidence of another Dakota species in the Dunvegan Formation.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3218.

Types. Hypotype?, GSC No. 1223.

Araliaephyllum rotundiloba (Newberry) Fritel

Plate XXXIII, figure 1; Plate XXXIV, figures 1, 2;
Plate XXXVII, figure 2; Plate XL, figure 3

Description. Leaf, with three major lobes, the lateral primary ones marked by a more or less well-defined accessory lobe on the lower side; the lobes are separated by rounded sinuses; base of leaf, broadly truncate. Venation, trinerved from top of petiole; lateral primaries inserted 30 to 35 degrees to midrib, nearly straight, running to margin; each sends off a branch a little distance from its base, which supplies the accessory lobe. Secondaries, camptodromous; tertiaries, obscure or not preserved.

Remarks. Fritel (1914b, pp. 3-22) discussed the amount of variability of Cretaceous species of '*Aralia*', the assignment of some *Aralia*-like leaves to *Sassafras* and *Liquidambar,* and the important differences between all fossil leaves and living members of the Araliaceae. Leaves having only three primary veins radiating from the top of the petiole, in which the lateral primaries have generally an accessory lobe fed by a branch vein are assigned by him to Fontaine's genus *Araliaephyllum,* which is a logical and clarifying procedure, the genus beginning in late Lower Cretaceous. In his specific analysis and discussion of synonyms Fritel considers *Araliaephyllum rotundiloba* (Newberry) to be a synonym of *Araliaephyllum polymorphum* (Newberry). Workers undoubtedly will disagree on specific limits, and in this instance the writer strongly supports exclusion of *A. rotundiloba* from this synonomy, because it is characterized by broadly rounded lobes, having much more obtuse summits. Of five specimens used by Newberry (1895, p. 118, Pl. 39, figs. 1-9) to illustrate his *Aralia polymorpha* only one (viz., Pl. 39, fig. 5) resembles rather closely *A. rotundiloba,* and according to Newberry this was an abnormal form that "may or may not represent the species". Newberry (op. cit., p. 118, Pl. 28, fig. 5; Pl. 36, fig. 9) described in the same publication his *Aralia rotundiloba,* compared with which the Dunvegan form now under consideration shares all essential specific characters. *Liquidambar obtusilobata* (non Heer) Hollick (1898, p. 101, Pl. 12, fig. 4), and *Aralia groenlandica* (non Heer) Lesquereux pars (1892, Pl. 54, fig. 3, non figs. 112) are likewise undoubtedly conspecific in the writer's opinion with *Araliaephyllum rotundiloba.*

Occurrence. Dunvegan Formation, British Columbia; GSC localities 3664, 3781, 4193, 4194.

Types. Hypotypes, GSC Nos. 1082, 1083, 1214, 1215, 1216.

Araliaephyllum groenlandica? Heer

Plate XLI, figure 5

Remarks. GSC No. 1217 is too fragmentary to be identified without question, but may be compared with one of the original specimens of *Aralia groenlandica* Heer from the Atane beds of Igdlokunguak, Greenland (Heer, 1882, Pl. 38, fig. 3).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 1199.

Types. Hypotype?, GSC No. 1217.

Aralia sp. cf. *A. parvidens* Hollick

Plate XL, figure 2; Plate XLI, figure 3

Remarks. Fragments of a trilobate '*Aralia*' are included here. They differ from *Aralia parvidens* Hollick (1930, p. 110, Pl. 84, fig. 2), in that the secondary veins, except those opposite the basal, entire margin, all directly enter serrate teeth as in one of the types of *Aralia wellingtoniana* Lesquereux (1892, Pl. 27, fig. 1). The larger leaf (Pl. XL, fig. 2) has a middle lobe about 6 cm wide where broadest. One specimen, GSC No. 1230 (Pl. XLI, fig. 3), shows that base of a leaf is acutely cuneate, although not markedly decurrent as in *A. wellingtoniana.* The lateral primaries are simple, subopposite, arising practically from top of petiole at angle of about 30 degrees to the midrib. Beneath the lateral primary that is slightly higher than the other a short thin basilar vein arises at a more acute angle than the secondaries, paralleling the margin for a short distance as in many leaves of *Platanus.* The first secondary on the abaxial side is camptodromous, and parallels the others as well as the remaining entire part of the margin, whereas the succeeding ones, together with one to three short, distal, abaxial branches which may occur, enter the serrate teeth, which are directed outward or in some instances slightly downward; an accessory tooth, supplied by a short tertiary vein, may lie between these main teeth. Tertiary veins, making a very broad angle to the secondaries, are generally sinuous, simple and percurrent or once divided.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3201.

Types. GSC Nos. 1229, 1230.

Hedera sp. cf. *H. cretacea* Lesquereux

Plate XXXVI, figure 2

Populites cyclophylla Dawson (non Heer), Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 22, Pl. 3, fig. 9 (1883).

Description. Leaf, subrhombic; base, truncate or very broadly cuneate; margin, slightly trilobed and upper part undulate. Nervation, palmate-pinnate; midvein, strong in lower half of leaf, thin above; primary laterals, suprabasilar, making an angle of about 90 degrees with one another, nearly straight, craspedodromous, terminating in rather obscure lobe, provided abaxially with several oblique camptodromous branches; a pair of thin basal veins lie below primary laterals running subparallel with basal margin; secondaries, remote, slightly curved upwards and apparently reaching margin or running very close to it; tertiaries, not preserved.

Remarks. Dawson's drawing greatly exaggerated the thickness of the veins; they are fairly stout only in lower half of the leaf. The species is seemingly very close to

Hedera cretacea Lesquereux (1892, p. 127, Pl. 18, fig. 1), differing only in the suprabasal position of the primary laterals, which may not be of specific significance. Berry (1916, p. 874, Pl. 78, figs. 1, 2) described a species, *Hedera cecilensis*, from the Magothy Formation that differs in the same way from *H. cretacea*. The Dunvegan form differs from that species in the lack of secondary marginal lobes.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 288.

Types. GSC No. 5131 (*Populites cyclophylla* Dawson).

Cornus ceterus Hollick

Plate XXXVII, figure 1

Remarks. An incomplete, suboblong leaf, with narrowly rounded, cuneate base lacks the apex. Midrib is moderately strong in lower part. Three alternate secondaries occur in the lower half of the leaf, leaving the midrib at an angle of about 30 degrees, the distance between the two lower much less than between second and third, strongly ascending and curving inward, becoming almost parallel with midvein, uniting presumably by a festoon close to margin.

Occurrence. Eagle sandstone equivalent of Milk River Formation, Montana; GSC locality 1621.

Types. Hypotype, GSC No. 1239.

Andromeda? *spatula* n. sp.

Plate XLI, figures 1, 4

Andromeda n. sp. Bell *in* Williams and Bocock, Roy. Soc. Can., Trans. 1932, 3rd ser., vol. 26, sec. 4, p. 222.

Description. Leaf blade, elliptical-spatulate, apparently coriaceous, with greatest width (about 4 cm) midlength and length nearly 10 cm. Petiole, not preserved. The blade gradually contracts to a well-rounded apex and at first in like degree, then cuneately to base, where it forms a narrow wing to the midrib. Midrib, relatively broad in basal half, decreasing gradually to apex near where it curves slightly. Secondaries, ten to fifteen pair, arising at acute angle (30 to 35 degrees), subparallel, nearly straight to submargin where they curve upward in camptodromous manner and lose their identity by joining oblique tertiary branches from adjacent secondaries, without presenting any well-defined loops. Tertiaries, broken, commonly flexuous, oblique to secondaries and of variable length, forming a loose network of areolae.

Remarks. The species is questionably assigned to *Andromeda* because of its strong resemblance to one or two specimens of comparable size referred by American authors to *Andromeda parlatorii* Heer. In particular, it is closest to a specimen from the Amboy clays, figured by Newberry (1895, Pl. 31, fig. 6). Most other specimens referred to *A. parlatorii,* even though in many instances larger than Heer's types, differ from the present species in their lanceolate form, acutely to bluntly pointed apices, and more importantly in their secondary veins, which arise at more open angles, are fewer, and curve upwards more regularly and more remote from the margin.

Occurrence. Dunvegan Formation, British Columbia; GSC localities 4194, 4197.

Types. Holotype, GSC No. 1077; paratype, GSC No. 1241.

Diospyros lesquereuxi Knowlton and Cockerell

Plate XXVII, figure 1 (pars)

Description. Leaf, subelliptical, well rounded at base and summit. Margin, entire. Venation, pinnate, camptodromous; midvein, straight, striated; secondaries, six or seven pair, alternate, thin, leaving midveins at angles 50 to 60 degrees, curved upwards distally, where by several, short, tertiary branches they are united submarginally by festoons. Tertiaries, few of which are preserved, lie at very open angles to a right angle between secondaries and between secondaries and midrib, generally curved and mostly simple and percurrent.

Remarks. The Dunvegan form agrees very closely not with type of *Diospyros rotundifolia* Lesquereux (1874, Pl. 30, fig. 1 = *Diospyros lesquereuxi*) but with subsequent specimens figured by Lesquereux (1892, Pl. 17, figs. 8-11), as well as with specimens referred to the species by Berry (1919, p. 135, Pl. 30, figs. 4, 5).

Occurrence. Dunvegan Formation, British Columbia; GSC locality 5250.

Types. Hypotype, GSC No. 1238.

Dicotylophyllum sp. A

Plate XLII, figure 3

Fagus protonucifera, Dawson pars, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21, Pl. 2, fig. 6 (not fig. 6a) (1883).

Remarks. The leaf GSC No. 5129 (Pl. XLII, fig. 3), one of Dawson's syntypes of his species, is wholly unfit for specific or even generic recognition, for it lacks all but a fraction of the margin. The midrib is moderately strong, and so are the secondaries, which leave it at angles of about 40 degrees. The lowest pair of secondaries are more ascending than the others, and run subparallel with the margin, which is at least entire for more than a centimetre. Tertiary veins are not preserved.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 287.

Types. GSC No. 5129 (*Fagus protonucifera* Dawson pars).

Dicotylophyllum sp. B

Plate XLII, figure 8

Description. Leaf, seemingly orbicular to squarish, about 6.5 cm long by 6 cm wide, if equilateral (one side only partly preserved); margin, entire; base, truncated, cuneate apparently on petiole, which is lacking; apex, lacking. Venation, camptodromous; midrib strong (about 1 mm wide) in lower half of leaf, thinning rapidly above where it is slightly flexuous; secondaries, about six pair, unevenly spaced, some nearly straight for most of length, others slightly and irregularly curved, leaving midvein at variable angles of 35 to 45 degrees, the lowest pair closely spaced at origin, the lowermost running subparallel with basal margin and diverging on its course from its neighbour; the secondaries curve upward distally and unite by means of tertiary branches, forming a simple festoon. Other tertiary veins, widely oblique to secondaries, mostly slightly curved; some simple and percurrent, others once divided.

Remarks. The venation of this form resembles in some respects that of *Ficus alabamensis* Berry (1919, Pl. 14, fig. 5) particularly in the downward inflection to the midvein of some of the lower secondaries. The secondaries, however, are less concentrated in the basal half of the leaf, and send off tertiary branches more distally, so that the less elongated components of their festoons impart to the venation a more compact appearance. Lack of much of the margin, particularly of its summit, precludes further comparison. As compared with *Dicotylophyllum shottoni* Seward and Conway (1935, p. 32, text-fig. 32) the secondaries are less ascending, and many of the tertiaries are simple and percurrent.

Occurrence. Eagle sandstone equivalent of the Milk River Formation, Montana; GSC locality 1621.

Types. GSC No. 5047.

Carpites? sp.

Plate XXXIX, figure 1

Fagus protonucifera Dawson pars, Roy. Soc. Can., Trans. 1882-83, vol. 1, sec. 4, p. 21, Pl. 2, fig. 6a (non fig. 6) (1883).

Remarks. No apparent connection exists between this specimen (GSC No. 5129a) and the other syntype of *Fagus protonucifera* Dawson. It also is too poorly preserved for any proper diagnosis, and the figure presented by Dawson is misleading in that it shows regular longitudinal striations. The specimen has a triangular-ovate outline with rounded-truncate base and sharply pointed apex. A sharp carina runs from the apex to the base which is minutely irregular in the central part of its course where it marks the edge of an abrupt depression that may be due in part to crushing. Nonetheless, a tetrahedral seed comparable with a seed of *Fagus* is suggested, if not proved.

Occurrence. Dunvegan Formation, British Columbia; GSC locality 3233.

Types. GSC No. 5129a (*Fagus protonucifera* Dawson pars).

INDEX TO LOCALITY NUMBERS

Dunvegan Formation

(Northwest Alberta and Northeast British Columbia)

284 East branch, lower forks, Pine River. Coll. A.R.C. Selwyn, 1875.

285 Pine River forks. Coll. A.R.C. Selwyn, 1875.

286 Pine River Mt. Coll. A.R.C. Selwyn, 1875.

287 Pine River. Coll. G. M. Dawson, 1879.

288 Pine River Canyon. Coll. G. M. Dawson, 1879.

290 Coal Brook, Peace River. Coll. G. M. Dawson, 1879.

1197 Peace River, west bank between Dunvegan and mouth of Montagneuse River. Coll. F. H. McLearn, 1917.

1198 About 7 miles west of Dunvegan, on south bank Peace River and west bank small tributary creek. Coll. F. H. McLearn, 1917.

1199 Peace River, south bank, sec. 31, tp. 83, rge. 9, W. 6th mer. Coll. F. H. McLearn, 1917.

1238 Pine River, lower forks, near coal seam. Coll. G. M. Dawson, 1877.

1664 Stinking Creek, Wapiti River area. Coll. C. S. Evans, 1929.

3200 Wabi Hill near Little Prairie, Pine River area. Dunvegan? Formation. Coll. ?

3201 North side Pine River Valley, east of Commotion Creek. Coll. G. Shaw, 1942.

3207 Lowland on west side Hulcross Valley, north of first creek lying north of west branch Hulcross River. Dunvegan? Formation. Coll. R. T. D. Wickenden, 1942.

3213 Monkman Pass. Coll. F. H. McLearn, 1942.

3217 Creek, near north side Duke Hill, Monkman Pass. Coll. F. H. McLearn, 1942.

3218 Monkman Pass. Coll. F. H. McLearn, 1942.

3220 Hulcross Creek. Dunvegan? Formation. Coll. G. Shaw, 1942.

3228 Pine River. Coll. J. Hunter, 1877.

3232 Twenty-five miles west of Dunvegan on Peace River. Coll. A. R. C. Selwyn, 1875.

3233 Pine River. Coll. A. R. C. Selwyn, 1875.

3234 Suskwa River, Pine River area. Coll. G. M. Dawson, 1879.

3292 Crest Suicide Hill, north of Fort St. John. Dunvegan? Formation. Coll. S. J. Holland, 1943.

3295 Rock quarry along highway, mile 68, above Fort St. John. Dunvegan? Formation. Coll. C. O. Hage, 1943.

3330 Sulphur River member, Dunvegan Formation, Sulphur River. Coll. H. H. Beach, 1944.

3336 Sulphur River member, Dunvegan Formation, lower Sulphur River. Coll. H. H. Beach, 1944.

3338 Suza Creek, Alberta. Coll. H. H. Beach, 1944.

3343 Torrens River, 2 miles south of 16th base line from uppermost sandstone member. Coll. A. J. Goodman and R. P. Morrison, 1944.

3344 Narroway River, about 1½ miles above mouth Torrens River, Mt. Torrens map-area. Dunvegan? Formation. Coll. A. J. Goodman and R. A. Morrison, 1944.

3351 Kiskatinaw River, below Young's farm, sec. 15, tp. 79, rge. 13, W. 6th mer. from lower part of formation. Coll. L. D. Burling, 1944.

3352 East of Bear flats, north side of Peace River, about 15 miles west of Fort St. John. Coll. L. D. Burling, 1944.

3353 Float from locality 3351. Coll. L. D. Burling, 1944.

3354 Float from lower third of formation, Kiskatinaw River, just above Alaska Highway bridge, 20 miles northwest of Dawson. Coll. L. D. Burling, 1944.

3355 Middle part of formation in quarry on abandoned section of Alaska Highway, 2 to 3 miles south of Beaton River bridge. Coll. L. D. Burling, 1944.

3356 Upper part of formation, ½ mile west of old mile-post 165 on abandoned section of Alaska Highway, south of Suicide Hill. Coll. L. D. Burling, 1944.

3357 Basal part of formation, mouth of ravine entering Beaton River from north, ½ mile below Cecil Lake Highway bridge and 6 miles east-northeast of Fort St. John. Coll. L. D. Burling, 1944.

3358 Float from upper part of formation, Kiskatinaw River, below mouth of Mica Creek, 1½ miles west of Sheardale school and about 20 miles north-northeast of Dawson Creek. Coll. L. D. Burling, 1944.

3359 Upper part of formation, just south of mile-post 142 on Alaska Highway, south of Beaton River bridge. Coll. L. D. Burling, 1944.

3360 Upper third of formation, Kiskatinaw River, just below mouth Mica Creek, 1½ miles west of Sheardale school, and about 20 miles north-northeast of Dawson Creek, Coll. L. D. Burling, 1944.

3492 Sustut group, B.C., north face of mountain 2.2 miles south-southeast of Niven River, long. 127°W. Coll. C. S. Lord, 1945.

3592 Middle part of formation, north bank Peace River, just east of Stone Creek. Coll. L. D. Burling, 1945.

3600 Loose block on shore Little Moose Lake, south of Gwillim Lake (Rocky Mountain Lake). Coll. L. D. Burling, 1945.

3601 Stone Creek, lower third of formation, east of Commotion well site. Coll. L. D. Burling, 1945.

3618 Dunvegan? Formation, just west of creek junction with South Moberly Creek; a trail running northwest from South Moberly Creek occurs at this locality. Coll. A. H. Lang, 1946.

3623 Unknown locality, but near Alberta-British Columbia Boundary. Coll. O. A. Erdman, 1946.

3624 Lower Wolverine River; locality unknown but near Alberta-British Columbia boundary. Coll. O. A. Erdman, 1946.

3629 Wapiti River, from carbonaceous sandstone containing a thin coal seam; locality unknown, but near Alberta-British Columbia boundary. Coll. O. A. Erdman, 1946.

3664 Just below creek that enters left bank of Peace River at long. 118°16′ W. from beds well down in formation and 470 feet below base of Kaskapoo Formation. Coll. L. D. Burling, 1946.

3780 Pine River, about 200 yards above bridge. Coll. C. M. Sternberg, 1948.

3781 East Pine River bridge. Coll. C. M. Sternberg, 1948.

3782 Below bridge on Pine River. Coll. C. M. Sternberg, 1948.

3783 = 3781

3784 East Pine River, ¼ mile below bridge. Coll. C. M. Sternberg, 1948.

3829 Fossil Creek, Alberta. Coll. R. Thorsteinsson, 1948.

3910 Grande Cache area; float from tributary of Muskeg River from beds in upper 30 feet of formation. Coll. R. Thorsteinsson, 1949.

3911 Grande Cache area; Gustavs Creek. Coll. R. Thorsteinsson, 1949.

3936 Peace River, midway between Boucher and Leith Creeks. Dunvegan? Formation. Coll. C. McLernon, 1950.

4191 Near centre sec. 10, tp. 82, rge. 15, W.6th mer. Coll. M. Y. Williams, 1930.

4192 Dunvegan Formation; locality unknown. Coll. M. Y. Williams, 1930.

4193 East Pine River, ¼ to 1 mile below Murray River. Coll. M. Y. Williams, 1930.

4194 East Pine River, ½ to 1 mile below Murray River. Coll. M. Y. Williams, 1930.

4195 Coldstream Creek from mouth to ¼ mile upstream. Coll. M. Y. Williams, 1930.

4196 Dunvegan Formation; locality unknown. Coll. M. Y. Williams, 1930.

4197 Murray River, ¾ mile above Perier River. Coll. M. Y. Williams, 1930.

4198 Dunvegan Formation, locality unknown. Coll. M. Y. Williams, 1930.

4199 Fort Nelson River; loose pieces on shore from nearby cliffs. Dunvegan? Formation. Coll. M. Y. Williams, 1930.

4201 Cliffs, northeast of Moberly Lake. Coll. M. Y. Williams, 1930.

4202 Dunvegan Formation; locality unknown. Coll. M. Y. Williams, 1930.

4203 Dunvegan Formation; locality unknown. Coll. M. Y. Williams, 1930.

4204 = 284

4205 = 290

4206 = 3234

4208 Stewart Creek. Coll. M. Y. Williams, 1930.

4466 Torrens Creek, 1¾ miles above junction with Hat Creek. Coll. H. Greiner, 1954.

4467 = 4466

4470 Torrens Creek, ¾ mile above junction with Hat Creek. Coll. H. Greiner, 1954.

4471 Torrens Creek, ½ mile above junction with Hat Creek. Coll. H. Greiner, 1954.

4473 Torrens Creek, ½ mile southeast of sand flat. Coll. H. Greiner, 1954.

4478 North branch of largest creek entering Torrens Creek. Coll. H. Greiner, 1954.

4635 Gully along side Alaska Highway, 2¾ miles southeast of bridge that lies 2 miles above mouth of gully. Coll. E. J. W. Irish, 1955.

4863 Kiskatinaw River, Charlie Lake area. Coll. E. J. W. Irish, 1956.

4892 Sec. 13, tp. 58, rge. 12, W. 5th mer., Alberta. Coll. Triad Oil Co., 1956.

5108 Upper Kakwa River basin, about 1.5 miles up small creek entering Mouse Cache Creek from north, below Dead Horse meadows. Coll. D. C. McGregor, 1958.

5109 Kakwa River basin, about 2 miles up small creek entering Mouse Creek from north, from basal beds of formation below Dead Horse meadows. Coll. D. C. McGregor, 1958.

5114 North bank Kakwa River, about 3 miles below Kapatatik Creek. Coll. D. C. McGregor, 1958.

5126 One mile upstream on creek that enters Kakwa River from south at second major fork of Kakwa River above Lyon Creek. Coll. D. C. McGregor, 1958.

5135 Kakwa River basin, about 1.5 miles up small creek entering Mouse Cache Creek from north below Dead Horse meadows. Coll. D. C. McGregor, 1958.

5138 Small creek, 3.5 miles upstream from junction with Kakwa River just below Atoshpee Creek. Coll. D. C. McGregor, 1958.

5249 Float from lower part of Bissett Creek, Pine River foothills. Coll. J. E. Hughes, 1958.

5250 Lower part of Bissett Creek. Coll. J. E. Hughes, 1958.

5251 Locally derived float from 400 to 600 feet above base of formation, Hartt Highway, Wabi Hill, from fault-block. Coll. J. E. Hughes, 1958.

5252 Same locality as 5251, but about 50 feet lower in section, Wabi Hill on railway line. Coll. J. E. Hughes, 1958.

5254 Windrem Creek, about 300 feet above concealed base of formation. Coll. J. E. Hughes, 1958.

5255 = 5254

5256 = 5254

5257 Dunvegan Formation; unknown locality. Coll. J. E. Hughes, 1958.

5514 Wolverine Creek, between Bullmoose Creek and Murray River, Dawson Creek area. Coll. D. F. Stott, 1959.

5649 Road-cut on No. 2 Highway, about a mile east of Chetwynd, B.C. Coll. D. F. Stott, 1960.

5656 Approximately 7 miles east on road to Lone Prairie, headwaters of Cowie Creek. Coll. D. F. Stott, 1960.

5692 Float above lower cliff, Kiskatinaw River above Highway bridge. Coll. L. D. Burling, 1946.

5703 Float on Kiskatinaw River at mouth of Mica Creek. Coll. L. D. Burling, 1946.

Bad Heart Formation

(Alberta)

3625 Tributary of Wapiti River from north, at top basal member of formation. Coll. O. A. Erdman, 1946.

5188 Belcourt Creek, ⅛ mile above junction with Huguenot Creek. Coll. D. F. Stott, 1958.

Milk River Formation

(Alberta)

844 Northwest ¼ sec. 30, tp. 1, rge. 12, W.4th mer. Coll. L. S. Russell, 1934.

845 Deadhorse coulée, N.W. ¼ sec. 33, tp. 1, rge. 11, W.4th mer. Coll. L. S. Russell, 1934.

846 Southeast ¼ sec. 14, tp. 2, rge. 11, W.4th mer. Coll. L. S. Russell, 1934.

852 Deadhorse coulée, north side, N.W. ¼ sec. 31, tp. 1, rge. 11, W.4th mer. (lower part of formation). Coll. L. S. Russell, 1934.

1271 Northeast ¼ sec. 36, tp. 2, rge. 15, W.4th mer. Coll. M. Y. Williams, 1925.

1273 Butte in Verdegris coulée, S.W. corner sec. 12, tp. 3, rge. 15, W.4th mer. Coll. M. Y. Williams, 1923.

1282 Northeast ¼ sec. 2, tp. 3, rge. 15, W.4th mer. Coll. M. Y. Williams, 1923.

1619 Milk River area. Coll. C. S. Evans, 1930.

1665 Stinking Creek, north of 16th base line, Wapiti River, Grande Mine. Coll. C. S. Evans, 1929.

1671 Stinking Creek, Wapiti River area. Coll. C. S. Evans, 1929.

1672 = 1671

2148 Verdegris coulée, S.E. corner sec. 12, tp. 3, rge. 15, W.4th mer. (lower parts of formation). Coll. M. Y. Williams, 1923.

3865 Dungarvan Creek, Waterton area. Coll. R. J. W. Douglas, 1949.

3866 Waterton area from beds above Wapiabi-lower Milk River contact. Coll. R. J. W. Douglas, 1949.

3888 = 3865

3934 Tough Creek, Mountain View area. Coll. R. J. W. Douglas, 1949.

Eagle Sandstone Equivalent of Milk River Formation

(Montana, U.S.A.)

1620 Buckley coulée. Coll. C. S. Evans, 1930.

1621 Buckley coulée (sec. 5, Geol. Surv., Canada, Sum. Rept. 1930, pt. B). Coll. C. S. Evans, 1930.

1622 Red coulée (sec. 5, Geol. Surv., Canada, Sum. Rept. 1930, pt. B). Coll. C. S. Evans, 1930.

REFERENCES

Baxter, R. W.

1954: University of Kansas collection of fossil plants. 1. The Dakota sandstone flora; *Trans. Kansas Acad. Sci.*, vol. 57, pp. 41-47, figs. 1-3.

Bayer, E.

1900: Einige neue Pflanzen der Perucer Kreideschichten in Böhmen; *K. Böhm. Gesell. Wissensch. Math.-Naturw. Classe,* Jahr 1899, No. 26, pp. 1-51, Pls. 1, 2, Text-figs. 1-15.

1920: Phytopalaeontologische Beitrage zur kenntnis der Perucer Kreideschichten in Böhmen; *Publn. (Prague)*, pp. 1-78, Text-figs. 1-33.

Baykovskaya, T. N.

1956: Upper Cretaceous floras of northern Asia; *Palaeobotanica,* Botanical Kumarov Institute, Acta, ser. 8, fasc. 2, pp. 49-1941, Pls. 1-27.

1957: The Upper Cretaceous floras of Tshulymo-Yenissei basin; *Akad. Sci., USSR,* Symposium in memory of A. N. Kryshtofovich, pp. 65-99, Pls. 1-7.

Bell, W. A.

1949: Uppermost Cretaceous and Paleocene floras of Western Alberta; *Geol. Surv., Canada,* Bull. 13, pp. 1-129, Pls. 1-67.

1956: Lower Cretaceous floras of Western Canada; *Geol. Surv., Canada,* Mem. 285, pp. 1-331, Pls. 1-84.

1957: Flora of the Upper Cretaceous Nanaimo group of Vancouver Island, British Columbia; *Geol. Surv., Canada,* Mem. 293, pp. 1-84, Pls. 1-67.

Berry, E. W.

1903: Flora of the Matawan formation (Crosswicks clays); *Bull. New York Bot. Garden,* vol. 3, pp. 45-103, Pls. 43-57.

1904: Additions to the flora of the Matawan formation; *Bull. Torrey Bot. Club,* vol. 32, pp. 43-48, Pls. 1, 2.

1906a: Flora of the Cliffwood clays; *N.J. Geol. Surv.,* Ann. Rept. 1905, pp. 135-172, Pls. 19-26.

1906b: Contribution to the Mesozoic flora of the Atlantic coastal plain, sec. I; *Bull. Torrey Bot. Club,* vol. 33, pp. 163-182, Pls. 7-9.

1908: A mid-Cretaceous species of Torreya; *Am. J. Sci.,* 4th ser., vol. 25, pp. 382-386, Text-figs. 1-3.

1911: Lower Cretaceous of Maryland; *Maryland Geol. Surv.,* Lower Cretaceous, pp. 214-508, Pls. 22-97.

1914: Upper Cretaceous and Eocene floras of South Carolina and Georgia; *U.S. Geol. Surv.,* Prof. Paper 84, pp. 1-61, Pls. 1-29.

1916: Upper Cretaceous; *Maryland Geol. Surv.,* two volumes, text pp. 1-578; text and plates, pp. 1-1022, Pls. 1-90.

1919: Upper Cretaceous floras of the eastern gulf region in Tennessee, Mississippi, Alabama and Georgia; *U.S. Geol. Surv.,* Prof. Paper 112, pp. 1-177, Pls. 5-33.

1922: The flora of the Woodbine sand at Arthur Bluff, Texas; *U.S. Geol. Surv.,* Prof. Paper 129G, pp. 153-180, Pls. 36-40.

1925: The flora of the Ripley formation; *U.S. Geol. Surv.,* Prof. Paper 136, pp. 1-94, Pls. 1-23.

1930: Revision of the lower Eocene Wilcox flora of the southeastern States; with descriptions of new species, chiefly from Tennessee and Kentucky; *U.S. Geol. Surv.,* Prof. Paper 156, pp. 1-196, Text-figs. 1-32, Pls. 1-50.

Brown, R. W.
1939: Fossil plants from the Colgate member of the Fox Hills sandstone and adjacent strata; *U.S. Geol. Surv.*, Prof. Paper 189, pp. 239-275, Pls. 48-63.
1950: Cretaceous plants from southwestern Colorado; *U.S. Geol. Surv.*, Prof. Paper 221, pp. 45-53, Pls. 9-12.

Capellini, J., and Heer, O.
1867: Les Phyllites Crétacées du Nebraska; *Allgem. Schweiz. Gesell. Soc. Helvét des Sciences Natur. Neue Denkschr.*, vol. 22, pp. 1-22, Pls. 1-4.

Carpentier, A.
1950: Flore Senonienne de Sidi Hajaj; *Serv. Géolog. Morocco;* Notes et Mem. 76, vol. 3, pp. 149-154, Pl. 1.

Cobban, W. A., and Reeside, J. B., Jr.
1952: Correlation of the Cretaceous formations of the Western Interior of the United States; *Bull. Geol. Soc. Amer.*, vol. 63, pp. 1011-1044.

Crickmay, C. H.
1944: Pouce Coupé-Peace River, Alberta and British Columbia; *Geol. Surv., Canada,* Paper 44-31, prel. map with descr. notes.

Dawson, G. M.
1881: Report on northern part of British Columbia and the Peace River country; *Geol. Surv., Canada,* Rept. Prog. 1879-80, Pt. B, pp. 1-177.

Dawson, J. W.
1883: On the Cretaceous and Tertiary floras of British Columbia and the Northwest Territories; *Trans. Roy Soc. Can.*, 1882, vol. 1, sec. 4, pp. 15-34, Pls. 1-8.
1886: On the Mesozoic floras of the Rocky Mountain region of Canada; *Trans. Roy. Soc. Can.*, 1885, vol. 3, sec. 4, pp. 1-22, Pls. 1-4.
1894: On new species of Cretaceous plants from Vancouver Island; *Trans. Roy. Soc. Can.*, 1893, vol. 11, sec. 4, pp. 53-72, Pls. 5-13.

Debey, M. H., and Ettingshausen, C.
1859: Die Urweltlichen Acrobryen des Kreidegebirges von Aachen und Maestricht; *K. Akad. Wissens. Denkschr. Math.-Naturw. Classe,* vol. 17, pp. 183-248, Pls. 1-7.

Dorf, E.
1938: Upper Cretaceous floras of the Rocky Mountain region; sec. I; *Carnegie Inst. Wash.*, Publ. 508, pp. 1-78, Pls. 1-19.
1942: Upper Cretaceous floras of the Rocky Mountain region; sec. II; *Carnegie Inst. Wash.*, Publ. 508, pp. 83-168, Pls. 1-17.
1952: Critical analysis of Cretaceous stratigraphy and paleobotany of Atlantic Coastal Plain; *Am. Assoc. Petrol. Geol.*, vol. 36, No. 11, pp. 2161-2184.

Evans, C.
1931: Milk River area and the Red Coulée oil field, Alberta; *Geol. Surv., Canada,* Sum. Rept. 1930, Pt. B, pp. 1-30.

Forbes, E.
1851: Note on the vegetable remains from Ardtun Head; *Quart. J. Geol. Soc. London,* vol. 7, p. 103, Pls. 2-4.

Fritel, P. H.
1914a: Sur l'attribution au genre Nuphar de quelques espèces fossiles de la flore Arctique; *Bull. Soc. Géol. de France,* 4th ser., vol. 13 (1913), pp. 293-297, Text-figs. 1-4.
1914b: Note sur les Aralias des flores crétaciques de l'Amérique du Nord et du Groenland; *Bull. Soc. Géol. de France,* 4th ser., vol. 14, pp. 1-22, Text-figs. 1-13.

Gleddie, J.
1949: Upper Cretaceous in western Peace River plains, Alberta; *Am. Assoc. Petrol. Geol.*, Bull. 33, No. 4, pp. 511-532, 9 figs.

Greas, E. M.
1922: An annotated list of fossil plants of the Dakota formation (Cretaceous) in the collections of the Carnegie Museum, including descriptions of three new species; *Carnegie Museum Annals,* vol. 13, 1919-1922, pp. 274-329, Pls. 14, 15.

Hage, C. O.
1944: Geology adjacent to the Alaska highway between Fort St. John and Fort Nelson, British Columbia; *Geol. Surv., Canada,* Paper 44-30, pp. 1-22.

Hall, J.
1845: Description of organic remains collected by Captain J. C. Frémont in the geographical survey of Oregon and north California; in Frémont, J.C. report of the exploring expedition to Oregon and north California in the years 1943-44; *U.S. 28th Congress, 2nd sess.,* S. Ex. Document 174, pp. 304-310, Pls. 1-4.

Heer, O.
1869: Beiträge zur Kreide-flora; Flora von Molstein in Mähren; *Allgem. Schweiz. Gesellsh. Soc. Helvét., neue Denkschr.,* vol. 23, pp. 1-24, Pls. 1-11.
1871: Beiträge zur Kreide-flora von Quedlingburg; *Allgem. Schweiz. Gesellsh. Soc. Helvét., neue Denkschr.,* vol. 24, pp. 1-15, Pls. 1-3.
1874: Die Kreide-flora der Artischen Zone; *Kongl. Svens. Vetens.-Akad. Handl.,* vol. 12, No. 6; reprinted in *Flora Fossile Arctica,* vol. 3, No. 6, pp. 1-140, Pls. 1-38 (1875).
1882: Die Fossile Flora Grönlands; sec. I; *Flora Fossile Arctica,* vol. 6, pt. 2, pp. 1-112, Pls. 1-47.
1883: Die Fossile Flora der Polarländer; sec. II; *Flora Fossile Arctica,* vol. 7, pp. 1-46, Pls. 48-65.

Hollick, A.
1892a: The Paleontology of the Cretaceous formation on Staten Island; *Trans. New York Akad. Sci.,* vol. 11, pp. 96-103, Pls. 1-4.
1892b: Additions to the paleobotany of the Cretaceous formation on Staten Island; *Trans. New York Acad. Sci.,* vol. 12, pp. 28-39, Pls. 1-4.
1892c: Preliminary contribution to our knowledge of the Cretaceous formation on Long Island and eastward; *Trans. New York Acad. Sci.,* vol. 12, pp. 222-237, Pls. 5-7.
1894: Additions to the paleobotany of the Cretaceous formation on Long Island; *Bull. Torrey Bot. Club,* vol. 21, pp. 49-65, Pls. 174-180.
1898: Additions to the paleobotany of the Cretaceous formation on Staten Island; *Ann. New York Acad. Sci.,* vol. 11, pp. 415-430, Pls. 36-38.
1904: Additions to the paleobotany of the Cretaceous formation on Long Island; II; *Bull. New York Bot. Garden,* pp. 403-418, Pls. 70-79.
1906: The Cretaceous flora of southern New York and New England; *U.S. Geol. Surv.,* Mon. 50, pp. 1-219, Pls. 1-40.
1909: Studies of Cretaceous coniferous remains from Kreischerville, New York; *Mem. New York Bot. Garden,* vol. 3, pp. 1-76, Pls. 3-29.
1912: Addition to the paleobotany of the Cretaceous formation on Long Island; III; *Bull. New York Bot. Garden,* vol. 8, pp. 154-170, Pls. 162-170.
1930: The Upper Cretaceous floras of Alaska; *U.S. Geol. Surv.,* Prof. Paper 159, pp. 1-119, Pls. 1-86.

Hosius, A.
1869: Ueber Einige Dicotyledonen der Westfälischen Kreideformation; *Palaeontographica,* vol. 17, pp. 89-104, Pls. 12-17.

Hosius, A., and von der Marck, W.
1880: Die Flora der Westfälischen Kreideformation; *Palaeontographica*, vol. 26, pp. 126-241, Pls. 24-44.

Imlay, R. W., and Reeside, J. B., Jr.
1954: Correlation of the Cretaceous formations of Greenland and Alaska; *Bull. Geol. Soc. Amer.*, vol. 65, pp. 223-246, Chart No. 10d.

Irish, E. J. W.
1950: Pierre Greys Lake Map-area, Alberta; *Geol. Surv., Canada*, Mem. 258, pp. 1-66.

Knowlton, F. H.
1900: Flora of the Montana formation; *U.S. Geol. Surv.*, Bull. 163, pp. 1-117, Pls. 1-19.
1905: Fossil plants of the Judith River beds; *U.S. Geol. Surv.*, Bull. 257, pp. 129-155, Pls. 1-19.
1916: Flora of the Fruitland and Kirtland formations; *U.S. Geol. Surv.*, Prof. Paper 98S, pp. 327-344, Pls. 84-91.
1917a: A fossil flora from the Frontier formation of southwestern Wyoming; *U.S. Geol. Surv.*, Prof. Paper 108F, pp. 73-94, Pls. 28-39.
1917b: Fossil floras of the Vermejo and Raton formations of Colorado and New Mexico; *U.S. Geol. Surv.*, Prof. Paper 101, pp. 223-455, Pls. 30-113.
1919: A catalogue of the Mesozoic and Cenozoic plants of North America; *U.S. Geol. Surv.*, Bull. 696.
1922: The Laramie flora of the Denver Basin; *U.S. Geol. Surv.*, Prof. Paper 130, pp. 1-175, Pls. 1-28.
1930: Flora of the Denver and associated formation of Colorado; *U.S. Geol. Surv.*, Prof. Paper 155, pp. 1-139, Pls. 1-59.

Krasser, F.
1896: Beiträge zur Kenntnis der Kreideflora von Kundstadt; *Beitr. Paläont. Geol. Osterreich-Ungarns*, vol. 10, pp. 113-152, Pls. 11-17.

Kryshtofovich, A. N.
1918: On the Cretaceous flora of Russian Sakhalin; *J. College Sci. Imperial Univ. Tokyo*, vol. 40, art. 8, pp. 1-73, Text-figs. 1-15.
1958: The Cretaceous flora of the Anadyr River basin; *Palaeobotanica, V.L. Kumarov Botan. Instit.*, Acta, ser. 8, fasc. 3, pp. 9-70, Text-figs. 1-54, Pls. 1-13.

Lamotte, R. S.
1944: Supplement to catalogue of Mesozoic and Cenozoic plants of North America, 1919-1937; *U.S. Geol. Surv.*, Bull. 924.

Lang, A. H.
1946: Brûlé and Entrance map-areas; *Geol. Surv., Canada*, Mem. 244, pp. 1-65.

Lesquereux, L.
1874: Contributions to the fossil flora of the western Territories; Pt. 1, The Cretaceous flora; *U.S. Geol. and Geog. Surv., Territories*, vol. 6, pp. 1-136, Pls. 1-30.
1876: A review of the Cretaceous flora of North America; *U.S. Geol. and Geog. Surv., Territories*, 8th. Ann. Rept. (Rept. Prog. 1874), pp. 316-365, Pls. 1-8.
1878: Contributions to the fossil flora of the western Territories; Pt. 2, The Tertiary flora; *U.S. Geol. and Geog. Surv., Territories*, vol. 7, pp. 1-366, Pls. 1-65.
1883: The fossil flora of the western Territories; Pt. 3, The Cretaceous and Tertiary floras; *U.S. Geol. and Geog. Surv., Territories*, vol. 8, pp. 1-283, Pls. 1-59.
1892: Flora of the Dakota group; *U.S. Geol. Surv.*, Mon. 17, pp. 1-226, Pls. 1-66.
1960: Lexicon of Geologic Names in the Western Canada sedimentary basin and Arctic Archipelago; *Alta. Soc. Petrol. Geologists* (Calgary, Alberta).

McLearn, F. H.
1918: Peace River section; *Geol. Surv., Canada,* Sum. Rept. 1917, Pt. C, pp. 14-21.
1919: Cretaceous of the lower Smoky River, Alberta; *Geol. Surv., Canada,* Sum. Rept. 1918, Pt. C, pp. 1-7.
1926: New species from the Coloradoan of lower Smoky and lower Peace Rivers, Alberta; *Geol. Surv., Canada,* Mus. Bull. 42, pp. 117-120, Pls. 20-23.
1929: Mesozoic palaeontology of Blairmore region, Alberta; *Geol. Surv., Canada,* Mus. Bull. 58, pp. 1-80, Pls. 1-19.
1932: Problems of Lower Cretaceous of the Canadian interior; *Trans. Roy. Soc. Can.,* 3rd ser., vol. 26, sec. 4, pp. 157-175, figs. 1-6.
1935: Problems of the geological history of the Alberta Upland from Devonian time; *Geol. Surv., Canada,* Mem. 176, Chapt. 8, pp. 112-121.
1937: The fossil zones of the Upper Cretaceous Alberta shale; *Trans. Roy. Soc. Can.,* 3rd ser., vol. 31, sec. 4, pp. 111-120.
1945: The Upper Cretaceous Dunvegan formation of northwestern Alberta and northeastern British Columbia; *Geol. Surv., Canada,* Paper 45-27, 6 pls. (fauna).

Nathorst, A. G.
1897: Zur Mesozoischen flora Spitzbergens; *K. Svensk. Vetens. Akad.,* Handl., vol. 30, No. 1, p. 5.
1907: *Pseudocycas,* eine neue Cycadophytengattung aus den cenomanen Kreideablagerungen Grönland; *K. Svensk. Vetens.-Akad.,* Handl., vol. 42, No. 5, pp. 1-11, Pls. 1-3.

Newberry, J. S.
1878: Illustrations of Cretaceous and Tertiary plants of the western Territories of the United States; *U.S. Geol. and Geog. Surv. Territories,* Pls. 1-26.
1895: Flora of the Amboy clays; *U.S. Geol. Surv.,* Mon. 26, pp. 1-257, Pls. 1-58.
1898: Later extinct floras of North America; *U.S. Geol. Surv.,* Mon. 35, pp. 1-151, Pls. 1-68.

Penhallow, D. P.
1908: Report on a collection of fossil woods from the Cretaceous of Alberta; *Ottawa Naturalist,* vol. 22, pp. 82-88, Figs. 1-6.

Richter, P. B.
1905: Beiträge zur flora des Oberen Kreide Quedlinburgs und seiner vingebung; Pt. I, Die Gattung *Credneria* und einige seitenere Pflanzenreste Publ., pp. 1-18, Pls. 1-6 (Leipsig).

Russell, L. S., and Landes, R. W.
1940: Geology of the southern Alberta plains; *Geol. Surv., Canada,* Mem. 221, pp. 1-223, Pls. 1-8 (fauna).

Seward, A. C.
1925: Notes sur la flora Crétacique du Groenland; *Soc. Géol. Belgique,* Livre Jubilaire, pp. 229-262, Pls. A-C.
1927: Cretaceous plant-bearing rocks of western Greenland; *Trans. Roy. Soc. London,* ser. B, vol. 215, pp. 57-175, Pls. 4-12.

Seward, A. C., and Conway, V. M.
1936: Additional Cretaceous plants from western Greenland; *K. Svensk. Ventens.-Akad.,* Handl., ser. 3, vol. 15, No. 3, pp. 1-41, Pls. 1-6.

Shaparenko, K. K.
1937: The tulip tree; *Trans. Bot. Inst. Acad. Sci. USSR,* ser. 1, No. 4.

Spieker, E. M.
1921: Report of oil surveys in the Peace River district, 1920; *Publ. Dept. Lands, British Columbia,* pp. K 11-27 (Victoria).
1922: The petroleum geology of a part of the western Peace River district, British Columbia; *Bull. Am. Assoc. Petrol. Geol.,* vol. 6, pp. 112-126.

Stelck, C. R.
1955: Cardium formation of the foothills of northeastern British Columbia; *Can. Inst. Min. Met.,* Bull. 48, pp. 266-273 (reprinted Trans., vol. 58, pp. 132-139).

Stephenson, L. W. *et al.*
1942: Correlation of the outcropping Cretaceous formations of the Atlantic and Gulf coastal plain and Trans-Pecos, Texas; *Geol. Soc. Amer.,* vol. 53, pp. 435-446, Corr. Chart No. 9 (reprinted 1949).

Stiehler, A. W.
1958: Beiträge zur Kenntnis der vorweltllichen Flora der Kreidegebirges im Harze; Pt. I, Algemeine Bemerkungen über des Kreidebirge zu Blankenburg und in der Grafschaft Wernigerode; *Palaeontographica,* vol. 5 (1855-1858), pp. 47-70, Pls. 9-11; pt. II, Die Flora des Langeberges bei Quedlingburg, pp. 71-80, Pls. 12-15.

Stockmans, F.
1946: Végétaux de l'assise des sables d'Aix-la-Chapelle recoltées en Belgique (Sénonian inférieure); *Musée Roy. d'Hist. Natur. de Belgique,* Mém. No. 105, pp. 1-51, Pls. 1-4.

Stopes, M. C.
1913: Catalogue of the Mesozoic plants in the British Museum (Natural History); the Cretaceous flora, Pt. I: Bibliography, algae, algae and Fungi (London).

Stott, D. F.
1960: Cretaceous Rocks between Smoky and Pine Rivers, Rocky Mountain Foothills, Alberta and British Columbia; *Geol. Surv., Canada,* Paper 60-16.
1961: Summary account of the Cretaceous and equivalent rocks, Rocky Mountain Foothills, Alberta; *Geol. Surv., Canada,* Paper 61-2, pp. 1-34, Figs. 1, 2.

Tateiwa, I.
1934: Cretaceous flora of Tsushima, Japan; *Japanese J. Geol. and Geogr.,* vol. 11, pp. 185-209, Pls. 23, 24.

Teixeira, C.
1948: Flora Mesozoica Portuguesa, Pt. I; *Serv. Géol. de Portugal,* pp. 1-118, Pls. 1-45.
1950: Flora Mesozoica Portuguesa, Pt. II; *Serv. Géol. de Portugal,* pp. 1-31, Pls. 1-13.

Tester, A. C.
1952: Additional facts concerning the age and origin of the type section of the Dakota stage (Abstract); *Geol. Soc. Amer.,* Bull. 63, p. 1386.

Vakhrameer, V. A.
1952: Stratigraphy and fossil flora of the Cretaceous deposits of western Kasakstan; Regional Stratigraphy of the USSR, vol. 1, pp. 1-340, Pls. 1-44 (Moscow).

Velenovsky, J.
1882: Die Flora der Böhmischen Kreideformation; Pt. 1; Credneriaceae and Araliaceae; *Beiträge Palaeont. Oesterreich-Ungarns,* vol. 2, pp. 8-32, Pls. 3-8.
1883: Die Flora der Böhmischen Kreideformation; Pt. 2, Proteaceae, Myriaceae, Cupuliferae, Moreae, Magnoliaceae, Bombaceae; *Beiträge Palaeont. Oesterreich-Ungarns,* vol. 3, pp. 26-47, Pls. 9-15.
1885: Die Gymnospermen der Böhmischen Kreideformation; pp. 1-34, Pls. 1-13 (Prague).

Velenovsky, J. (cont'd)

1886: Die Flora der Böhmischen Kreideformation; Pt. 3; *Beiträge Palaeont. Oesterreich-Ungarns,* vol. 4, pp. 1-14, Pls. 1-8.

1887: Die Flora der Böhmischen Kreideformation; Pt. 4; *Beiträge Palaeont. Oesterreich-Ungarns,* vol. 5, pp. 1-14, Pls. 1-8.

1887a: Neue Beiträge zur Kenntnis der Pflanzen des Böhmischen Cenomans; *Sitz. K. böhm. Ges. Wiss.,* 1886, pp. 633-645, Pl. (one).

1888: Ueber einige neue Pflanzenformen der Böhmischen Kreideformation; *Sitz. K. böhm. Ges. Wiss.,* 1887, pp. 590-598, Pl. (one).

1888a: Die Farne der Bömischen Kreideformation; *Abhandl. K. böhm. Ges. Wiss.,* ser. 7, vol. 2, pp. 1-32, Pls. 1-6.

1889: Kvetena ceského Cenomanu; *Abhandl. K. böhm. Ges. Wiss.,* ser. 7, vol. 3, pp. 1-75, Pls. 1-6.

Velenovsky, J., and Viniklar, L.

1926: Flora Cretacea Bohemiae; *Rozpravy, Stätniho Geolog. Ustavu Ceskoslovenské Republiky,* Svazek 1, pp. 1-57, Pls. 1-7.

1927: Flora Cretacea Bohemiae; *Rozpravy, Stätniho Geolog. Ustavu Ceskoslovenské Republiky,* Svazek 2, pp. 1-54, Pls. 8-17.

1929: Flora Cretacea Bohemiae; *Rozpravy, Stätniho Geolog. Ustavu Ceskoslovenské Republiky,* Svazek 3, pp. 1-33, Pls. 17-22.

1931: Flora Cretacea Bohemiae; *Rozpravy, Stätniho Geolog. Ustavu Ceskoslovenské Republiky,* Svazek 5, pp. 1-112, Pls. 23-32.

Warren, P. S., and Stelck, C. R.

1940: Cenomanian and Turonian faunas in the Pouce Coupé district, Alberta and British Columbia; *Trans. Roy. Soc. Can.,* 3rd ser., vol. 34, sec. 4, pp. 143-152, Pls. 1-4 (fauna).

1958: Lower Cenomanian ammonoidea and pelecypoda from Peace River area, western Canada; *Research Council, Alberta,* Bull. 2, pt. 2, pp. 36-51, Pls. 5-16.

Williams, M. Y., and Bocock, J. B.

1932: Stratigraphy and palaeontology of the Peace River valley of British Columbia; *Trans. Roy. Soc. Can.,* 3rd ser., vol. 26, pp. 197-224.

Williams, M. Y., and Dyer, W. S.

1930: Geology of southern Alberta and southwestern Saskatchewan; *Geol. Surv., Canada,* Mem. 163, pp. 1-160.

Zenker, J. C.

1833: Beiträge zur Naturgeschichte der Urwelt, 67 pp., 6 Pl.; Jena.

PLATES I to XLII

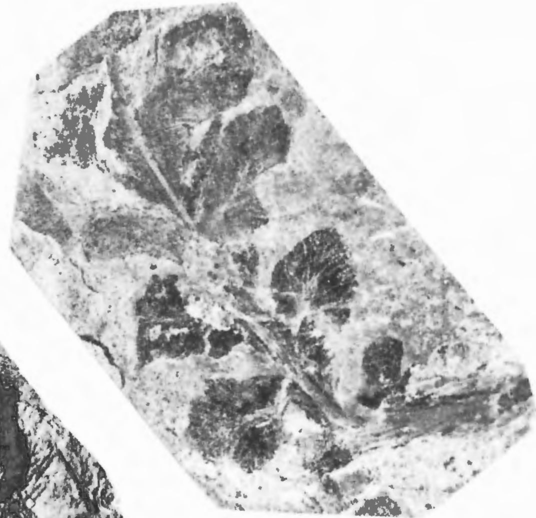
PLATE I

Figure 1. *Onychiopsis* sp. cf. *O. psilotoides* (Stokes and Webb) (P. 16)
GSC No. 1302. Dunvegan Formation, GSC locality 3330.

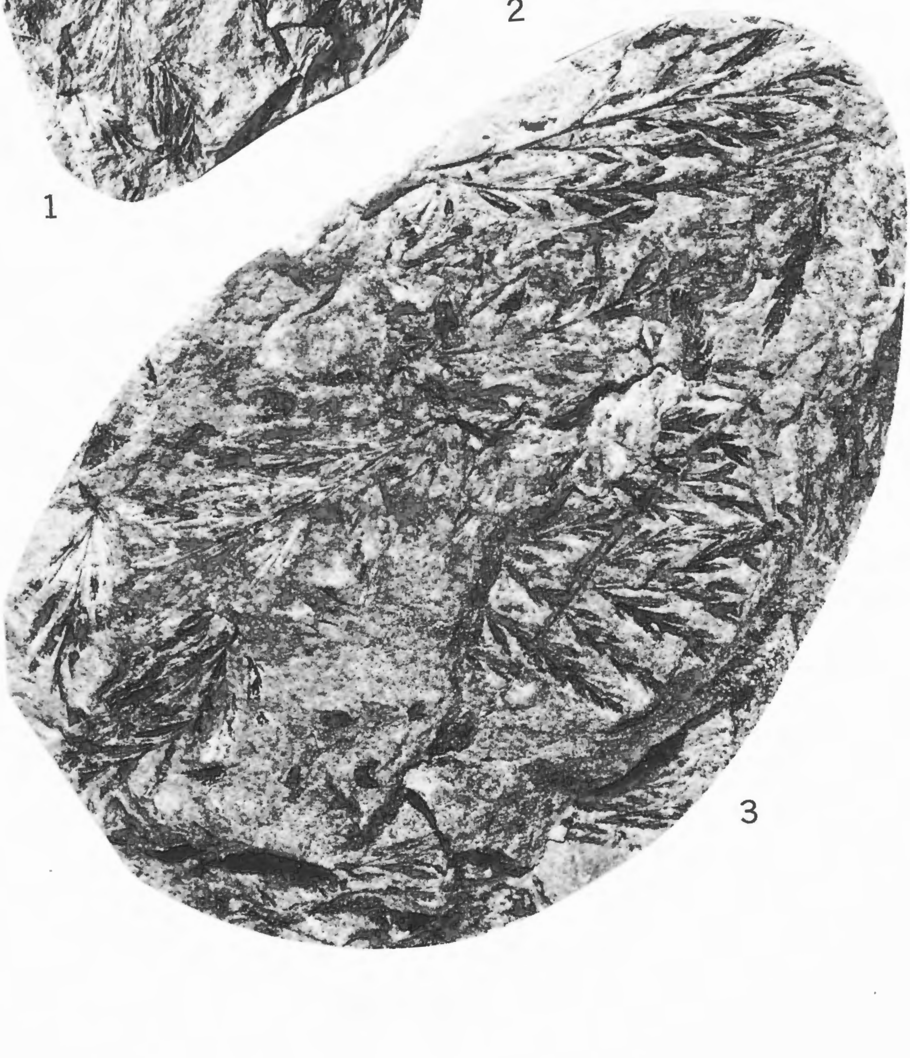
Figure 2. *Onoclea hebridica* (Forbes) (P. 16)
Hypotype, GSC No. 1178x3. Milk River Formation, GSC locality 3934.

Figure 3. *Onychiopsis* sp. cf. *O. psilotoides* (Stokes and Webb) (P. 16)
GSC No. 1302x2. Dunvegan Formation, GSC locality 3330.

1



2



3

Plate II

Figure 1.	*Onoclea hebridica* (Forbes) Hypotype, GSC No. 1268x2. Milk River Formation, GSC locality 3934.	(P. 16)
Figure 2.	*Saccoloma gardneri* (Lesquereux) Knowlton Hypotype, GSC No. 1173x3. Milk River Formation, GSC locality 3888.	(P. 17)
Figure 3.	*Onoclea hebridica* (Forbes) Hypotype, GSC No. 1179x3. Milk River Formation, GSC locality 3934.	(P. 16)
Figure 4.	*Saccoloma gardneri* (Lesquereux) Knowlton Hypotype, GSC No. 1174x2. Milk River Formation, GSC locality 3888.	(P. 17)
Figure 5.	*Onoclea hebridica* (Forbes) Hypotype, GSC No. 1177. Milk River Formation, GSC locality 3934.	(P. 16)
Figure 6.	*Onoclea hebridica* (Forbes) Hypotype, GSC No. 1270x3. Milk River Formation, GSC locality 3934.	(P. 16)

PLATE II

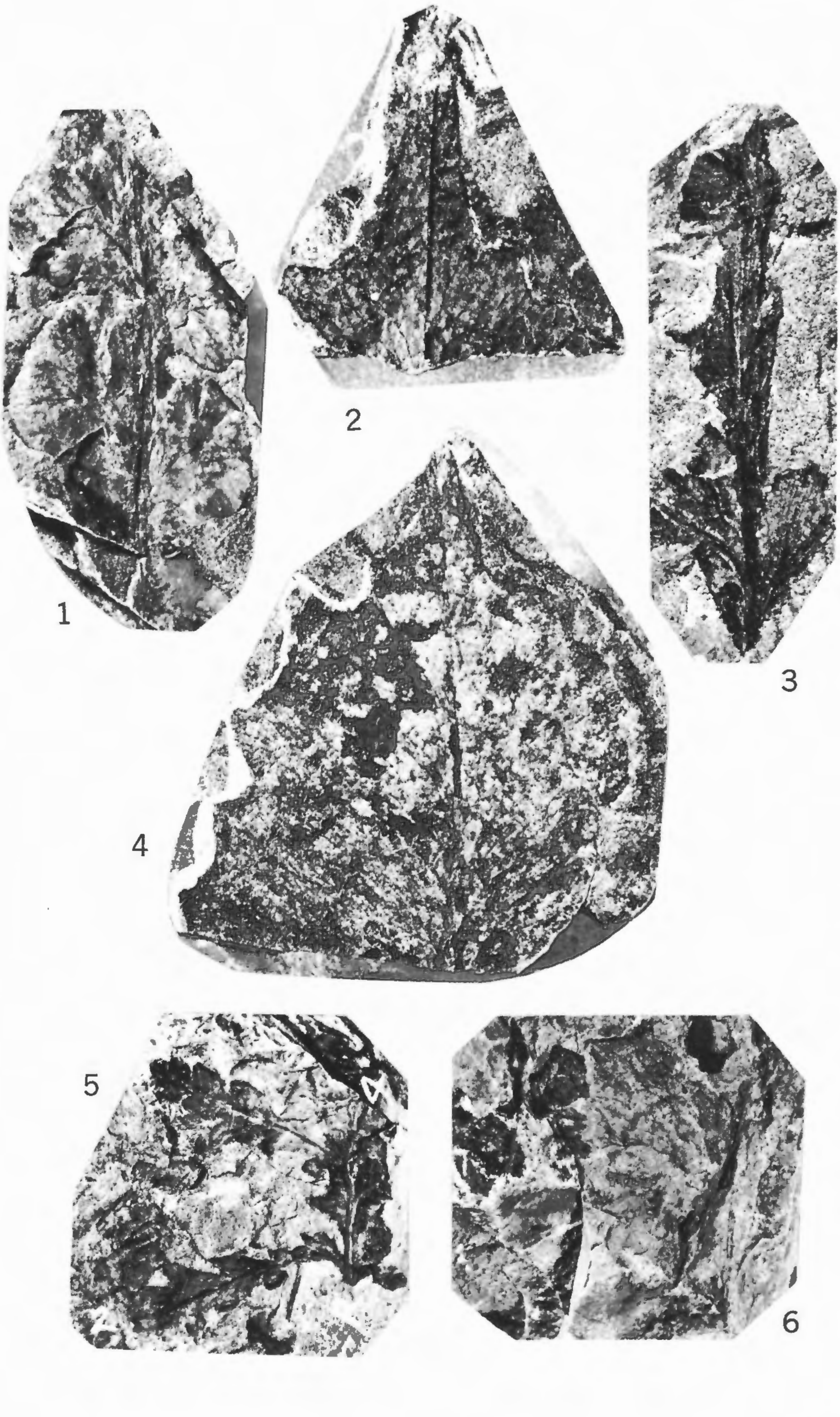


Plate III

Figure 1.	*Tapeinidium? undulatum* (Hall) Knowlton Hypotype, GSC No. 5157. Milk River Formation, GSC locality 2148.	(P. 19)
Figure 2.	*Tapeinidium? undulatum* (Hall) Knowlton Hypotype, GSC No. 5159x3. Milk River Formation, GSC locality 852.	(P. 19)
Figure 3.	*Saccoloma* sp. GSC No. 1107. Dunvegan Formation, GSC locality 4194.	(P. 18)
Figure 4.	*Saccoloma* sp. GSC No. 1107x2.	(P. 18)
Figure 5.	*Tapeinidium? undulatum* (Hall) Knowlton Hypotype, GSC No. 1054x2. Dunvegan Formation, GSC locality 4203.	(P. 19)
Figure 6.	*Onoclea hebridica* (Forbes) Hypotype, GSC No. 1176x3. Milk River Formation, GSC locality 3934.	(P. 16)

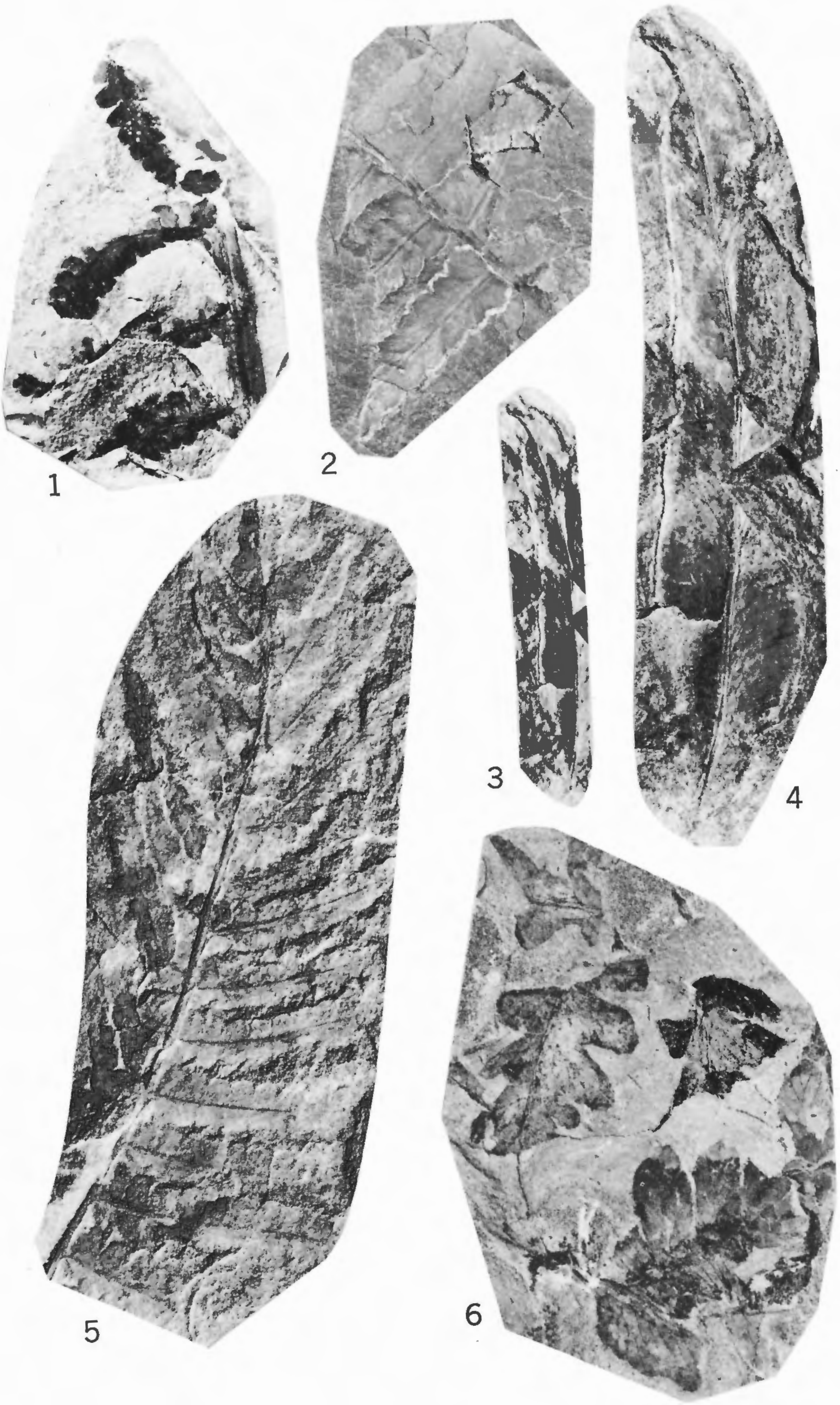
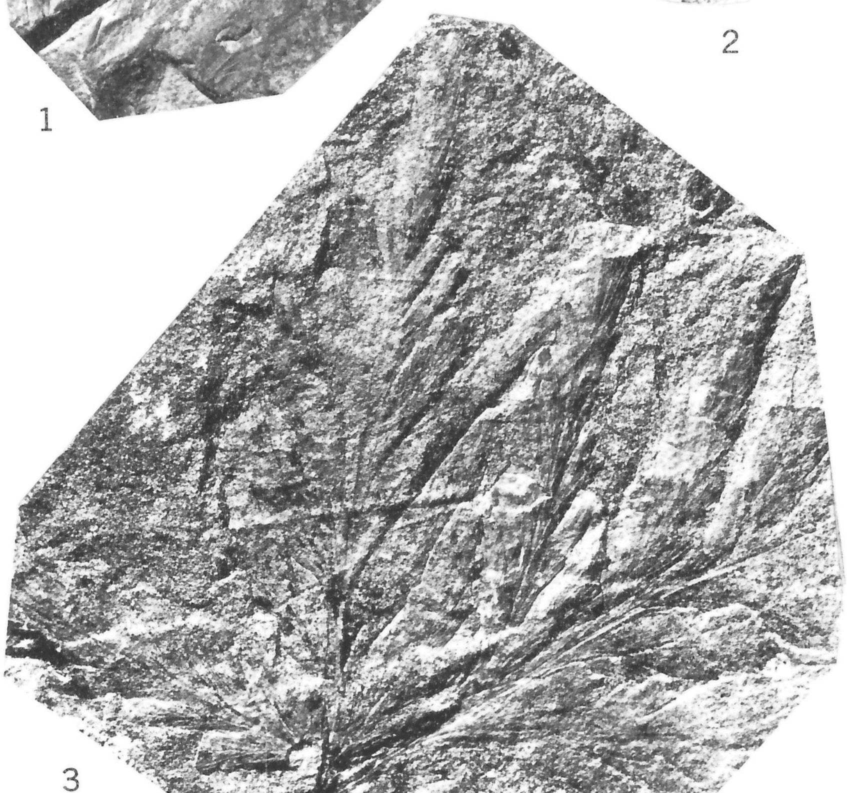


Plate IV

Figure 1.	*Sphenopteris stricta* (Newberry) Hypotype, GSC No. 1046. Dunvegan Formation, GSC locality 5252.	(P. 19)
Figure 2.	*Sphenopteris stricta* (Newberry) Hypotype, GSC No. 1049. Dunvegan Formation, GSC locality 4192.	(P. 19)
Figure 3.	*Sphenopteris stricta* (Newberry) Hypotype, GSC No. 1048. Dunvegan Formation, GSC locality 4193.	(P. 19)

1

2



3

Plate V

Figure 1. *Sphenopteris stricta* (Newberry) (P. 19)
Hypotype, GSC No. 1047x3. Dunvegan Formation, GSC locality 4192.

Figure 2. *Cladophlebis arctica*? (Heer) (P. 21)
Hypotype?, GSC No. 1053. Dunvegan Formation, GSC locality 4195.

Figure 3. *Sphenopteris stricta* (Newberry) (P. 19)
Hypotype, GSC No. 1050x2. Dunvegan Formation, GSC locality 4193.

PLATE V

1

2

3

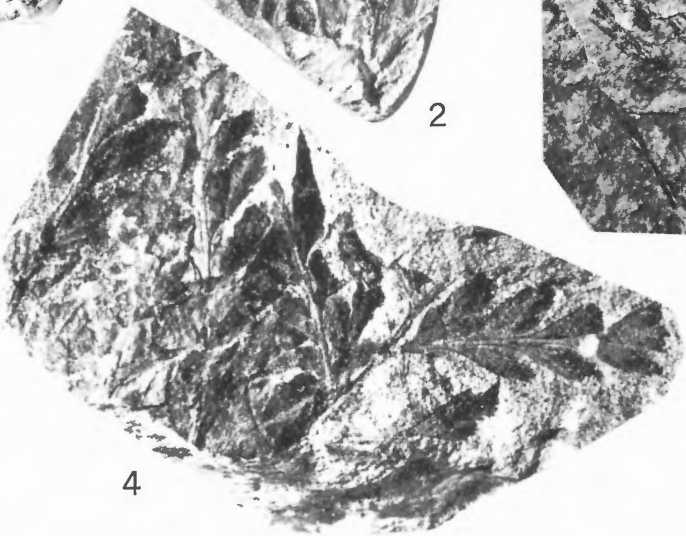
Plate VI

Figure 1.	*Sphenopteris stricta* (Newberry) (P. 19) Hypotype, GSC No. 1108. Dunvegan Formation, GSC locality 4192.
Figure 2.	*Sphenopteris stricta* (Newberry) (P. 19) Hypotype, GSC No. 1110. Dunvegan Formation, GSC locality 4192.
Figure 3.	*Sphenopteris stricta* (Newberry) (P. 19) Hypotype, GSC No. 1285. Dunvegan Formation, GSC locality 3351.
Figure 4.	*Sphenopteris* (*Dennstaedtia*?) *burlingi* Bell (P. 20) Hypotype, GSC No. 1291x2. Milk River Formation, GSC locality 3934.
Figure 5.	*Sphenopteris stricta* (Newberry) (P. 19) Hypotype, GSC No. 1051. Dunvegan Formation, GSC locality 4192.

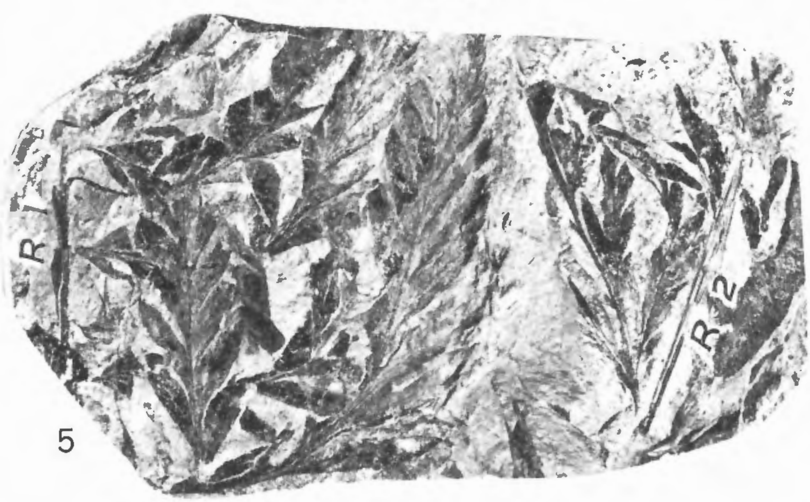
1

2

3



4



5

Plate VII

Figure 1. *Cladophlebis simplicima* n. sp. (P. 22)
Paratype, GSC No. 1111. Dunvegan Formation, GSC locality 5254.

Figure 2. *Cladophlebis arctica*? (Heer) (P. 21)
Hypotype?, GSC No. 1113. Bad Heart Formation, GSC locality 5188.

Figure 3. *Cladophlebis* sp. cf. *C. virginiensis* Fontaine (P. 21)
GSC No. 1114. Dunvegan Formation, GSC locality 4194.

Figure 4. *Cladophlebis simplicima* n. sp. (P. 22)
Paratype, GSC No. 1112x3. Dunvegan Formation, GSC locality 5254.

Figure 5. *Cladophlebis simplicima* n. sp. (P. 22)
Holotype, GSC No. 1271x3. Milk River Formation, GSC locality 3934.

Figure 6. *Cladophlebis simplicima* n. sp. (P. 22)
Paratype, GSC No. 1111x3. Dunvegan Formation, GSC locality 5254.

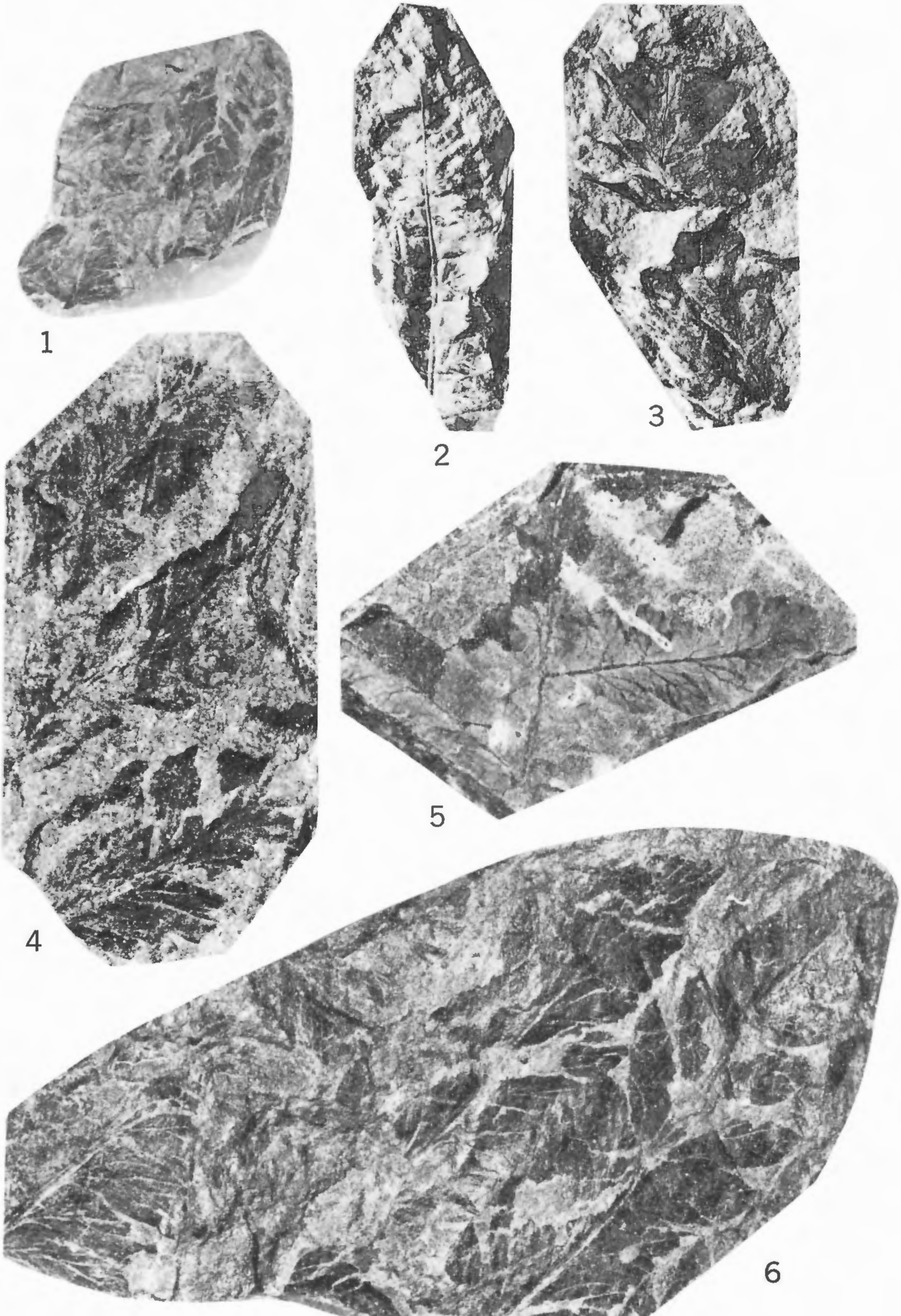
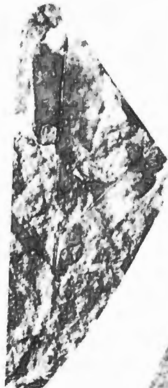

1
2
3
4
5
6

Plate VIII

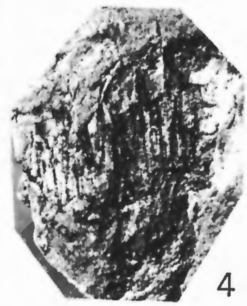
Figure 1.	*Filicites* sp. GSC No. 1070. Dunvegan Formation, GSC locality 4193.	(P. 22)
Figure 2.	*Filicites* sp. GSC No. 1070x3.	(P. 22)
Figure 3.	*Equisetum* sp. GSC No. 1274x3. Milk River Formation, GSC locality 3934.	(P. 23)
Figure 4.	*Equisetum* sp. GSC No. 1272x3. Milk River Formation, GSC locality 3934.	(P. 23)
Figure 5.	*Pseudocycas unjiga* (Dawson) Syntype, GSC No. 5125x3. Dunvegan Formation, GSC locality 3232.	(P. 24)



1

2

3



4

5

Plate IX

Figure 1.	*Baiera* sp. cf. *B. furcata* (Lindley and Hutton) Braun GSC No. 1189. Dunvegan Formation, GSC locality 5649.	(P. 24)
Figure 2.	*Equisetum* sp. GSC No. 1276. Milk River Formation, GSC locality 3934.	(P. 23)
Figure 3.	*Ginkgo* sp. GSC No. 1292. Dunvegan Formation, GSC locality 4193.	(P. 24)
Figure 4.	*Equisetum* sp. GSC No. 1275. Milk River Formation, GSC locality 3934.	(P. 23)
Figure 5.	*Protophyllocladus polymorpha* (Lesquereux) Hypotype, GSC No. 1187. Dunvegan Formation, GSC locality 5692.	(P. 31)
Figure 6.	*Pseudocycas unjiga* (Dawson) Syntype, GSC No. 5393. Dunvegan Formation, GSC locality 285.	(P. 24)
Figure 7.	*Pseudocycas unjiga* (Dawson) Hypotype, GSC No. 1183x½. Dunvegan Formation, GSC locality 3784.	(P. 24)

PLATE IX

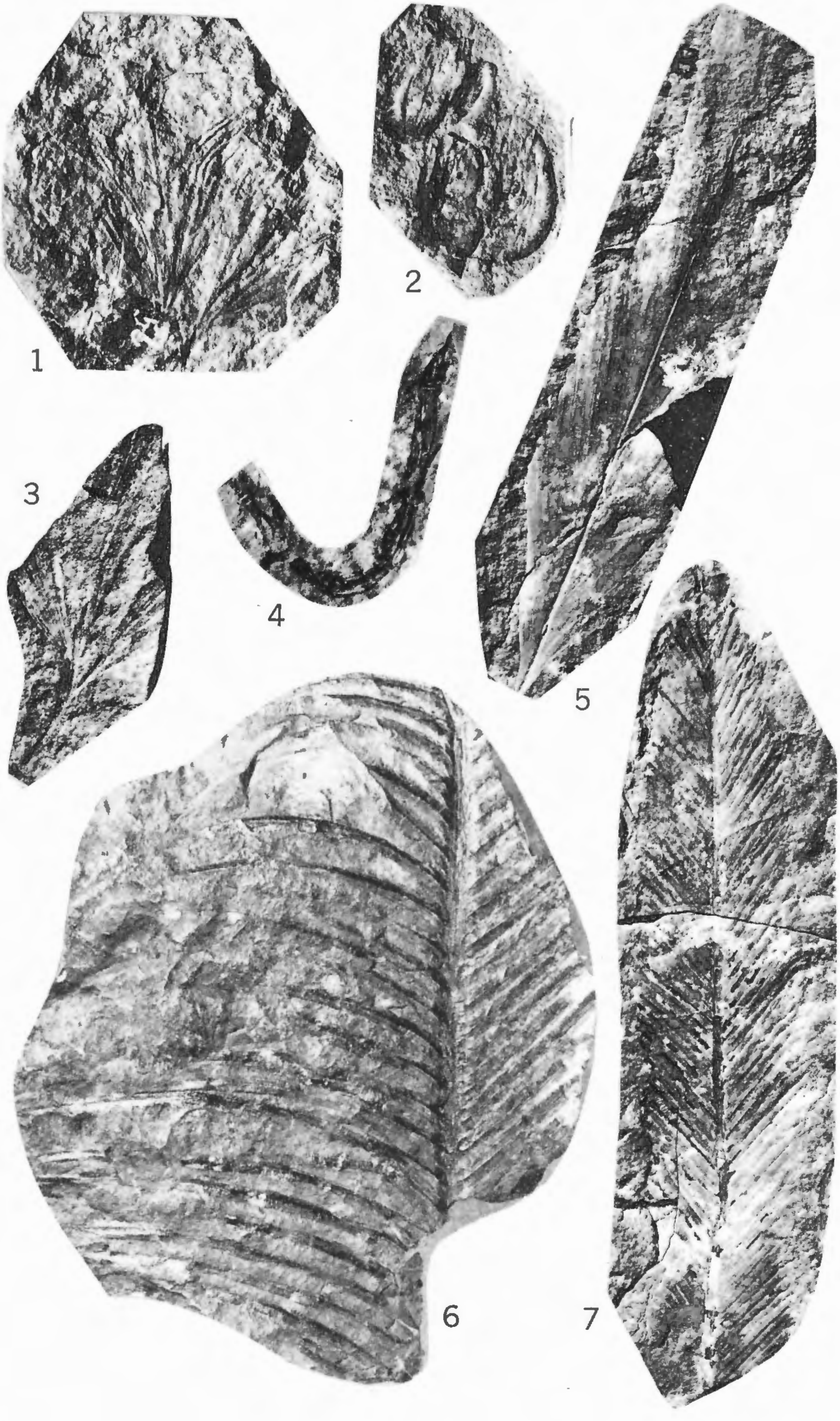


Plate X

Figure 1. *Metasequoia cuneata* (Newberry) (P. 29)
Hypotype, GSC No. 1095. Dunvegan Formation, GSC locality 4192.

Figure 2. *Metasequoia cuneata* (Newberry) (P. 29)
Hypotype, GSC No. 1167. Dunvegan Formation, GSC locality 3618.

Figure 3. *Metasequoia cuneata* (Newberry) (P. 29)
Hypotype, GSC No. 1180x3. Dunvegan Formation, GSC locality 3351.

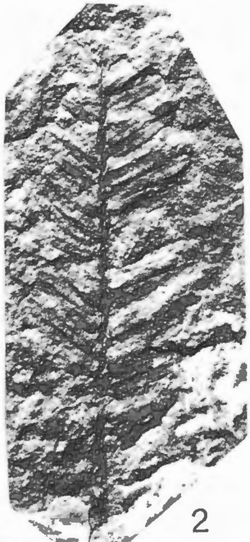
Figure 4. *Elatocladus* sp. cf. *Sequoia major* Velenovsky and Viniklar (P. 29)
GSC No. 1156. Milk River Formation, GSC locality 3934.

Figure 5. *Dammarites robinsi* (Dawson) Bell (P. 26)
Hypotype, GSC No. 1188. Dunvegan Formation, GSC locality 4196.

Figure 6. *Cephalotaxopsis heterophylla* Hollick (P. 27)
Hypotype, GSC No. 1170x3. Dunvegan Formation, GSC locality 5692.

PLATE X

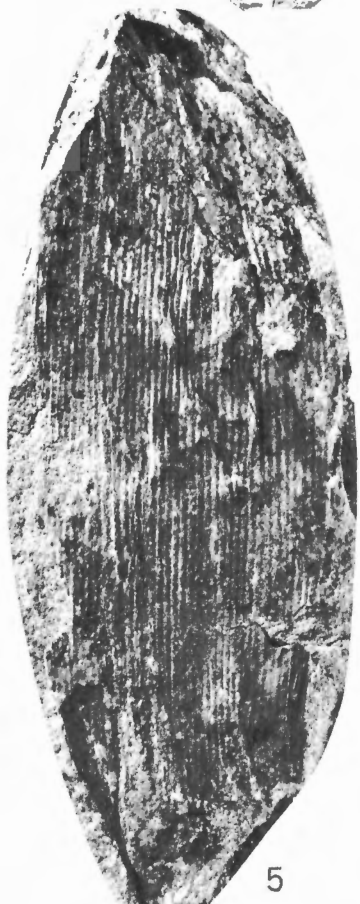
1



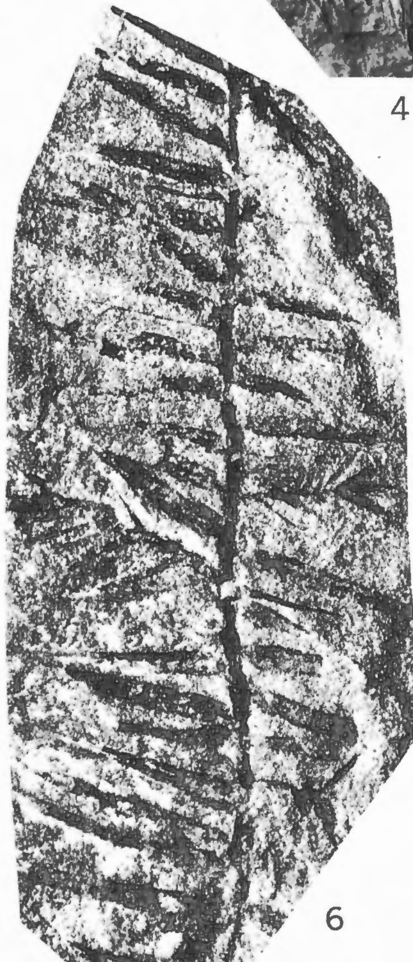
2

3

4



5



6

PLATE XI

Figure 1. *Elatocladus* sp. cf. *Sequoia major* Velenovsky and Viniklar (P. 29)
GSC No. 1153. Milk River Formation, GSC locality 3934.

Figure 2. *Elatocladus* sp. cf. *Sequoia major* Velenovsky and Viniklar (P. 29)
GSC No. 1156x3. Milk River Formation, GSC locality 3934.

Figure 3. *Brachyphyllum* (*Athrotaxites*?) *douglasi* n. sp. (P. 26)
?Paratype, GSC No. 1164x2. Milk River Formation, GSC locality 3934 (?immature cone).

Figure 4. *Geinitzia formosa* Heer (P. 28)
Hypotype, GSC No. 1118x3. Milk River Formation, GSC locality 3934.

Figure 5. *Geinitzia formosa* Heer (P. 28)
Hypotype, GSC No. 1116. Milk River Formation, GSC locality 1282.

PLATE XI

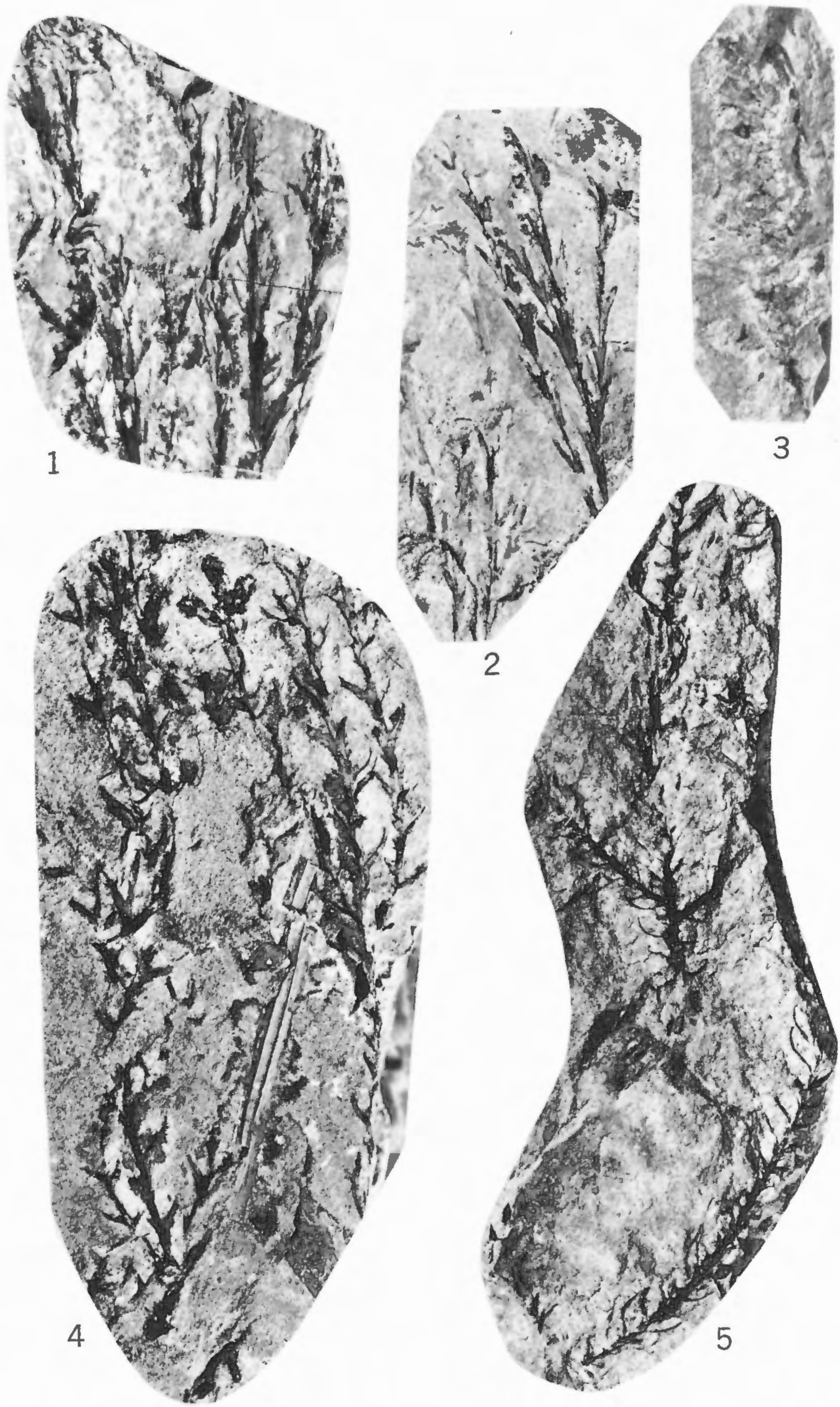


PLATE XII

Figure 1. *Widdringtonites reichii* (Ettingshausen) Heer (P. 30)
Hypotype, GSC No. 1158. Dunvegan Formation, GSC locality 3623.

Figure 2. *Geinitzia formosa* Heer (P. 28)
Hypotype, GSC No. 5150. Milk River Formation, GSC locality 844.

Figure 3. *Geinitzia formosa* Heer (P. 28)
Hypotype, GSC No. 1117x2. Milk River Formation, GSC locality 3934.

Figure 4. *Sequoiites* sp. cf. *Geinitzia formosa* Heer (P. 28)
GSC No. 1079. Dunvegan Formation, GSC locality 4208.

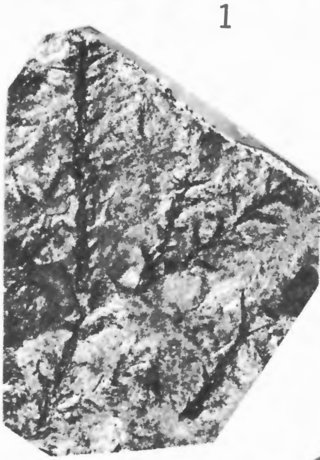
Figure 5. *Geinitzia formosa* Heer (P. 28)
Hypotype, GSC No. 1117. Milk River Formation, GSC locality 3934.

Figure 6. *Sequoiites* sp. cf. *Geinitzia formosa* Heer (P. 28)
GSC No. 1166. Bad Heart Formation, GSC locality 5188.

1

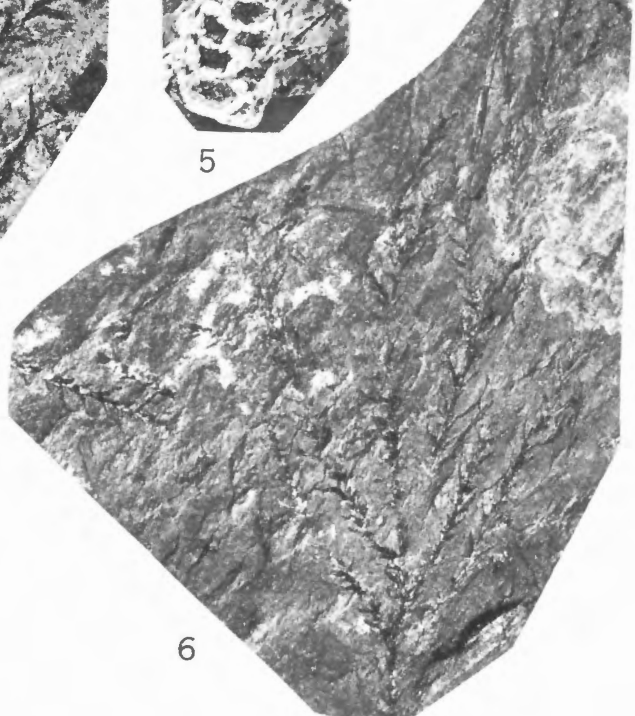
2

3



4

5



6

Plate XIII

Figure 1. *Widdringtonites reichii* (Ettingshausen) Heer (P. 30)
Hypotype, GSC No. 1069. Dunvegan Formation, GSC locality 4192.

Figure 2. *Brachyphyllum* (*Athrotaxites*?) *douglasi* n. sp. (P. 26)
Holotype, GSC No. 1160. Milk River Formation, GSC locality 3934.

Figure 3. *Elatocladus albertaensis* Bell (P. 31)
Hypotype, GSC No. 1115. Milk River Formation, GSC locality 1282.

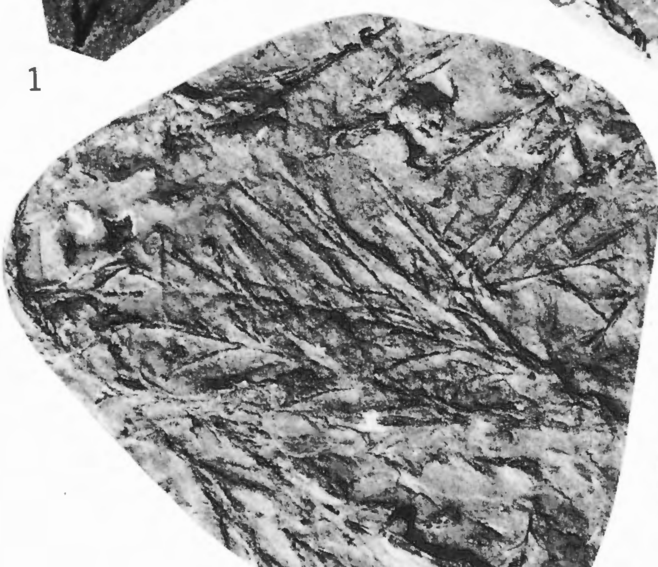
Figure 4. *Widdringtonites reichii* (Ettingshausen) Heer (P. 30)
Hypotype, GSC No. 1165. Dunvegan Formation, GSC locality 3781.

Figure 5. *Brachyphyllum* (*Athrotaxites*?) *douglasi* n. sp. (P. 26)
Paratype, GSC No. 1163x3. Milk River Formation, GSC locality 3934.

1

2

3



4

5

PLATE XIV

Figure 1. *Torreyites dicksonioides* (Dawson) n. comb. (P. 27)
Holotype, GSC No. 5127. Dunvegan Formation, GSC locality 287.

Figure 2. *Alnus perantiqua* (Dawson) Bell (P. 32)
Hypotype, GSC No. 1264. Milk River Formation, GSC locality 3934.

Figure 3. *Dryophyllum gracile* Debey (P. 32)
Hypotype, GSC No. 1080. Dunvegan Formation, GSC locality 4195.

Figure 4. *Elatocladus albertaensis* Bell (P. 31)
Hypotype, GSC No. 1151. Milk River Formation, GSC locality 1619.

Figure 5. *Brachyphyllum* (*Athrotaxites*?) *douglasi* n. sp. (P. 26)
Paratype, GSC No. 1161x2. Milk River Formation, GSC locality 3934.

Figure 6. *Elatocladus albertaensis* Bell (P. 31)
Hypotype, GSC No. 5007x2 (syntype of *Picea albertensis* Penhallow). Belly River Group, Red Deer River, Alberta.

Figure 7. *Ficus glascoeana* Lesquereux (P. 33)
Hypotype, GSC No. 1066x4/7. Dunvegan Formation, GSC locality 4196.

PLATE XIV

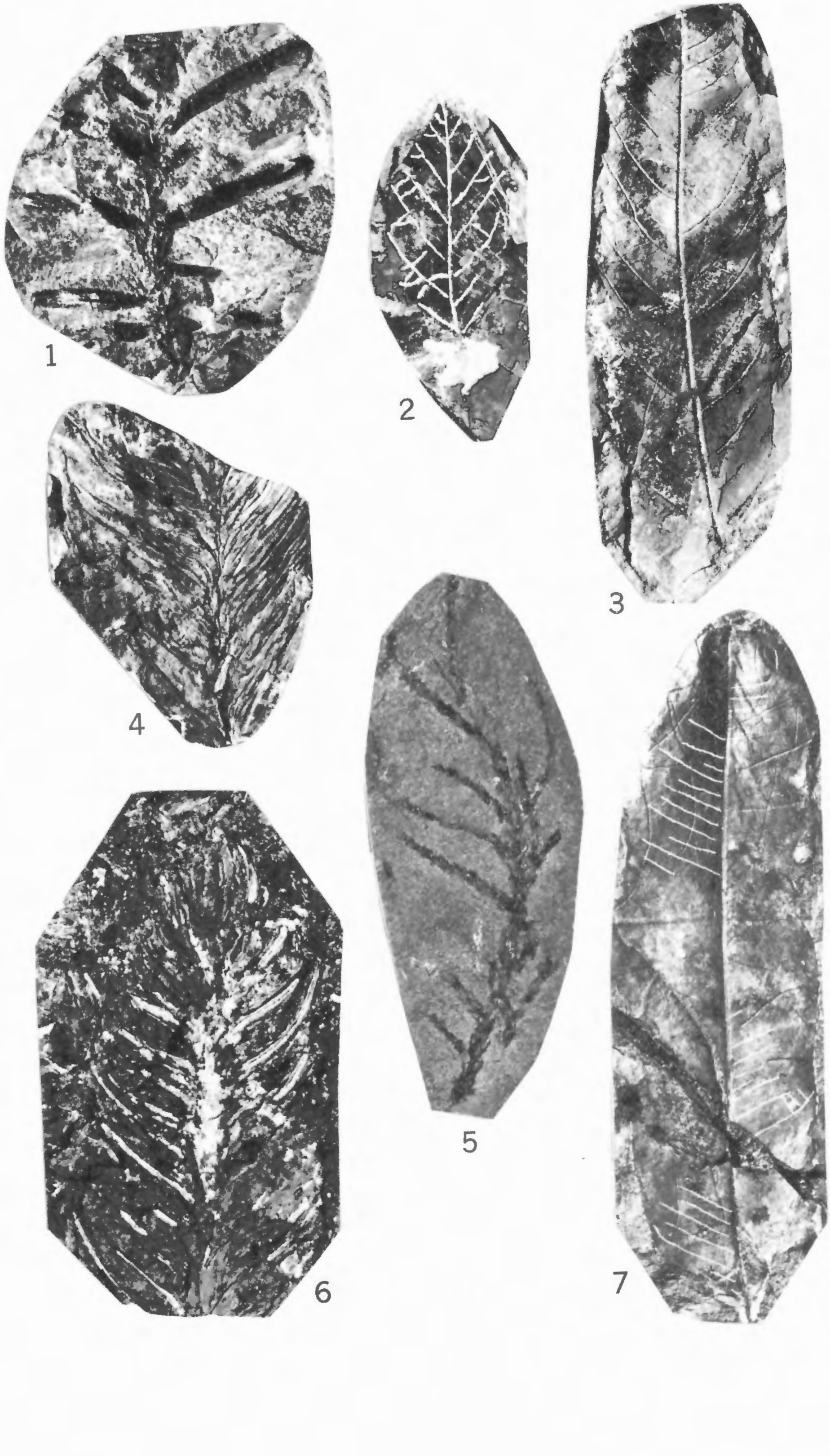


PLATE XV

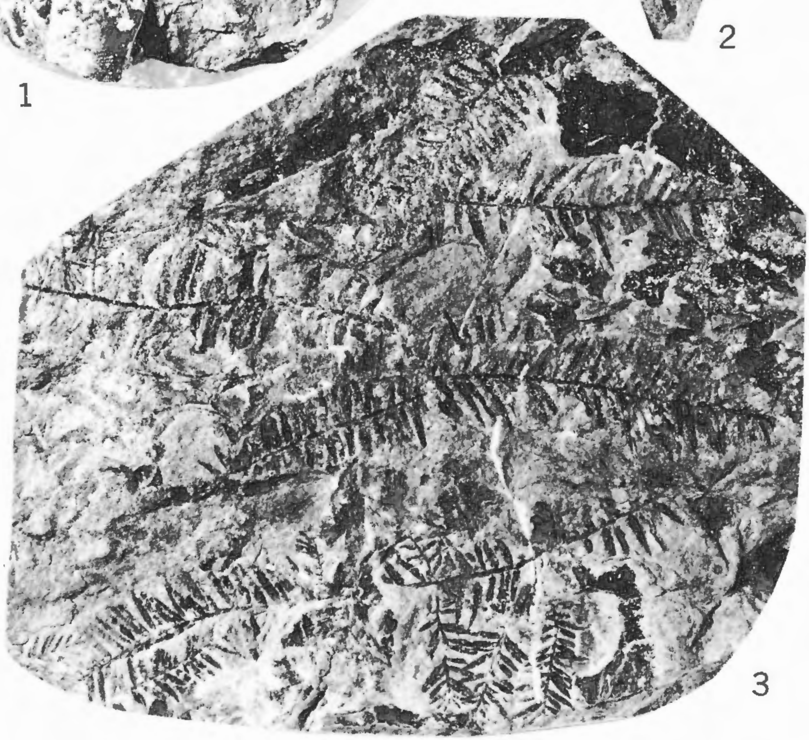
Figure 1. *Ficus daphnogenoides* (Heer) Berry (P. 33)
Hypotypes, GSC Nos. 1073 (left) and 1074 (right). Dunvegan Formation, GSC locality 4195.

Figure 2. *Ficus daphnogenoides* (Heer) Berry (P. 33)
Hypotype, GSC No. 5390 (type of *Laurophyllum debile* Dawson). Dunvegan Formation, GSC locality 284 (4204).

Figure 3. *Cephalotaxopsis heterophylla* Hollick (P. 27)
Hypotype, GSC No. 1169. Dunvegan Formation, GSC locality 3228.

1

2



3

Plate XVI

Figure 1. *Ficus missouriensis* Knowlton (P. 34)
Hypotype, GSC No. 1257. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Figure 2. *Ficus missouriensis* Knowlton (P. 34)
Hypotype, GSC No. 5054. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Figure 3. *Ficus trinervis* Knowlton (P. 34)
Hypotype, GSC No. 5068. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Figure 4. *Ficus daphnogenoides* (Heer) Berry (P. 33)
Hypotype, GSC No. 1296x¾. Dunvegan Formation, GSC locality 3351.

Figure 5. *Ficus daphnogenoides* (Heer) Berry (P. 33)
Hypotype, GSC No. 1294x3. Dunvegan Formation, GSC locality 3352.

Figure 6. *Ficus trinervis* Knowlton (P. 34)
Hypotype, GSC No. 5067. Milk River Formation, GSC locality 845.

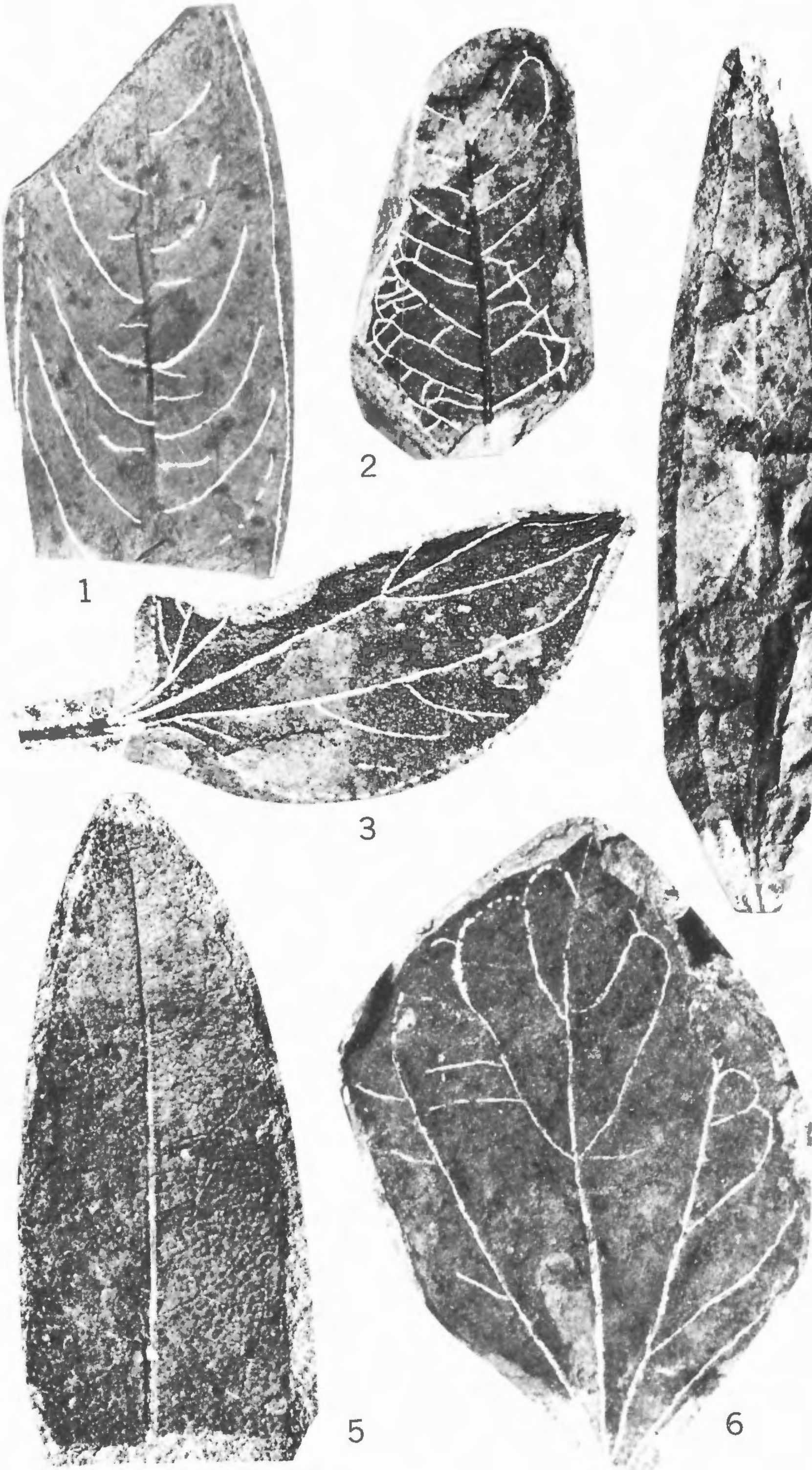

1
2
3
4
5
6

Plate XVII

Figure 1. *Ficus trinervis* Knowlton (P. 34)
Hypotype, GSC No. 5069. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Figure 2. *Nymphaeites exemplaris* Hollick (P. 35)
Hypotype, GSC No. 1075. Dunvegan Formation, GSC locality 4198.

Figure 3. *Castaliites* sp. cf. *C. cordatus* Hollick (P. 36)
GSC No. 1147. Dunvegan Formation, GSC locality 3664.

Figure 4. *Nymphaeites exemplaris* Hollick (P. 35)
Hypotype, GSC No. 1222. Dunvegan Formation, GSC locality 3780.

Figure 5. *Ficus*? sp. (P. 35)
GSC No. 1279. Dunvegan Formation, GSC locality 5135.

Figure 6. *Castaliites* sp. cf. *C. cordatus* Hollick (P. 36)
GSC No. 1219. Dunvegan Formation, GSC locality 3629.

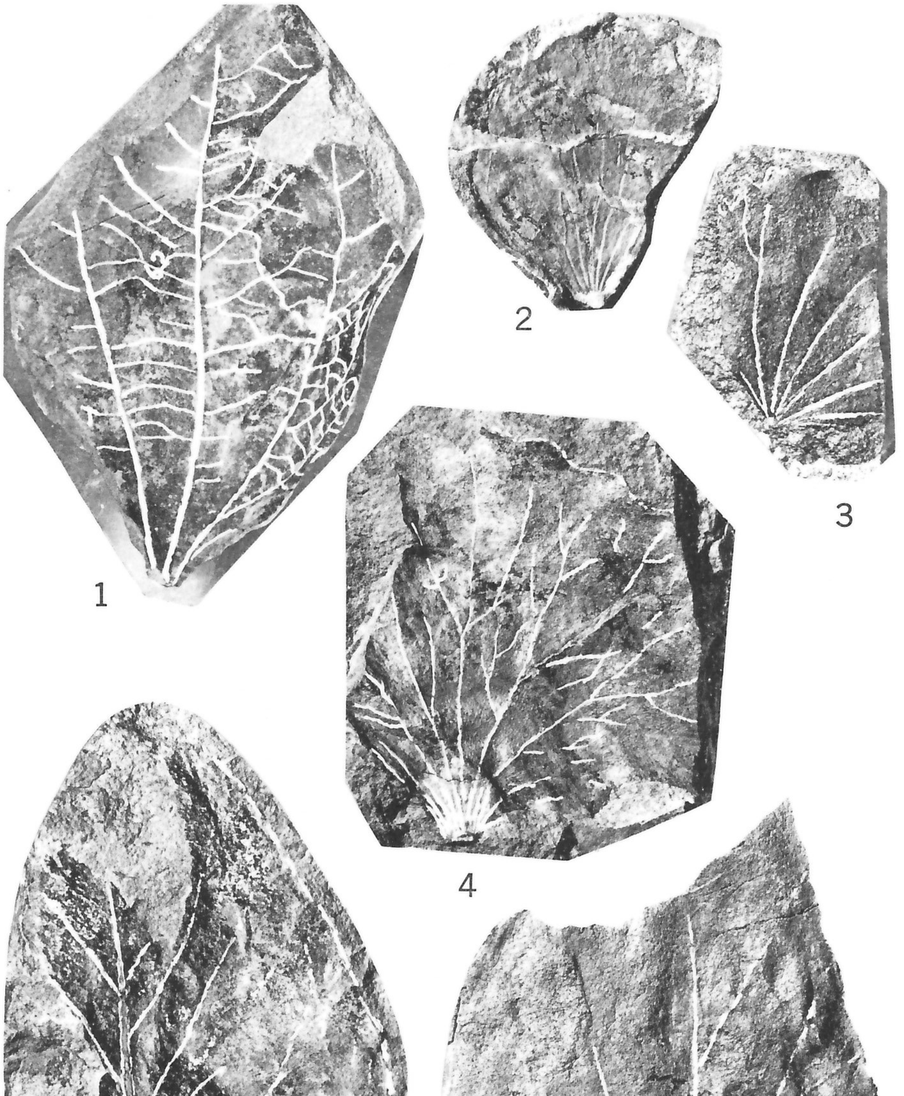

1
2
3
4
5
6

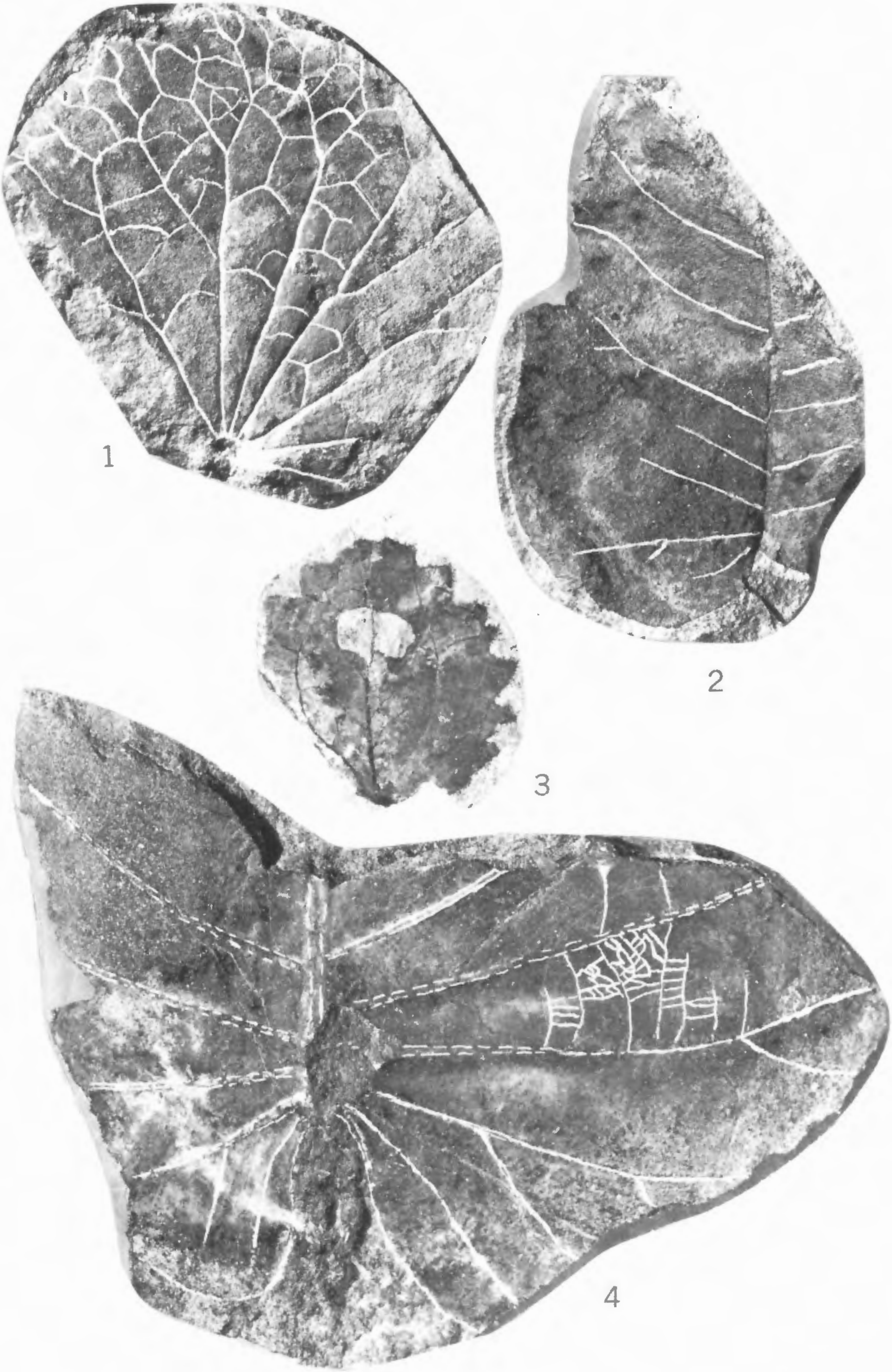
Plate XVIII

Figure 1. *Castaliites* sp. cf. *C. cordatus* Hollick (P. 36)
GSC No. 1218. Dunvegan Formation, GSC locality 3936.

Figure 2. *Palaeonuphar nordenskiöldi* (Heer) n. comb. (P. 36)
Hypotype, GSC No. 1240. Dunvegan Formation, GSC locality 3664.

Figure 3. *Trochodendroides* (*Cercidiphyllum*?) *arctica* (Heer) Berry (P. 37)
Hypotype, GSC No. 1260x3. Milk River Formation, GSC locality 3934.

Figure 4. *Palaeonuphar nordenskiöldi* (Heer) n. comb. (P. 36)
Hypotype, GSC No. 1221. Dunvegan Formation, GSC locality 1197.



1 2 3 4

Plate XIX

Figure 1. *Trochodendroides* (*Cercidiphyllum*?) *arctica* (Heer) Berry (P. 37)
Hypotype, GSC No. 1261. Bad Heart Formation, GSC locality 5188.

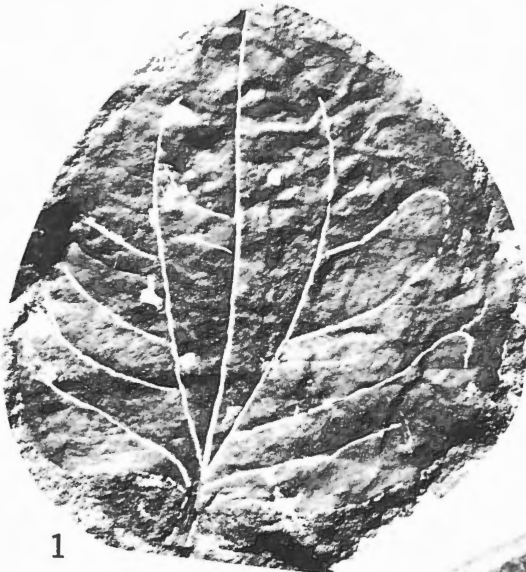
Figure 2. *Trochodendroides* (*Cercidiphyllum*?) *arctica* (Heer) Berry (P. 37)
Hypotype, GSC No. 1259. Milk River Formation, GSC locality 3934.

Figure 3. *Trochodendroides* (*Cercidiphyllum*?) *arctica* (Heer) Berry (P. 37)
Hypotype, GSC No. 1263. Bad Heart Formation, GSC locality 5188.

Figure 4. *Trochodendroides* (*Cercidiphyllum*?) *arctica* (Heer) Berry (P. 37)
Hypotype, GSC No. 1262. Bad Heart Formation, GSC locality 5188.

Figure 5. *Trochodendroides* (*Cercidiphyllum*?) *potomacensis* (Ward) (P. 38)
Hypotype, GSC No. 1224x3. Dunvegan Formation, GSC locality 3784.

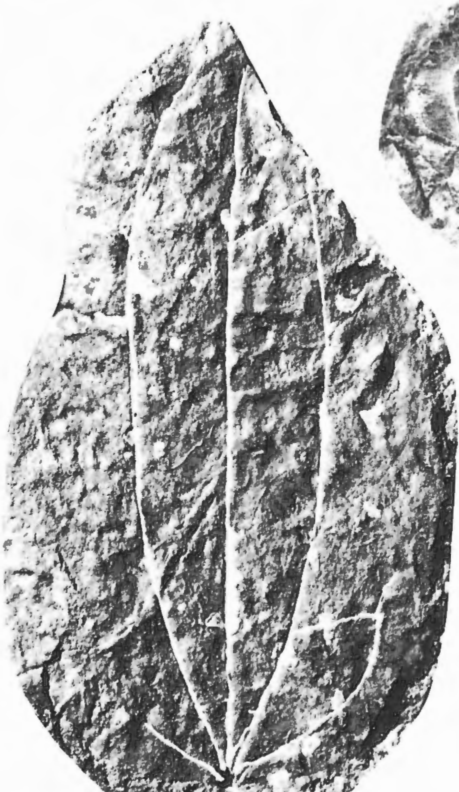
PLATE XIX



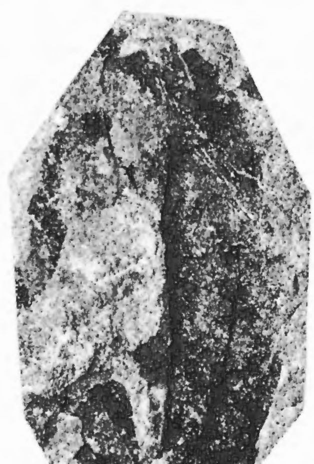
1

2

3



4



5

Plate XX

Figure 1. *Magnolia magnifica* Dawson (P. 41)
Holotype, GSC No. 5133x⅔. Dunvegan Formation, GSC locality 290.

Figure 2. *Populites wickendeni* n. sp. (P. 40)
Holotype, GSC No. 1247. Milk River Formation, GSC locality 3934.

Figure 3. *Menispermites* sp. (P. 40)
GSC No. 1255. Milk River Formation, GSC locality 845.

Figure 4. *Menispermites* sp. (Knowlton) n. comb. (P. 39)
Figured specimen, GSC No. 1220. Eagle sandstone equivalent of Milk River Formation, Montana, GSC locality 1622.


1
2
3
4

Plate XXI

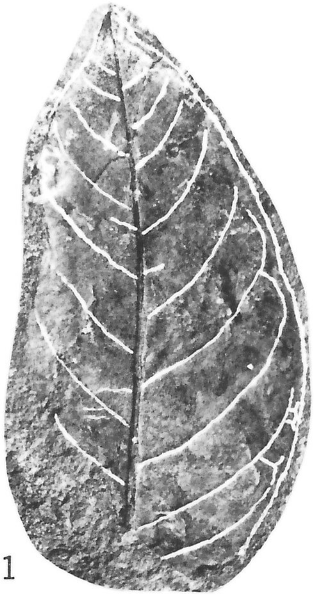
Figure 1. *Magnolia? coalvillensis* Knowlton (P. 42)
Hypotype, GSC No. 5064. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1622.

Figure 2. *Trochodendroides dorfi?* n. sp. (P. 39)
Hypotype, GSC No. 5050. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Figure 3. *Populites wickendeni* n. sp. (P. 40)
Paratype, GSC No. 1248. Milk River Formation, GSC locality 3934.

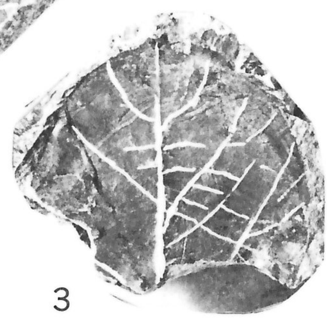
Figure 4. *Ficus glascoeana* Lesquereux (P. 33)
Hypotype, GSC No. 1071. Dunvegan Formation, GSC locality 4196.

Figure 5. *Magnolia magnifica* Dawson (P. 41)
Hypotype, GSC No. 5128 (holotype of *Ficus maxima* Dawson). Dunvegan Formation, GSC locality 290.

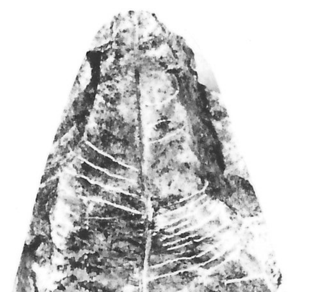


1

2



3



4

5

Plate XXII

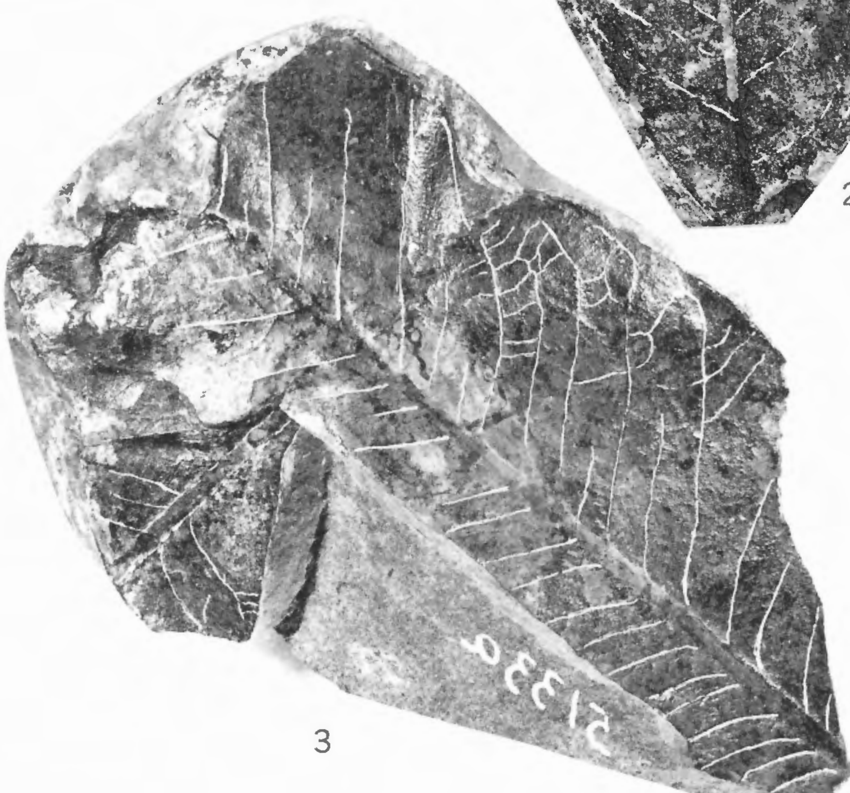
Figure 1. *Magnolia lacoeana* Lesquereux (P. 42)
Hypotype, GSC No. 1234. Dunvegan Formation, GSC locality 3664.

Figure 2. *Magnolia boulayana* Lesquereux (P. 41)
Hypotype, GSC No. 1065. Dunvegan Formation, GSC locality 4195.

Figure 3. *Magnolia magnifica* Dawson (P. 41)
Hypotype, GSC No. 5133ax⅘. Dunvegan Formation, GSC locality 290.

1

2



3

Plate XXIII

Figure 1. *Magnolia rhamnoides* n. sp. (P. 43)
Paratype, GSC No. 1064. Dunvegan Formation, GSC locality 4194.

Figure 2. *Magnolia*? *coalvillensis* Knowlton (P. 42)
Hypotype, GSC No. 5063. Milk River Formation, GSC locality 845.

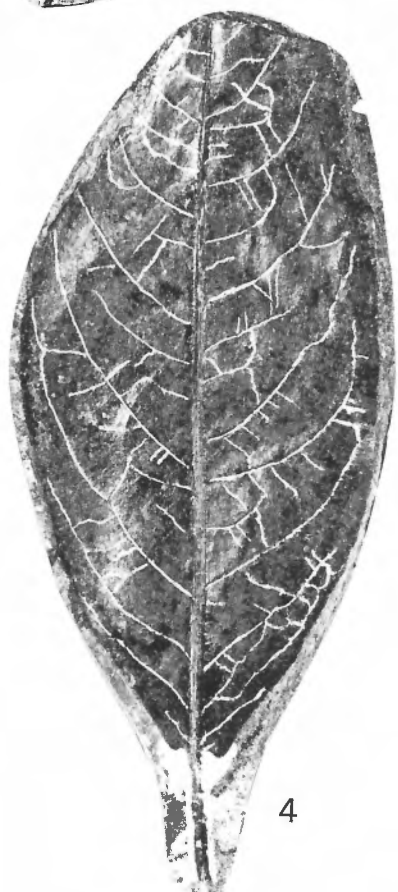
Figure 3. *Magnolia boulayana* Lesquereux (P. 41)
Hypotype, GSC No. 1063. Dunvegan Formation, GSC locality 4197.

Figure 4. *Magnolia rhamnoides* n. sp. (P. 43)
Holotype, GSC No. 1067. Dunvegan Formation, GSC locality 4194.

1

2

3



4

Plate XXIV

Figure 1.	*Magnolia rhamnoides* n. sp. Paratype, GSC No. 1059. Dunvegan Formation, GSC locality 4193.	(P. 43)
Figure 2.	*Magnolia rhamnoides* n. sp. Paratype, GSC No. 5397. Dunvegan Formation, GSC locality 287.	(P. 43)
Figure 3.	*Magnolia rhamnoides* n. sp. Paratype, GSC No. 1060. Dunvegan Formation, GSC locality 4193.	(P. 43)
Figure 4.	*Magnolia rhamnoides* n. sp. Paratype, GSC No. 1233. Dunvegan Formation, GSC locality 3292.	(P. 43)


1
2
3
4

Plate XXV

Figure 1. *Magnolia hollicki* Berry (P. 44)
Hypotype, GSC No. 1068. Dunvegan Formation, GSC locality 3780.

Figure 2. *Laurophyllum flexuosum* (Newberry) n. comb. (P. 45)
Hypotype, GSC No. 5396 (*Proteoides longus* Dawson). Dunvegan Formation, GSC locality 4205.

Figure 3. *Liriodendron giganteum* Lesquereux pars (P. 44)
Hypotype, GSC No. 1185. Dunvegan Formation, GSC locality 3664.

Figure 4. *Laurophyllum flexuosum* (Newberry) n. comb. (P. 45)
Hypotype, GSC No. 1072. Dunvegan Formation, GSC locality 4193.

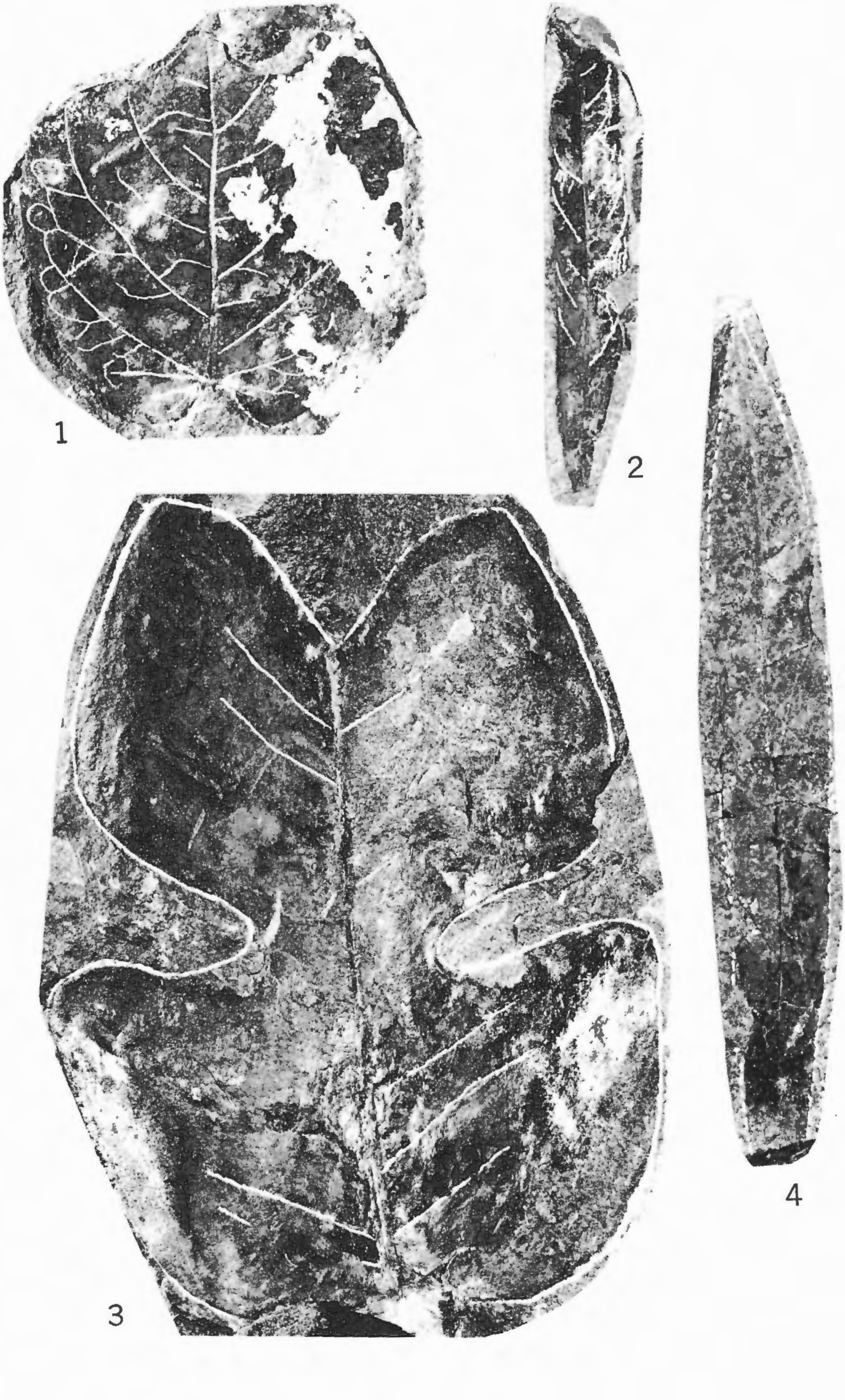

1
2
3
4

Plate XXVI

Figure 1. *Laurophyllum* sp. (P. 46)
Figured specimen, GSC No. 5058. Milk River Formation, GSC locality 1282.

Figure 2. *Laurophyllum* sp. (P. 46)
GSC No. 1289. Milk River Formation, GSC locality 3934.

Figure 3. *Laurophyllum* sp. (P. 46)
GSC No. 5057. Milk River Formation, GSC locality 1282.

Figure 4. *Laurophyllum* sp. (P. 46)
GSC No. 5056. Milk River Formation, GSC locality 1271.

Figure 5. *Liriodendron giganteum* Lesquereux pars (P. 44)
Hypotype, GSC No. 1184x¾. Dunvegan Formation, GSC locality 3664.

PLATE XXVI

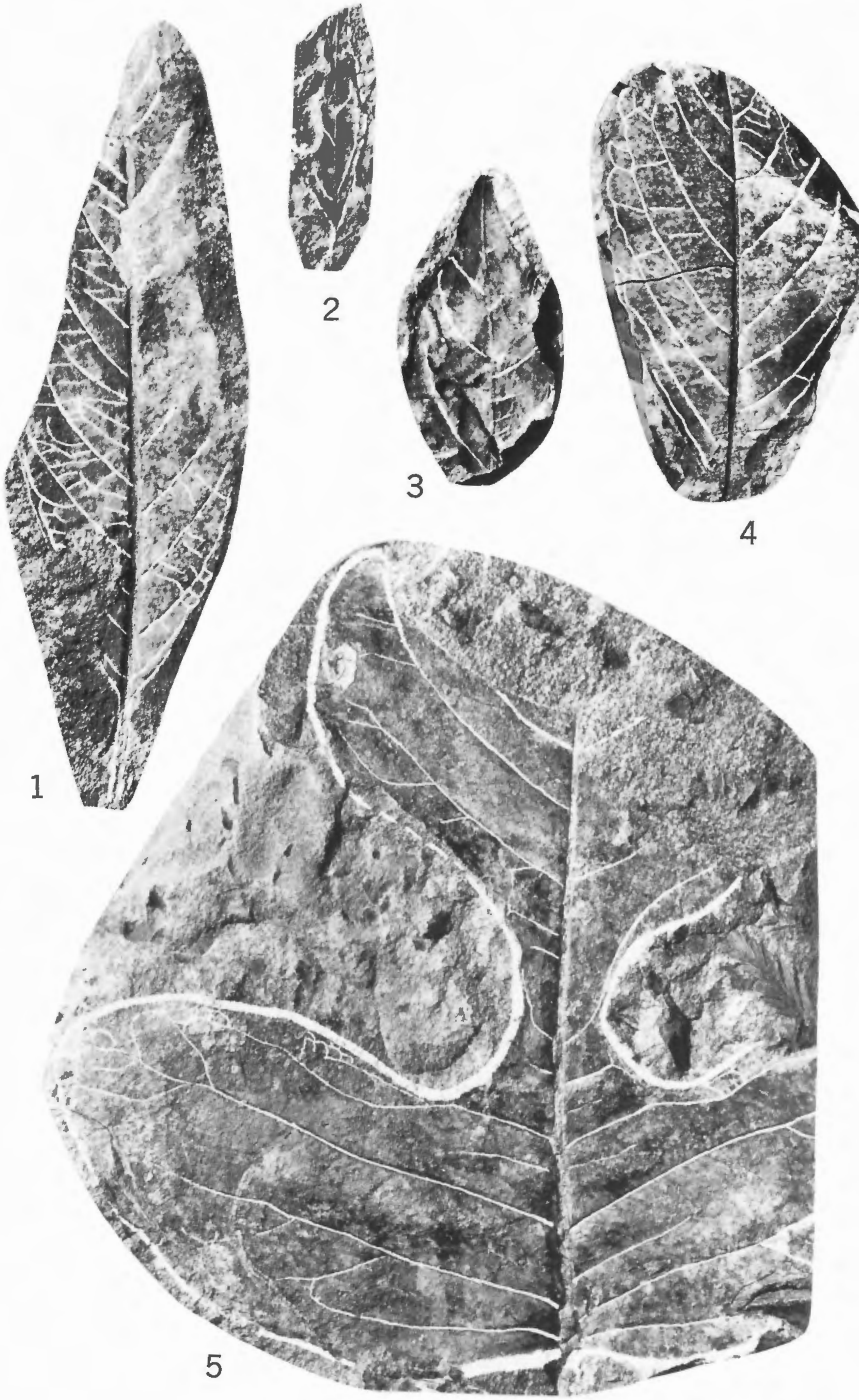


Plate XXVII

Figure 1. *Diospyros lesquereuxi* Knowlton and Cockerell (P. 62)
Hypotype, GSC No. 1238 (top leaf); and

Cinnamomum heeri Lesquereux (P. 46)
Hypotype, GSC No. 1286 (bottom leaf). Dunvegan Formation, GSC locality 5250.

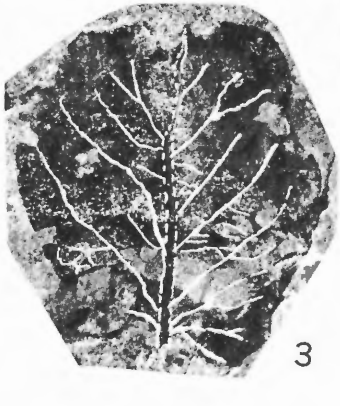
Figure 2. *Protophyllum multinerve*? Lesquereux (P. 51)
Hypotype?, GSC No. 5135. Dunvegan Formation, GSC locality 4205.

Figure 3. *Dalbergia hyperborea* Heer (P. 55)
Hypotype, GSC No. 1244. Dunvegan Formation, GSC locality 3780.

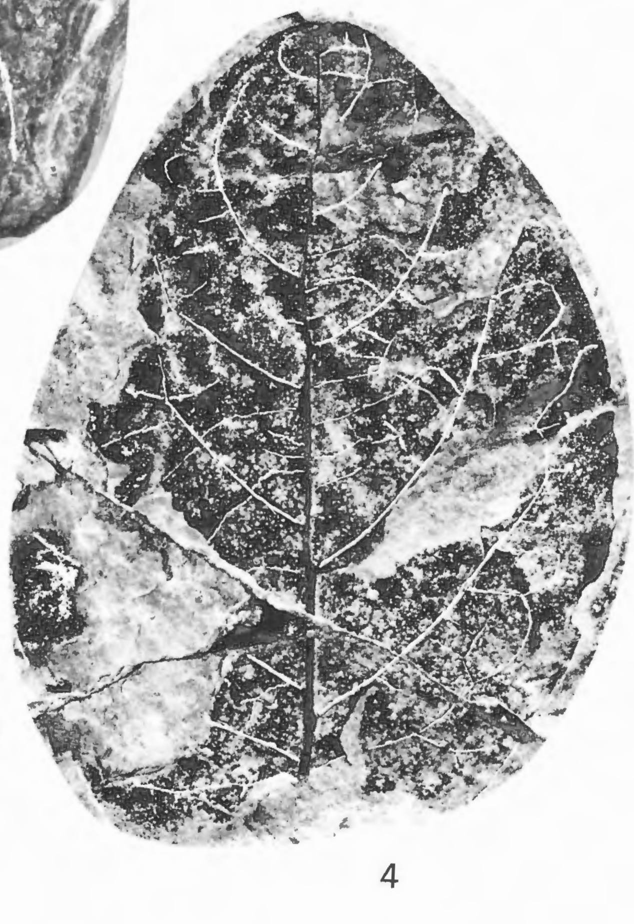
Figure 4. *Magnolia* sp. cf. *M. rotundifolia* Newberry (P. 43)
GSC No. 1236. Dunvegan Formation, GSC locality 3780.

1

2



3



4

Plate XXVIII

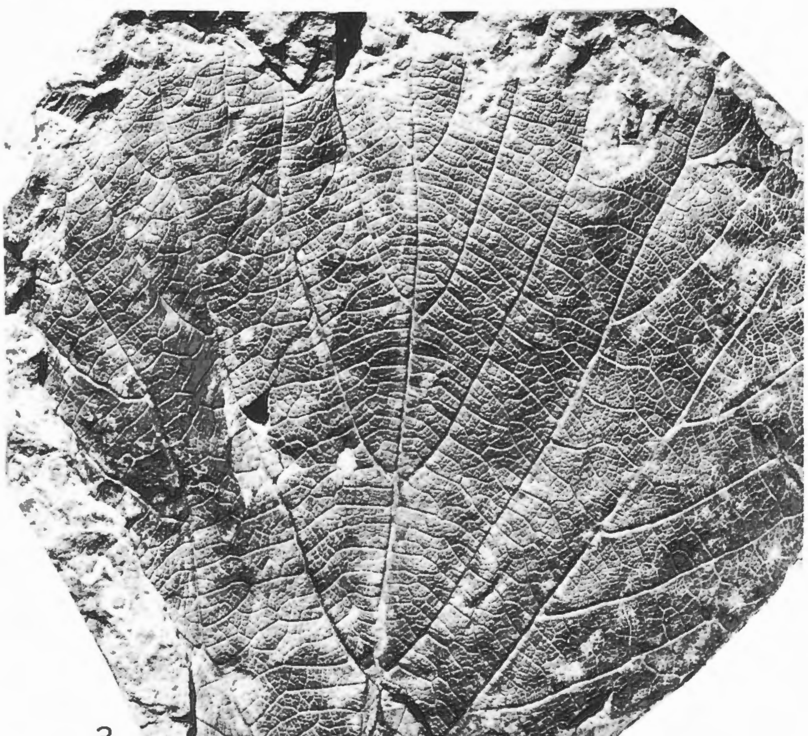
Figure 1. *Platanus newberryana* Heer (P. 48)
Hypotype, GSC No. 1101. Dunvegan Formation, GSC locality 4195.

Figure 2. *Platanus newberryana* Heer (P. 48)
Hypotype, GSC No. 1202. Dunvegan Formation, GSC locality 3200.

Figure 3. *Platanus williamsi* n. sp. (P. 47)
Paratype, GSC No. 1207x¾. Dunvegan Formation, GSC locality 3780.

1

2



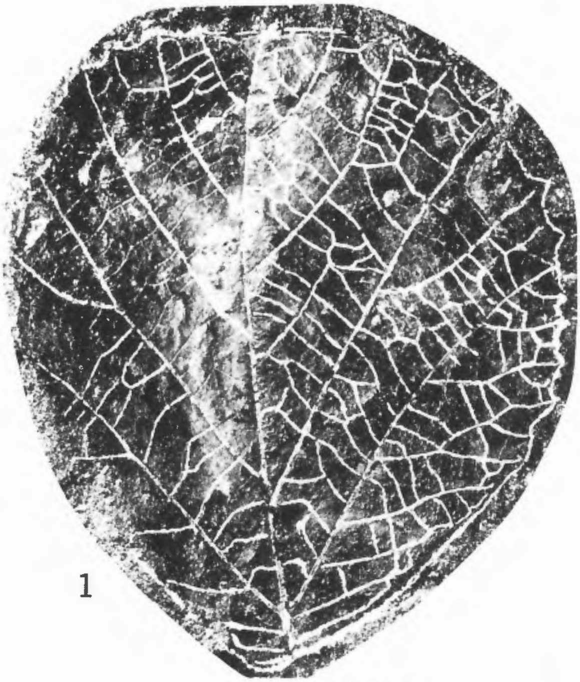
3

Plate XXIX

Figure 1. *Credneria truncatodenticulata* n. sp. (P. 50)
Holotype, GSC No. 1213. Dunvegan Formation, GSC locality 5703.

Figure 2. *Platanus williamsi* n. sp. (P. 47)
Paratype, GSC No. 1204. Dunvegan Formation, GSC locality 4196.

PLATE XXIX

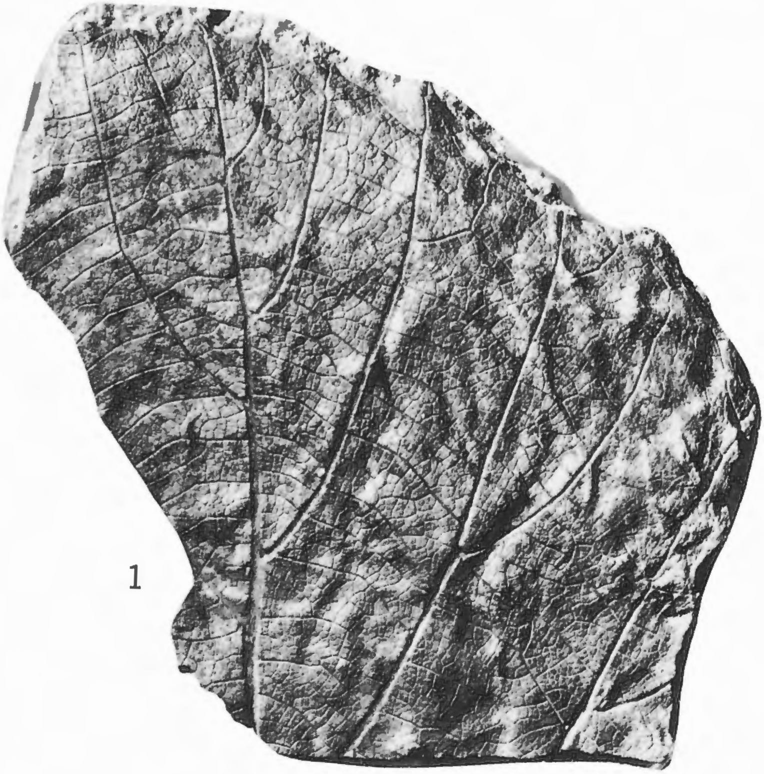


1

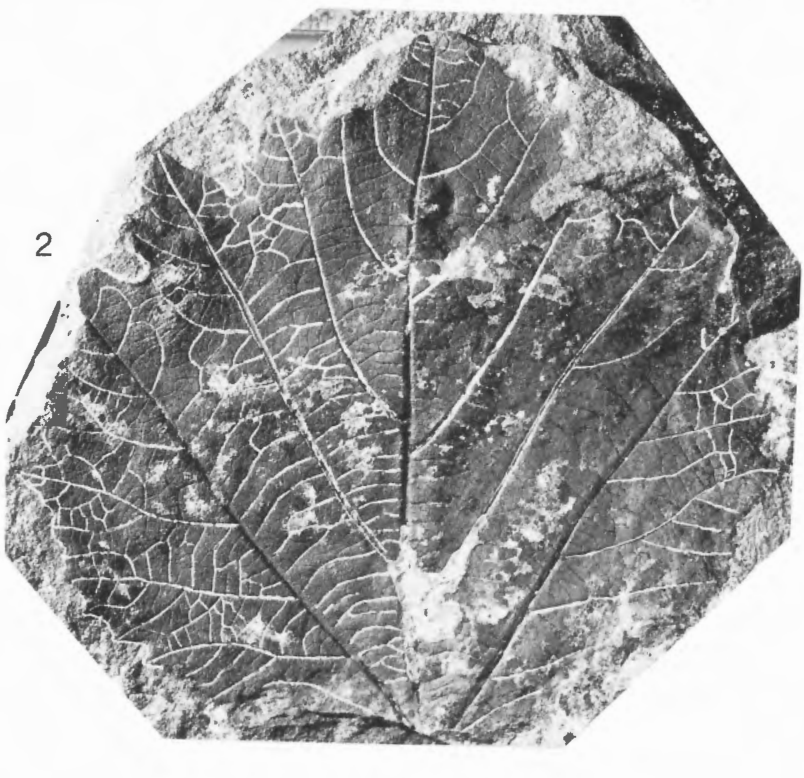
2

PLATE XXX

Figure 1.	*Platanus williamsi* n. sp. Paratype, GSC No. 1393x3/7. Dunvegan Formation, GSC locality 3780.	(P. 47)
Figure 2.	*Platanus williamsi* n. sp. Holotype, GSC No. 1098x½. Dunvegan Formation, GSC locality 4193.	(P. 47)



1



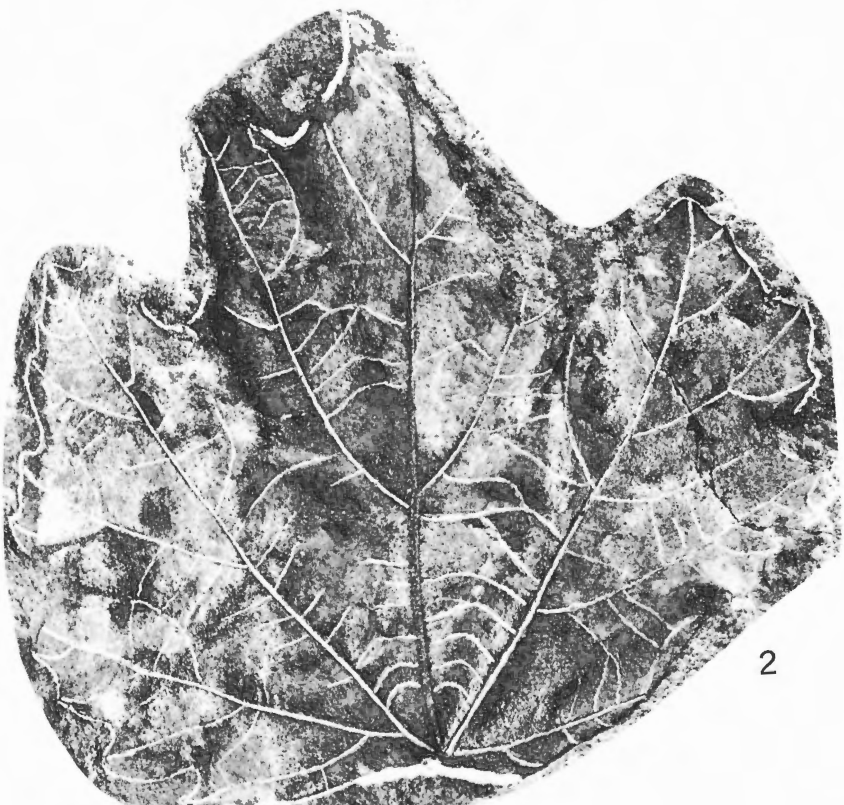
2

Plate XXXI

Figure 1. *Credneria macrophylla* Heer (P. 49)
Hypotype, GSC No. 1078x⅗. Dunvegan Formation, GSC locality 4193.

Figure 2. *Platanus latiloba* Newberry (P. 48)
Hypotype, GSC No. 1245. Dunvegan Formation, GSC locality 3664.

1



2

PLATE XXXII

Figure 1. *Platanus affinis* Lesquereux (P. 49)
Hypotype, GSC No. 1091. Dunvegan Formation, GSC locality 4197.

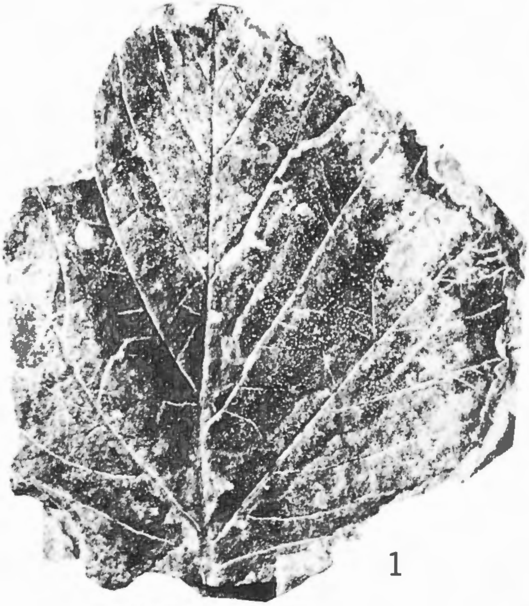
Figure 2. *Hymenaea fayettensis* Berry (P. 54)
Hypotype, GSC No. 5132 (*Diospyros nitida* Dawson). Dunvegan Formation. GSC locality 288.

Figure 3. *Bauhinia*? *cretacea*? Newberry (P. 55)
Hypotype?, GSC No. 1076. Dunvegan Formation, GSC locality 4194.

Figure 4. *Dalbergia hyperborea* Heer (P. 55)
Hypotype, GSC No. 1243. Dunvegan Formation, GSC locality 3780.

Figure 5. *Ampelophyllites attenuatus* (Lesquereux) Knowlton (P. 50)
Hypotype, GSC No. 1093. Dunvegan Formation, GSC locality 4196.

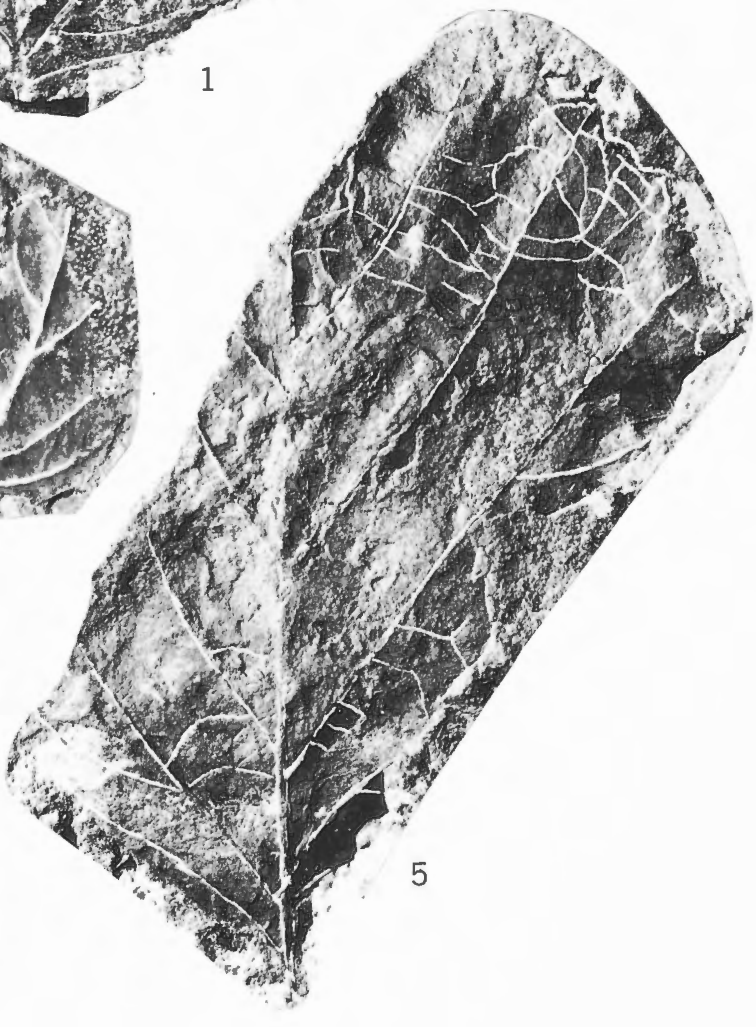
PLATE XXXII



1

2

3



5

4

Plate XXXIII

Figure 1. *Araliaephyllum rotundiloba* (Newberry) Fritel (P. 58)
Hypotype, GSC No. 1216. Dunvegan Formation, GSC locality 3664.

Figure 2. *Platanus newberryana* Heer (P. 48)
Hypotype, GSC No. 1203. Dunvegan Formation, GSC locality 3592.

Figure 3. *Ampelophyllites attenuatus* (Lesquereux) Knowlton (P. 50)
Hypotype, GSC No. 1097. Dunvegan Formation, GSC locality 4202.

Figure 4. *Cassia alaskana* Hollick (P. 54)
Hypotype, GSC No. 1258. Milk River Formation, GSC locality 1271.

Figure 5. *Cassia alaskana* Hollick (P. 54)
Hypotype, GSC No. 5061. Milk River Formation, GSC locality 844.

PLATE XXXIII

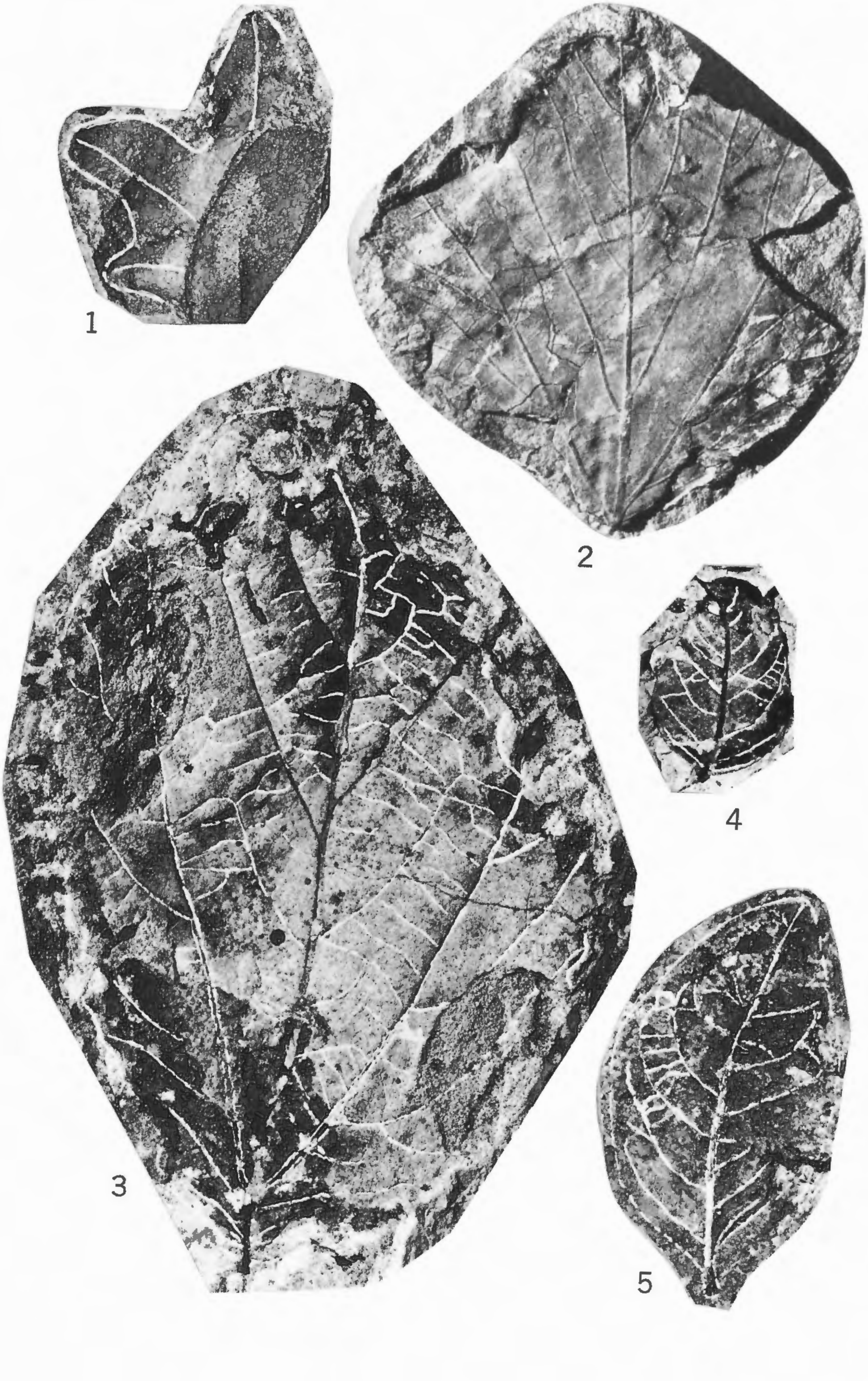


Plate XXXIV

Figure 1. *Araliaephyllum rotundiloba* (Newberry) Fritel (P. 58)
Hypotype, GSC No. 1215. Dunvegan Formation, GSC locality 3781.

Figure 2. *Araliaephyllum rotundiloba* (Newberry) Fritel (P. 58)
Hypotype, GSC No. 1082. Dunvegan Formation, GSC locality 4193.

Figure 3. *Pseudoprotophyllum boreale* (Dawson) Hollick (P. 52)
Hypotype, GSC No. 1190. Sustut Group, British Columbia, GSC locality 3492.


1


2


3

Plate XXXV

Figure 1. *Pseudoprotophyllum boreale* (Dawson) Hollick (P. 52)
Hypotype, GSC No. 5389 (recorded by Dawson as *Protophyllum leconteanum*?). Dunvegan Formation, GSC locality 287.

Figure 2. *Ilex*? *mammillata* n. sp. (P. 56)
Holotype, GSC No. 1249. Milk River Formation, GSC locality 3934.

Figure 3. *Ilex*? *mammillata* n. sp. (P. 56)
Paratype, GSC No. 1254. Milk River Formation, GSC locality 3934.

Figure 4. *Pseudoprotophyllum boreale* (Dawson) Hollick (P. 52)
Holotype, GSC No. 5398. Dunvegan Formation, GSC locality 290 (4205).

PLATE XXXV

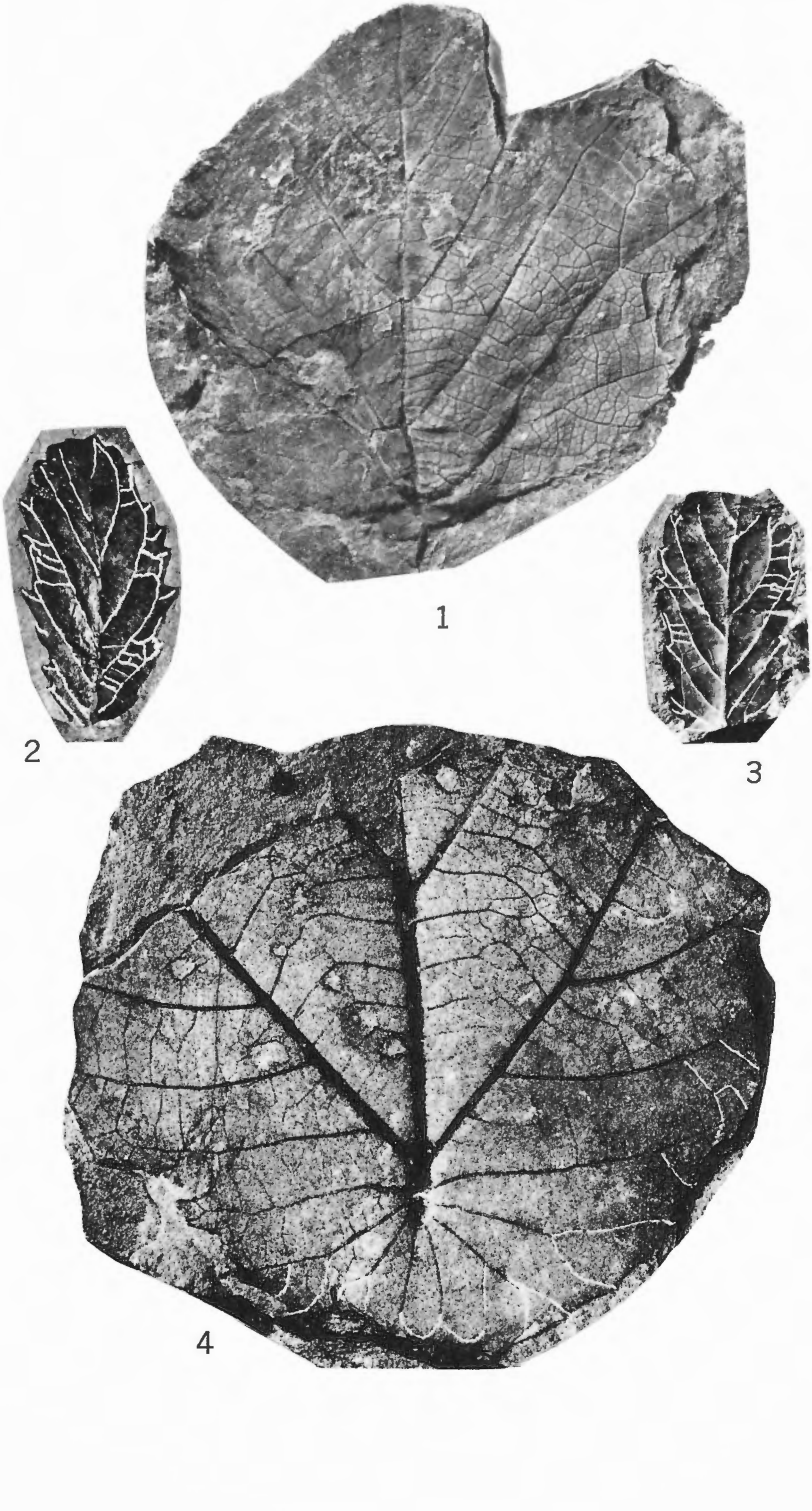


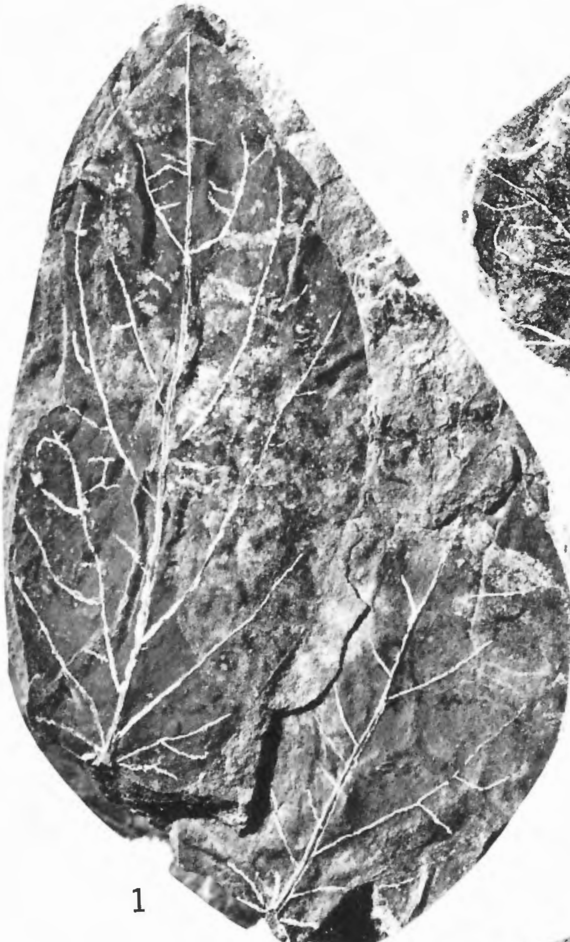
Plate XXXVI

Figure 1. *Dalbergia hyperborea* Heer (P. 55)
Hypotype, GSC No. 1301. Dunvegan Formation, GSC locality 3780.

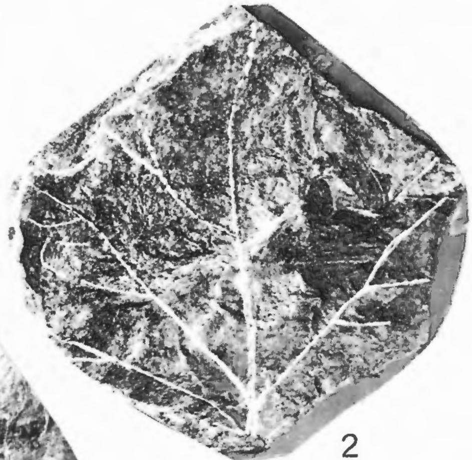
Figure 2. *Hedera* sp. cf. *H. cretacea* Lesquereux (P. 60)
GSC No. 5131 (*Populites cyclophylla* Dawson). Dunvegan Formation, locality 288.

Figure 3. *Ilex*? *mammillata* n. sp. (P. 56)
Holotype, GSC No. 1249, (counterpart of specimen, Pl. 35, fig. 2). Milk River Formation, GSC locality 3934.

Figure 4. *Pseudoaspidiophyllum latifolium* Hollick (P. 53)
Hypotype, GSC No. 1200x¾. Dunvegan Formation, GSC locality 3780.

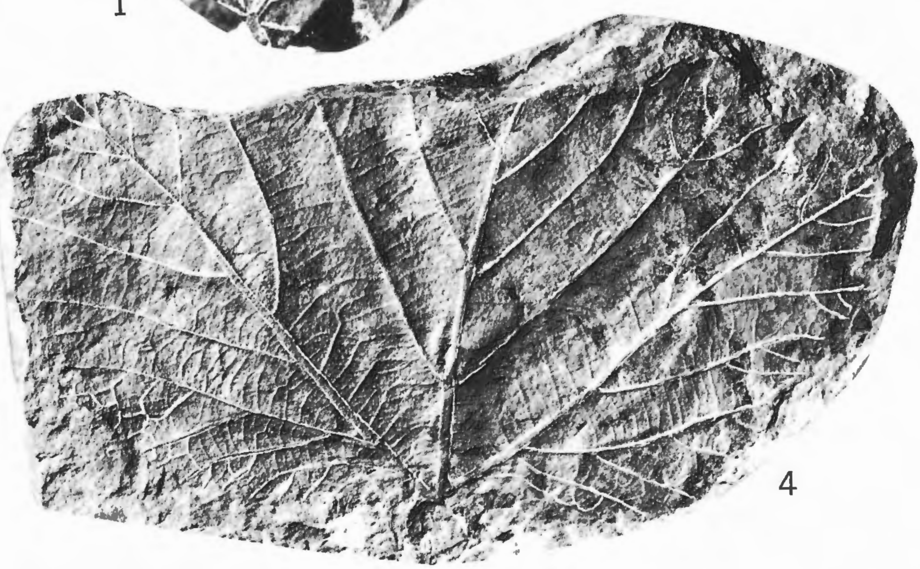


1



2

3



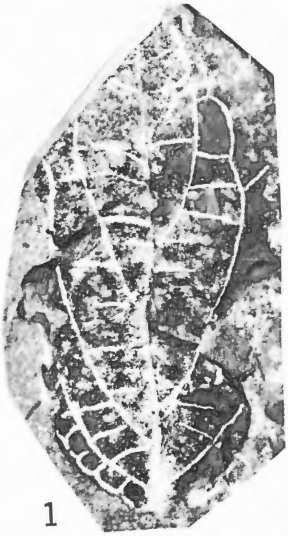
4

Plate XXXVII

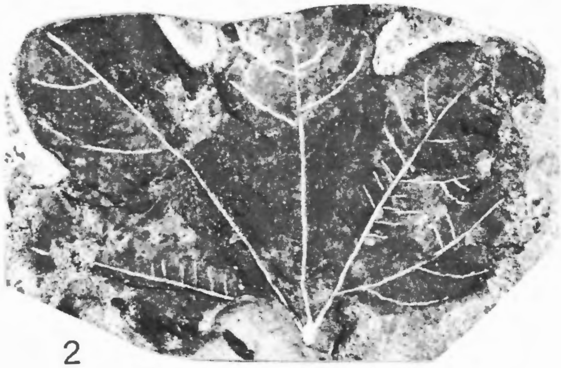
Figure 1. *Cornus ceterus* Hollick (P. 61)
Hypotype, GSC No. 1239. Eagle sandstone equivalent of Milk River Formation, Montana, GSC locality 1621.

Figure 2. *Araliaephyllum rotundiloba* (Newberry) Fritel (P. 58)
Hypotype, GSC No. 1214. Dunvegan Formation, GSC locality 3664.

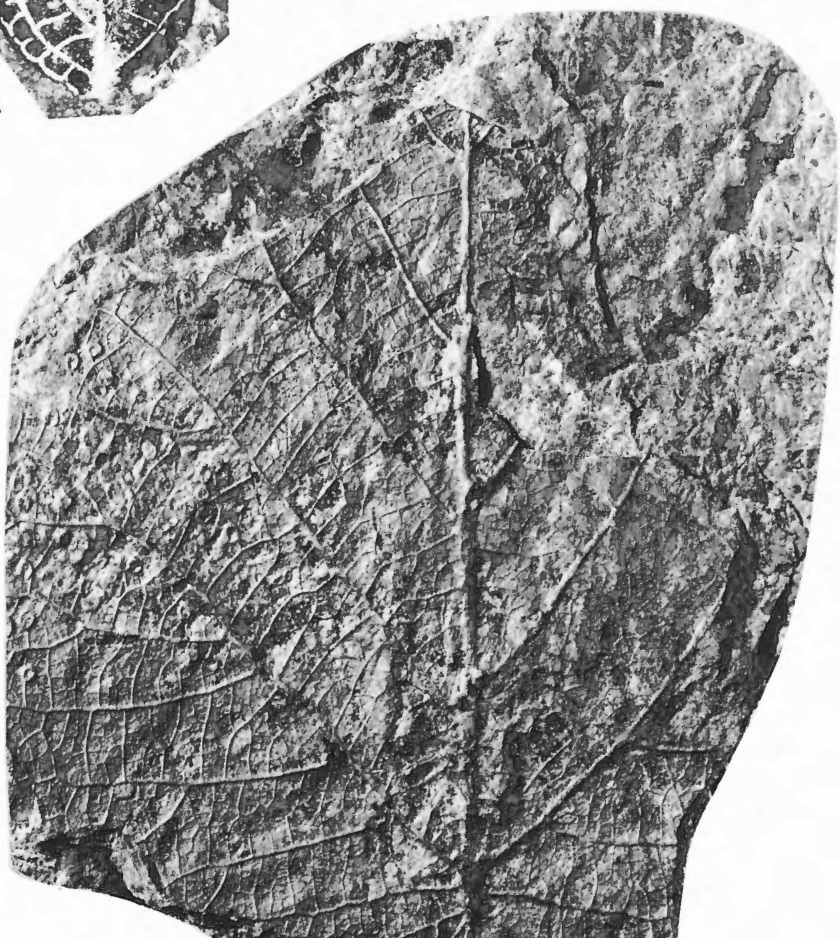
Figure 3. *Pseudoprotophyllum boreale* (Dawson) Hollick (P. 52)
Hypotype, GSC No. 1196. Dunvegan Formation, GSC locality 3780.



1



2



3

Plate XXXVIII

Figure 1. *Pseudoaspidiophyllum latifolium* Hollick (P. 53)
Hypotype, GSC No. 1104x½. Dunvegan Formation, GSC locality 4197.

Figure 2. *Pseudoaspidiophyllum latifolium* Hollick (P. 53)
Hypotype, GSC No. 1201x¾. Dunvegan Formation, GSC locality 3780.

1

2

Plate XXXIX

Figure 1. *Carpites* sp. (P. 63)
GSC No. 5129ax3 (*Fagus protonucifera* Dawson pars). Dunvegan Formation, GSC locality 3233.

Figure 2. *Ilex*? *mammillata* n. sp. (P. 56)
Paratype, GSC No. 1250. Milk River Formation, GSC locality 3934.

Figure 3. *Pseudoprotophyllum boreale* (Dawson) Hollick (P. 52)
Hypotype, GSC No. 1193. Dunvegan Formation, GSC locality 3780.

Figure 4. *Pseudoprotophyllum boreale* (Dawson) Hollick (P. 52)
Hypotype, GSC No. 1212. Dunvegan Formation, GSC locality 5190.

1

2

3

4

Plate XL

Figure 1. *Sterculia aperta*? Lesquereux (P. 58)
Hypotype?, GSC No. 1223. Dunvegan Formation, GSC locality 3218.

Figure 2. *Aralia* sp. cf. *A. parvidens* Hollick (P. 60)
GSC No. 1229. Dunvegan Formation, GSC locality 3201.

Figure 3. *Araliaephyllum rotundiloba* (Newberry) Fritel (P. 58)
Hypotype, GSC No. 1083. Dunvegan Formation, GSC locality 4194.

Figure 4. *Aspidiophyllum dentatum*? Lesquereux (P. 53)
Hypotype?, GSC No. 1094. Dunvegan Formation, GSC locality 4198.

PLATE XL

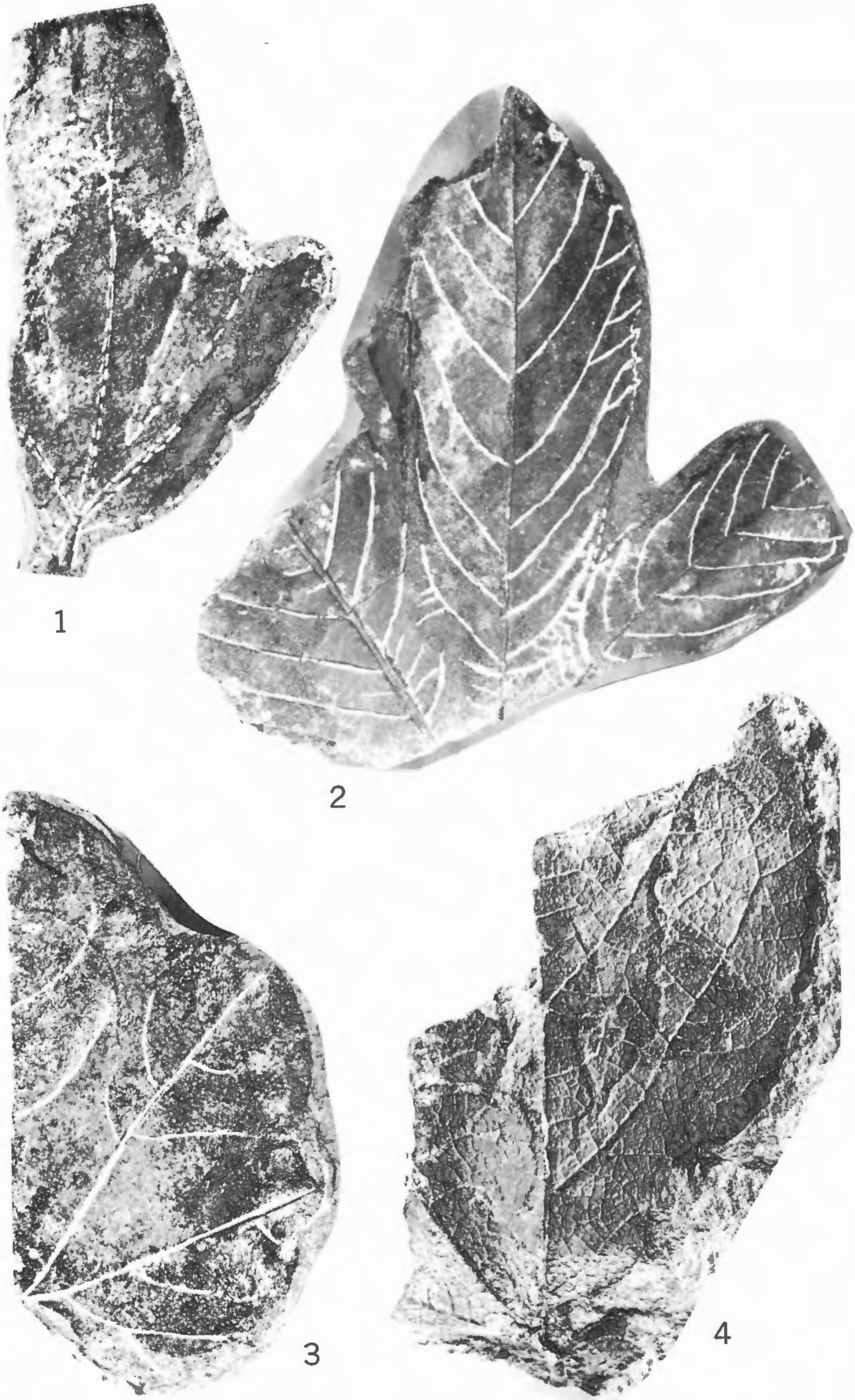


Plate XLI

Figure 1. *Andromeda? spatula* n. sp. (P. 61)
Paratype, GSC No. 1241. Dunvegan Formation, GSC locality 4194.

Figure 2. *Celastrinites* sp. (P. 57)
GSC No. 1283. Milk River Formation, GSC locality 1271.

Figure 3. *Aralia* sp. cf. *A. parvidens* Hollick (P. 60)
GSC No. 1230. Dunvegan Formation, GSC locality 3201.

Figure 4. *Andromeda? spatula* n. sp. (P. 61)
Holotype, GSC No. 1077. Dunvegan Formation, GSC locality 4197.

Figure 5. *Araliaephyllum groenlandica?* Heer (P. 59)
Hypotype?, GSC No. 1217. Dunvegan Formation, GSC locality 1199.

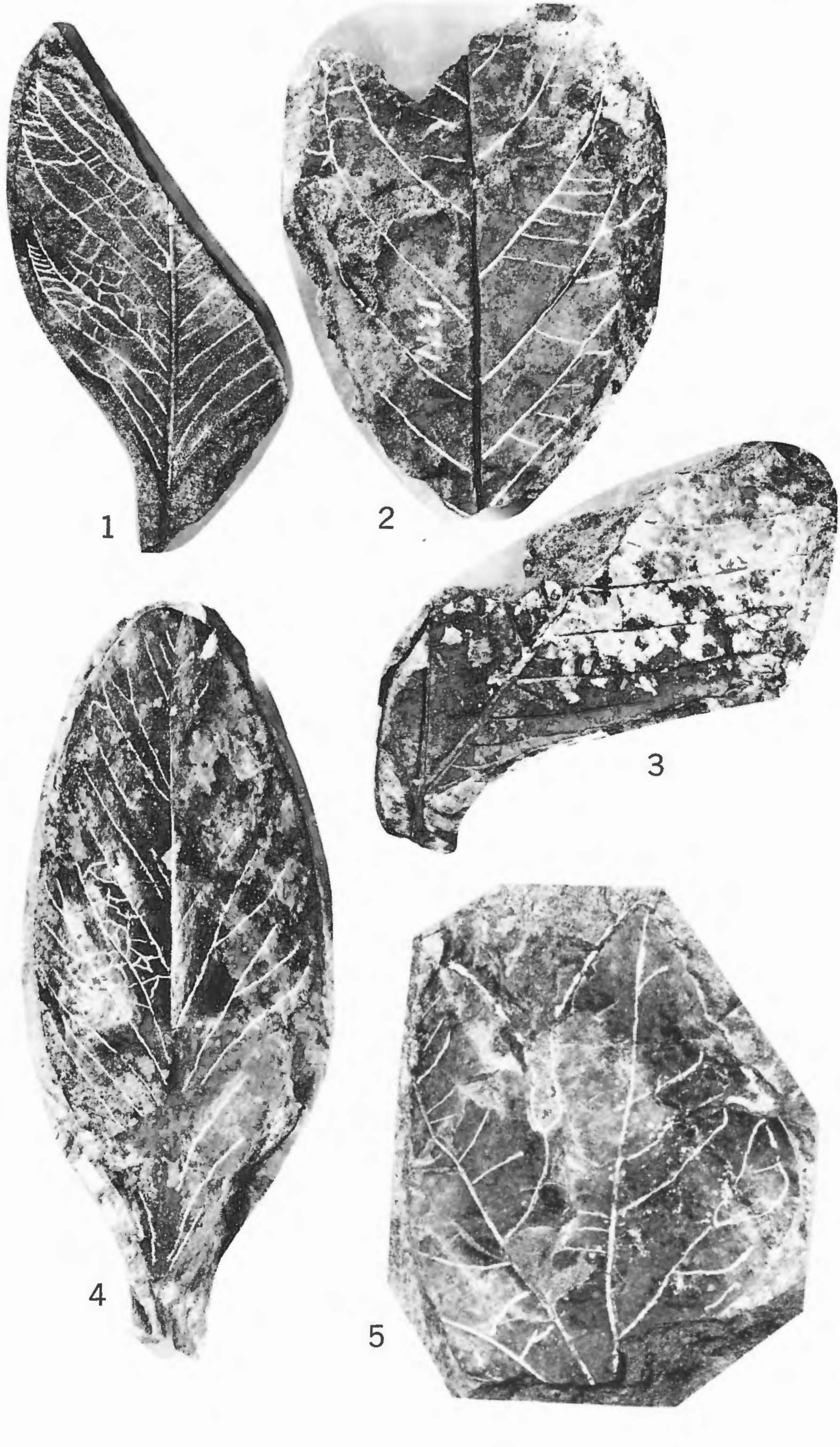

1
2
3
4
5

Plate XLII

Figure 1. *Zizyphus mcgregori* n. sp. (P. 57)
Holotype, GSC No. 1225x3. Bad Heart Formation, GSC locality 5188.

Figure 2. *Zizyphus mcgregori* n. sp. (P. 57)
Holotype, GSC No. 1225 (nat. size). Bad Heart Formation, GSC locality 5188.

Figure 3. *Dicotylophyllum* sp. A (P. 62)
GSC No. 5129 (*Fagus protonucifera* Dawson pars). Dunvegan Formation, GSC locality 287.

Figure 4. *Leguminosites spatulatus* n. sp. (P. 56)
Holotype, GSC No. 1280. Dunvegan Formation, GSC locality 4195. (Broken left margin gives false appearance of teeth.)

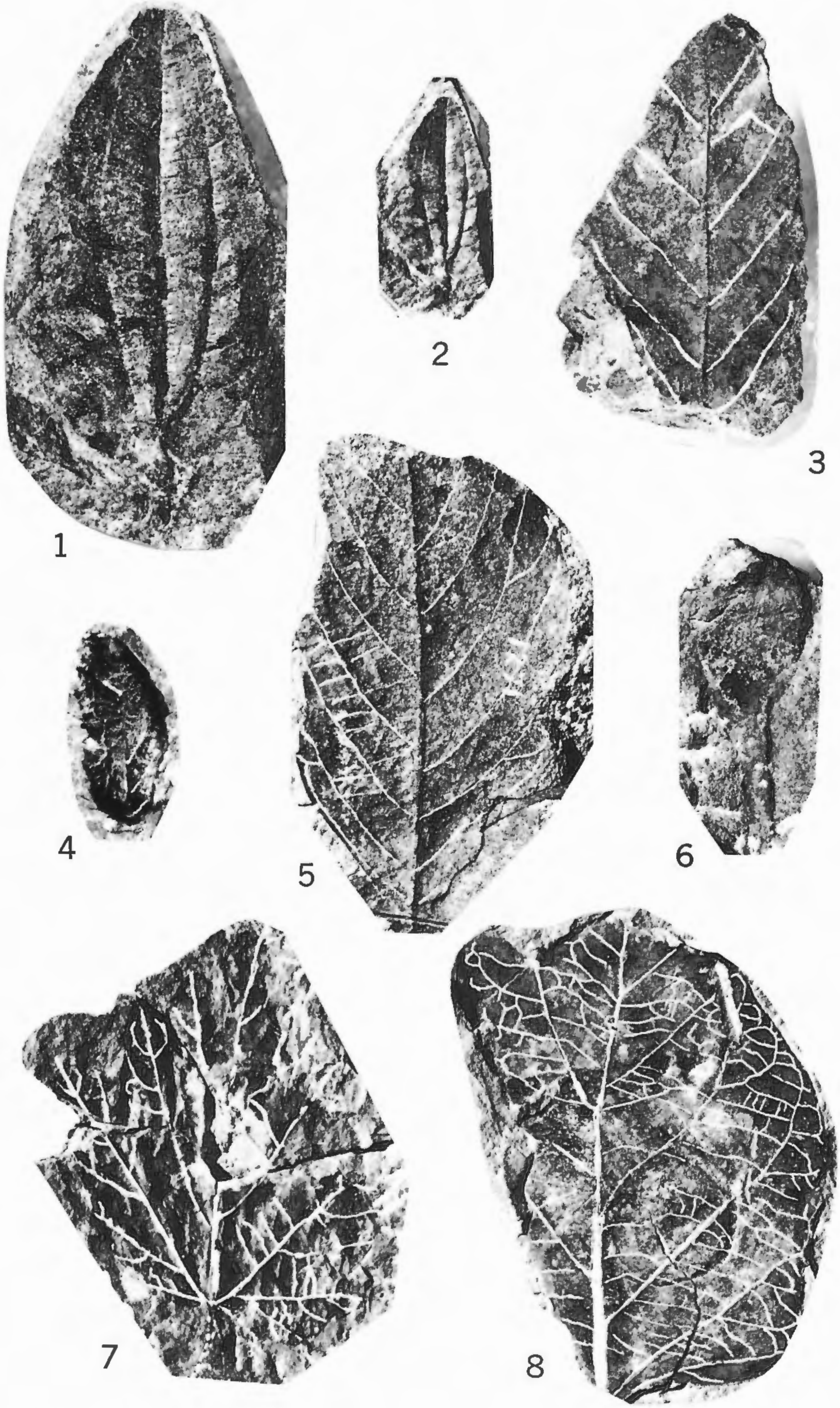
Figure 5. *Celastrinites* sp. (P. 57)
GSC No. 1282. Milk River Formation, GSC locality 1271.

Figure 6. *Leguminosites spatulatus* n. sp. (P. 56)
Paratype, GSC No. 1281. Dunvegan Formation, GSC locality 4194.

Figure 7. *Vitis* sp. (P. 58)
GSC No. 1226. Bad Heart Formation, GSC locality 5188.

Figure 8. *Dicotylophyllum* sp. B (P. 63)
GSC No. 5047. Eagle sandstone equivalent of Milk River Formation, Montana, U.S.A., GSC locality 1621.

Plate XLII



INDEX TO FOSSILS

Numbers in **bold face** type indicate pages where species are described.

PAGE

Adiantites praelongus
see *Protophyllocladus polymorpha*
Allantodiopsis erosa 23
Alnus perantiqua **32**
Ampelophyllites attenuatus **50**
Andromeda? n. sp.
see *Andromeda*? *spatula*
A. parlatorii 62
Andromeda? *spatula* **61**
Anemia stricta
see *Sphenopteris stricta*
Antholites horridus 23
see *Isoetites horridus*
Apeibopsis nordenskiöldi 36
Araliaephyllum groenlandica? **59**
A. polymorphum 59
A. rotundiloba **58**
Aralia groenlandica 59
A. polymorpha 59
Aralia sp. cf. *A. parvidens* **60**
Aralia wellingtoniana 60
Aspidiophyllum dentatum? **53**
Asplenium hurleyensis 18
Athrotaxites berryi 26

Baiera sp. cf. *B. furcata* **24**
Baiera sp. cf. *B. lindleyana* 24
Bauhinia? *cretacea*? **55**
Betula perantiqua
see *Alnus perantiqua*
Brachyphyllum (*Athrotaxites*?)
douglasi **26**

Carpites? sp. **63**
Carpolithus horridus 23
Cassia alaskana **54**
Castaliites sp. cf. *C. cordatus* **36**
Celastrinites sp. **57**
Cephalotaxopsis heterophylla **27**
Cinnamomum heeri **46**
Cladophlebis arctica? **21**
C. simplicima **22**
Cladophlebis sp. cf. *C. virginiensis* **21**
Cladophlebis virginiensis 21
Cornus ceterus **61**
Credneria denticulata 50
C. inordinata 50
C. longifolia 51
C. macrophylla **49**
C. truncatodenticulata **50**

PAGE

Cycadites unjiga
see *Pseudocycas unjiga*

Dalbergia hyperborea **55**
Dammarites dubius
see *Dammarites robinsi*
D. robinsi **26**
Dicksonia groenlandica 20
Dicotylophyllum shottoni 63
Dicotylophyllum sp. A **62**
Dicotylophyllum sp. B 35, **63**
Diospyros lesquereuxi 54, **62**
D. nitida
see *Hymenaea fayettensis*
D. rotundifolia 62
Dryophyllum gracile **32**
D. protofagus 32

Elatides curvifolia 28
Elatocladus albertaensis **31**
E. heterophylla 28
Elatocladus sp. cf. *Sequoia major* **29**
Equisetum sp. **23**

Fagus protonucifera
see *Dicotylophyllum* sp. A
Ficus alabamensis 49, 63
F. daphnogenoides **33**
F. dawsoni
see *Magnolia magnifica*
F. glascoeana **33**
F. martini 35
F. maxima
see *Magnolia magnifica*
F. missouriensis **34**
F. praetrinervis
see *Ficus trinervis*
F. proteoides 34
Ficus? sp. **35**
F. trinervis **34**
Filicites sp. **22**

Geinitzia formosa **28**, 31
Ginkgo sp. **24**
Glyptostrobus gracillimus
see *Widdringtonites reichii*
Grewiopsis mclearni
see *Trochodendroides arctica*

Hedera cecilensis 61
H. cretacea 61

PAGE

Hedera sp. cf. *H. cretacea* **60**
Hymenaea fayettensis **54**

Ilex affinis 56
Ilex? *mammillata* **56**
Isoetites horridus **23**

Jenkinsella arctica 38

Laurophyllum debile
see *Ficus daphnogenoides*
L. flexuosum **45**
L. plutonium 45
Laurophyllum sp. **46**
Laurus plutonia 45
Leguminosites karatsheenis 56
L. spatulatus **56**
L. tuscaloosensis 56
Liquidambar obtusilobata 59
Liriodendron giganteum **44**
L. meekii 45
L. praetulipiferum **44**
see *L. giganteum*
L. procaccinii 45

Magnolia boulayana 41
M.? *coalvillensis* **42**
M. glaucoides 42
M. hollicki **44**
M. lacoeana **42**
M. magnifica **41**
M. rhamnoides **43**
M. rotundifolia 43
Magnolia sp. cf. *M. rotundifolia* **43**
M. tenuinervis 42
Menispermites knightii 39
M. nordenskiöldi
see *Palaeonuphar nordenskiöldi*
M. reniformis **39**
Menispermites sp. **40**
Menispermites sp. Dawson
see *Trochodendroides arctica*
Menispermites sp. (Knowlton) **39**
Metasequoia cuneata **29**
Myrica longa 46

Nilssonia lata
see *Pseudoctenis latipennis*
Noegerathiopsis robinsi
see *Dammarites robinsi*
Nymphaeites exemplaris **35**

Onoclea hebridica **16**
O. sensibilis
see *O. hebridica*
O. sensibilis fossilis
see *O. hebridica*
O. sensibilis var. *obtusilobatus* 17
see *O. hebridica* **16**
Onychiopsis sp. cf. *O. psilotoides* 4, **16**
Osmunda arctica
see *Cladophlebis arctica*

PAGE

Palaeonuphar nordenskiöldi **36**
Phragmites cordaiformis
see *Dammarites robinsi*
Picea albertensis
see *Elatocladus albertaensis*
Platanus affinis **49**
P. asperaeformis 47
P. latiloba **48**
P. newberryana **48**
P. primaeva?
see *P. affinis*
P. primaeva var. *subintegrifolia* 47
P. williamsi **47**
Populites cyclophylla
see *Hedera* sp. cf. *H. cretacea*
P. litigiosus 40
P. wickendeni **40**
Populus arctica
see *Trochodendroides (Cercidiphyllum?) arctica*
P. hookeri
see *Trochodendroides (Cercidiphyllum?) arctica*
P. obtrita
see *Trochodendroides (Cercidiphyllum?) arctica*
P. potomacensis 38
P. protozadachii
see *Trochodendroides (Cercidiphyllum?) arctica*
Pragmites cordaiformis
see *Dammarites robinsi*
Proteoides daphnogenoides 34
P. longus
see *Laurophyllum flexuosum*
P. major
see *Protophyllocladus polymorpha*
Protophyllocladus polymorpha **31**
Protophyllum boreale
see *Pseudoprotophyllum boreale*
P. crednerioides 40
P. leconteanum?
see *Pseudoprotophyllum boreale*
P. multinerve? **51**
P. rugosum
see *P. multinerve*?
Pseudoaspidiophyllum latifolium **53**
Pseudoctenis latipennis **25**
Pseudocycas insignis 25
P. pumilio 25
Pseudocycas sp. A cf. *P. unjiga*
see *P. unjiga*
P. unjiga **24**
Pseudoprotophyllum boreale **52**
P. comparabile 52
P. dentatum 52
P. magnum 52
P. venustum 52
Pteris frigida 21
P. (Oleandra) glossopteroides
see *Saccoloma gardneri*

PAGE

Pterospermites cordifolius 36
Pterospermites sp.
see *Menispermites* sp. (Knowlton)
P. wardii 57

Rhamnites eminens 43
Rulac quercifolium 56

Saccoloma gardneri **17**, 23
Saccoloma? sp. **18**
Salisburia baynesiana
see *Protophyllocladus polymorpha*
Salix lesquereuxi 45
Sequoia concinna 29
Sequoia cuneata
see *Metasequoia cuneata*
S. langsdorfii pars
see *Metasequoia cuneata*
S. major
see *Elatocladus* sp. cf.
Sequoia major
S. reichenbachii
see *Geinitzia formosa*
Sequoia sp. Hollick 30
Sequoiites sp. cf. *Geinitzia formosa* **28**
Sphenopteris (Dennstaedtia?) burlingi **20**
S. (Onychiopsis?) johnstrupi 20
S. mclearni 20
S. psilotoides 20
S. stricta **19**
Sterculia aperta? **58**

Tapeinidium? *undulatum* **19**
Taxodium cuneatum
see *Metasequoia cuneata*

PAGE

Taxodium sp.
see *Metasequoia cuneata*
Torreya densifolia
see *Metasequoia cuneata*
T. dicksonioides
see *Torreyites dicksonioides*
Torreyites dicksonioides **27**
T. tyrrelli 27
Trochodendroides (Cercidiphyllum?)
arctica **37**, 39
T. cuneata
see *T. (Cercidiphyllum?) arctica*
T. dorfi **38**
T. dorfi? **39**
T. (Cercidiphyllum?) potomacensis .. **38**
T. speciosa
see *T. (Cercidiphyllum?) arctica*
Tumion densifolium
see *Metasequoia cuneata*
Tumion dicksonioides
see *Torreyites dicksonioides*

Ulmus dubia
see *Alnus perantiqua*

Vitis sp. **58**

Widdringtonites reichii **30**
W. subtilis 30

Zamites albertensis
see *Dammarites robinsi*
Zizyphus electilis 57
Z. mcgregori **57**
Z. pseudomeeki 57
Z. varietas 57