

A REVIEW OF THE FOSSIL PLANTS IN THE UNITED STATES  
NATIONAL MUSEUM FROM THE FLORISSANT LAKE  
BEDS AT FLORISSANT, COLORADO, WITH DESCRIPTIONS  
OF NEW SPECIES AND LIST OF TYPE-SPECIMENS.

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The Florissant lake beds of Colorado have been a perennial and never-failing source of supply for finely preserved fossil plants and insects since their discovery nearly fifty years ago; in fact, it is perhaps safe to say that this locality has supplied a greater number of specimens in these groups than any other single locality in the world. It has been reported that more than 30,000 specimens of insects, representing over 1,000 species, have been obtained here, but no accurate estimate has been, or indeed can be made, of the number of plants collected, though they undoubtedly amount to very many thousands, now scattered through the museums and collections of the world. Notwithstanding the wealth of plant material, every considerable collection that is made there is almost certain to include new forms or material throwing additional light on previously described species.

The present paper was primarily undertaken for the purpose of placing on record studies of a number of collections not previously investigated, or only partially studied, but has been expanded to include practically all of the plant material from Florissant now deposited in the United States National Museum. These collections and their sources are as follows:

1. *The Hambach collection.*—This is a collection of about 100 specimens, forming a part of an extensive paleontological collection purchased in 1907 from Dr. Gustavus Hambach, of St. Louis, Missouri. It includes the types of species of Florissant plants described and figured by Walter C. G. Kirchner,<sup>1</sup> and also is especially rich in specimens of exceptionally well-preserved flowers and fruits, many of which were unnamed.

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<sup>1</sup> Kirchner, Walter C. G., Contributions to the fossil flora of Florissant, Colorado, Trans. Acad. Sci. St. Louis, vol. 8, 1898, pp. 161-188, pls. 11-15.

2. *The Scudder collection.*—This collection was made by the late Samuel H. Scudder, of Cambridge, Massachusetts, under the auspices of the United States Geological and Geographical Survey of the Territories, of which Dr. F. V. Hayden was the director. This collection of plants was made as an incident in collecting fossil insects, in which group Scudder was the well-known authority. Although comprising only about 150 specimens, it is made up of carefully selected material and contains a number of undescribed forms as well as some very fine examples of previously known species. It had remained packed in the original boxes in the National Museum until the occupancy of the new museum building in 1911.

3. *The Lacoë collection.*—This is a collection of about 200 specimens that was acquired by the late R. D. Lacoë, of Pittston, Pennsylvania, and by him donated to the United States National Museum in 1893, together with his immense collection of Paleozoic material. These specimens are in the main exceptionally well preserved and were studied and named by Leo Lesquereux<sup>1</sup> in his well known account of the Florissant flora. As many of these type-specimens were apparently received by Lesquereux too late to be figured in his work, they are figured in the present paper, either under the names given them by Lesquereux, or under species that subsequent study has shown them to belong with.

4. *Old National Museum collections.*—This material, which is comprised in several unit trays, represents collections that have been acquired in various ways and at different times by the United States National Museum, but which has remained unstudied. It is made up mainly of well-known species, though one or two apparently new forms were detected.

In addition to the unnamed material, the entire United States National Museum collections of Florissant material has been re-studied and named in accordance with the later understanding of this flora. This embraces the original material obtained by the Hayden survey, and which served in large part as the basis for Lesquereux's work as published in his Tertiary Flora and Cretaceous and Tertiary Floras. A large portion, if not indeed all, of the material used in the preparation of the latter work that is not now in the United States National Museum, is, or should be, in the museum of Princeton University.

5. *Collection of 1913.*—This is a small and relatively unimportant collection made in 1913, when Edward W. Berry and the writer spent several days at Florissant. The most valuable part of this collection is a series of specimens of fossil wood from the well-known "fossil forest," located about 2 miles west of the town of Florissant. No fossil wood from this locality was previously contained in the

<sup>1</sup> Lesquereux, Leo, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cretaceous and Tertiary Floras), 1883.

United States National Museum collections. It is not described in the present paper.

A word may be said regarding the geological occurrence and stratigraphic position of the fossiliferous lake beds at Florissant. So far as now known the first geological account of the Florissant Lake basin was made by Dr. A. C. Peale<sup>1</sup> who visited the area and made a small collection of plants on October 11, 1873. In his account he presented a map showing the approximate outline of the ancient lake, and in addition to the brief description of the beds and their abundant fossil contents, gave a section of the succession of the strata as observed in a low bluff just below the town of Florissant.

In point of time apparently the next geological account of this lake basin was given by Samuel H. Scudder,<sup>2</sup> who visited the locality in the summer of 1877. After quoting in full Doctor Peale's account he presents his own observations which were made jointly with Prof. Arthur Lakes. He gives descriptions of the beds, several geological sections, and a revised map. It is probable that the Scudder collection of plants here reported on was made at this time.

As the locality became more and more widely known for its fossil resources, additional accounts were published, but it is not necessary to review these in the present place. One of the latest and perhaps best accounts is that given by Prof. Junius Henderson,<sup>3</sup> based on the results of a visit in 1905.

From the several descriptions it appears that Lake Florissant was a small lake approximately 5 miles in length and not much if any exceeding a mile in width, but with a very irregular shore line. Henderson says:

The whole topography of the region indicates that the basin was formerly a mountain valley and its laterals formed in granite by stream erosion. \* \* \* The ramification of the lake into lateral valleys and consequent tortuous outline gives a great length of shore line in proportion to the area. It consisted of two somewhat distinct bodies of water connected by a narrow strait and placed at such an angle with each other as to form a wide L; or, to state it another way, the lake was nearly divided at the angle by two promontories which jutted into it from opposite shores.

That the lake was shallow is attested by the sun-cracking of some of the shales, the character of the fish remains, and the erect stumps of *Sequoia*. According to Henderson—

The beds are comprised chiefly of volcanic ashes, mud, and sand, the component particles of which are generally somewhat though not very much worn by the action of water. The conclusion reached in both field and laboratory is that the deposits were formed largely by volcanic ashes from repeated eruptions falling upon the surface of the water and settling to the bottom, assorted by the sluggish lake currents; also by mud and ashes falling or flowing into position where they were rapidly washed into the lake by rains, streams, and waves without much grinding.

<sup>1</sup> Peale, A. C., U. S. Geol. and Geogr. Surv. Terr., Ann. Rept. 1873 [1874], p. 210.

<sup>2</sup> Scudder, S. H., U. S. Geol. and Geogr. Surv. Terr., Bull., vol. 6, 1882, pp. 279-300

<sup>3</sup> Henderson, Junius, Univ. of Colorado Studies, vol. 3, 1906, pp. 145-151

The strata of the upper deposits differ greatly from each other in composition, fineness of material, and thickness. At least the whole fossiliferous portion examined has been deposited in water, is thin-bedded, and very distinctly stratified. It often weathers out in large scales little thicker than ordinary writing paper. During the periods of deposition large numbers of insects and plants were sometimes entombed and preserved in great perfection. While there is a general sameness to the formation in various parts of the basin, yet, upon more particular examination of the strata, great dissimilarity in minor details forces itself upon the attention. Especially is this true when one compares a vertical section in the northwestern basin with one in the southeastern basin.

The lower part of the formation seems wholly nonfossiliferous, is of a drab color, quite homogeneous, thick-bedded, and has a decidedly conchoidal fracture. Our limited examination of that portion of the formation left the impression that it was formed by mud flows without much assortment by moving water. This is offered merely as a suggestion for future work, not as a final conclusion, and its investigation may throw important light on the history of the lake. Near the northwestern end of the basin a shaft has been sunk for some distance into the nonfossiliferous beds, and in other places wells have been sunk, affording excellent sections and showing that the floor deposits extend to considerable depth—just what depth we have not learned. The fossiliferous beds above the floor deposits are approximately 20 feet in thickness.

As regards the geological age of these lake beds there has been some difference of opinion. As they lie on, and are completely surrounded by, granite, and further are isolated from all other sedimentary rocks by several miles of crystallines, no aid can be expected from stratigraphy and dependence must be placed entirely in the paleontological contents. As a result of his hasty examination Doctor Peale inclined to regard them as of Pliocene age, but Lesquereux, who studied the plants, at first considered them as probably belonging to the upper Miocene. Later, when larger collections became available, Lesquereux came into substantial agreement with Cope, who had studied the scant fish remains, and these beds came to be referred to the lower Miocene or Oligocene, which is the age usually assigned them in textbooks and elsewhere. Within the past few years, however, there has been a revival of interest in the study of the Florissant flora and fauna, due largely to the activities of Prof. T. D. A. Cockerell,<sup>1</sup> and as a result of these studies and comparisons with various floras of this country and Europe, the conviction has been growing that the position originally assigned by Lesquereux is more nearly correct, namely, that the beds are upper Miocene in age. While it is improbable that the final word has been said regarding the exact stratigraphic position of these beds, until conclusive evidence to the contrary has been presented the Florissant plant-bearing beds may be regarded as upper Miocene.

It may be of interest to note in this connection that lake beds of similar lithologic composition, and containing many of the Florissant species of plants, have recently been discovered in other parts of Colorado. These will be described and discussed in full in a later publication.

<sup>1</sup> See Univ. Colorado Studies, vol. 3, No. 3, 1906, pp. 157-176; Amer. Nat., vol. 44, 1910, pp. 31-47.

## MOSSES.<sup>1</sup>

### HYPNUM? BROWNII Kirchner.

*Hypnum brownii* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 178, pl. 12, figs. 4, 4a.—BRITTON and HOLLICK, Bull. Torrey Bot. Club, vol. 34, 1907, p. 139, pl. 9, figs 3, 3a.

*Type*.—Cat. No. 33,678, U.S.N.M.

I have examined this specimen with care, and am unable to make more out of it than did the author of the species. It consists of a cluster of delicate, arched and often forked branches, while the leaves are ovate-lanceolate and acute. It seems beyond any reasonable question to be a moss, but, as Britton and Hollick have said, its reference to *Hypnum* is a matter requiring confirmation. The Scudder collection contains a single fragmentary branch that appears to belong here.

### POLYTRICHUM? FLORISSANTI, new species.

Plate 12, fig. 4, three times enlarged.

*Type*.—Cat. No. 34,760, U.S.N.M.

The Hambach collection contains a single example—the one here figured—that appears to be a fruiting moss. It has a long, exceedingly slender pedicel fully 2 cm. in length, and a large ovoid capsule that is nearly 3 mm. long and a little over 1.5 mm. in diameter. The capsule appears to be ribbed and somewhat fimbriate at apex, but this appearance may be due to the state of preservation. The pedicel is practically straight, evidently erect, and the capsule is erect and symmetrical. There is no evidence concerning either calypah, operculum, or peristome. The ribbed appearance of the

<sup>1</sup> In 1883, Lesquereux described from Florissant what was supposed to be a moss under the name:

*Fontinalis pristina* Lesquereux (Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 135, pl. 21, fig. 9).

The specimens figured seemed to represent an axis or "stem" with numerous, obscurely two-ranked linear "leaves," and were tacitly assumed to have been correctly referred to the mosses. When the short list of American fossil mosses was reviewed by Britton and Hollick [Bull. Torr. Bot. Club, vol. 34, 1907, pp. 139-142, pl. 9], they passed over the present form with the statement that "it may be merely remarked that the correctness of its reference to the genus *Fontinalis* is questionable."

In the Scudder and Hambach collections there was found several specimens that agree perfectly with the figures given by Lesquereux, and without special study they were referred to *Fontinalis pristina*. Later however, a specimen was noted that showed conclusively that it is a feather. It is about 21 mm. in length and 4 mm. in width, and is preserved entire, consisting of the calamus or basal portion about 3 mm. long, and the delicate rachis that passes to within about 3 mm. of the tip. Arranged on either side are the delicate barbs with faint indications of the barbules and interlocking processes; in other words it is perfect and unmistakable feather. It has been submitted to a number of ornithologists, among them Dr. Charles W. Richmond and Mr. H. C. Oberholser, who indorse this reference without qualification, the latter suggesting that it was doubtless from a small bird, and not improbably a passerine bird. As two species of birds have been described from the Florissant lake beds, there is every reasonable probability of separate feathers being occasionally preserved.

If there had been present only the upper half of the above described feather it would have been identified at once as Lesquereux's *Fontinalis pristina*, for it would then be indistinguishable from the original figure as well as from specimens usually so identified, but being preserved entire, as it is, its avian character is at once apparent.

capsule suggests a fully mature and more or less shriveled condition after the discharge of the spores. There is no evidence of the presence of leaves. This moss, if it has been correctly interpreted, suggests an old fruiting plant of the genus *Polytrichum*, such for instance as the well-known hair-cap moss, *Polytrichum juniperinum*, but on account of its poor preservation, it is not possible to be certain of its affinity. The generic reference has consequently been questioned.

**PLAGIOPODOPSIS SCUDDERI** Britton and Hollick.

Plate 12, fig. 2.

*Plagiopodopsis scudderi* BRITTON and HOLLICK. Bull. Torrey Bot. Club, vol. 42, 1915, p. 10, text figs. 1, 2.

This splendid moss was detected in the Scudder collection by the writer and by him submitted to Mrs. Elizabeth G. Britton and Dr. Arthur Hollick for examination and publication. As it has the fruit preserved in a fair degree of perfection it was possible to determine its affinity with the living species *Plagiopus oederi* (Gunner) Limpricht, of the Bartramiaceae, with reasonable certainty. They established for it the genus *Plagiopodopsis*, with the following description:

Plants cespitose, matted together by basal radicles; stem about 1 cm. high, erect, simple, or branching; leaves crowded, spreading, about 2 mm. long by 0.5 mm. wide, lanceolate-acuminate, costate to apex; perichaetial leaves longer, extending to or beyond the capsule; seta terminal, 2-3 mm. long, erect and partly exserted; capsule ovoid, 1.5 mm. long by 0.75 mm. broad, erect or inclined, rugose or plicate; mouth 0.5 mm. broad, too indistinct to show any traces of peristome; calyptra and lid unknown.

The figure here given (pl. 12, fig. 2) is a new figure of the type-specimen, showing it three times natural size. It is a somewhat clearer figure than that given by Britton and Hollick.

Family POLYPODIACEAE.

**PHEGOPTERIS GUYOTTII** (Lesquereux) Cockerell.

Plate 12, fig. 1.

*Phegopteris guyottii* (LESQUEREUX) COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 76.

*Sphenopteris guyottii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 137, pl. 21, figs. 1-7.

A fine specimen in the Hambach collection, but again without trace of fruit.

**DRYOPTERIS SCANSA** Cockerell.

*Dryopteris scansa* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 76, pl. 6, fig. 9; pl. 10, fig. 38.

A single specimen in the Scudder collection that is apparently the same as the first of the figures given by Cockerell, though not quite so

well preserved. The reference of this to *Dryopteris* must be considered doubtful.

### Family PSILOTACEAE.

#### *Tmesipteris allenii* (Lesquereux) Hollick.

*Tmesipteris allenii* (LESQUEREUX) HOLLICK, Bull. Torr. Bot. Club, vol. 21, 1894, p. 256, pl. 205, fig. 12.

*Ophioglossum allenii* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1872 [1873], p. 371.

*Salvinia allenii* (LESQUEREUX) LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 65, pl. 5, fig. 11.

This is one of the most characteristic plants found at Florissant, and while not actually abundant, is present in almost every collection from there and is always perfectly preserved. It is regularly elliptical in shape with a pronounced emarginate apex and excurrent midvein. The nervation is peculiar in that there is the strong midvein, between which and the margin there is a very coarse reticulate areolation. Not one of these leaves, so far as known to the writer, has ever been found attached, nor has a trace of fruit been observed, though if correctly referred to this modern genus, the fruit might fall off and not be recognizable thereafter.

The single living species of *Tmesipteris* (*T. tannensis*), which is widely distributed throughout Australia, New Zealand, Tasmania, and the Polynesian islands, has drooping branches thickly beset with small linear decurrent leaves which are either sharply apiculate or emarginate with the midvein excurrent. The nervation consists of a very strong midvein and a very fine reticulate areolation between it and the margin.

Broadly speaking the fossil form resembles the living in the emarginate, excurrent apex and in the manner of areolation, but it differs widely in shape, manner of attachment of the leaves, and in the very coarse reticulation. It seems doubtful if they are congeneric, though they may belong to the same family.

### Family PINACEAE.

#### *Pinus florissanti* Lesquereux.

*Pinus florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 138, pl. 21, fig. 13.

The Hambach collection contains a single cone that is referred to this species, but it is much less perfect than the type. *Pinus florissanti* was established by Lesquereux for a finely preserved, nearly perfect cone, and so far as known to the writer, no specimen has been obtained which in any way connects this type of cone with the leaf-bearing specimens, though doubtless one of them was the species which bore the cone.

## PINUS WHEELERI Cockerell.

Plate 12, fig. 3.

*Pinus wheeleri* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 78, pl. 6, fig. 11.

Cat. No. 34,755, U.S.N.M.

The Scudder collection contains a fine specimen belonging to this species, which is much better than the type upon which it was based. It includes two short "spurs" a centimeter in length, each bearing a cluster of five leaves. None of the leaves is entirely preserved, however, the longest being only retained for 4.5 cm. of its length, which, according to the original description, was 12 cm. or more.

A fragment of a cone has been attributed to this species by Professor Cockerell, but it is purely conjectural as to whether it belongs here or to the better known *P. florissantii*. The only cone found in the collections under consideration is referred to the latter species.

## SEQUOIA AFFINIS Lesquereux.

*Sequoia affinis* LESQUEREUX, U. S. Geol. and Geogr. Surv. Terr. Bull., vol. 1, 1875 [1876], p. 384; Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1874 [1876], p. 310; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 75, pl. 7, figs. 3-5; pl. 65, figs. 1-4; vol. 8 (Cret. and Tert. Fl.), 1883, p. 138.

*Glyptostrobus ungeri?* HEER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 139, pl. 22, figs. 1-6a.

*Sequoia haydenii* (LESQUEREUX) COCKERELL, Science, vol. 26, 1907, p. 447; Pop. Sci. Mon., vol. 73, 1908, p. 122, fig. in text; Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 78.

With the exception of the dictotyledonous leaves referred to the several species of *Myrica* or *Fagopsis*, this coniferous plant is possibly the most abundant form found at Florissant. It occurs in pieces of all sizes, from single slender twigs up to forking branches and branchlets covering a square foot or more in area, and often preserved in a high degree of perfection. The branches and branchlets with the two quite distinct kinds of leaves, the male aments and the mature cones are all known in completeness of detail but little inferior to living material.

That this conifer is the form described by Lesquereux under the name of *Sequoia affinis*, there can, of course, be no doubt, nor can there be any question as to the identity with it of the material described and figured by him as *Glyptostrobus ungeri* Heer. That it is properly referred to the genus *Sequoia* is also reasonably certain, for as Cockerell and others have pointed out, it is of the type of the living *S. sempervirens*, and is not a *Glyptostrobus*. I quite agree with Cockerell that there is probably only a single species of this type of conifer present at Florissant, and for this it seems to me the available name is *Sequoia affinis*.



Cockerell, as set forth in the synonymy outlined above, includes this species under the name of *Sequoia haydenii* (Lesquereux) Cockerell, on the ground of its identity with *Hypnum haydenii* Lesquereux,<sup>1</sup> which would give the specific name *haydenii* the priority. It seems impossible that this should belong to *Sequoia*, and the suggestion of Britton and Hollick<sup>2</sup> that it is nearest to certain forms of *Juniperus* is followed, and consequently *Hypnum haydenii* Lesquereux, is treated as a doubtful species of *Juniperus*.

The reference of certain fossil trunks to this species, while possibly true, is unwarranted on the basis of our present knowledge, since they have never been—nor are they likely ever to be—found connected. The inferential combination of species not found in actual organic connection is often harmful and misleading.

**SABINA LINGUAEFOLIA (Lesquereux) Cockerell.**

Plate 14.

*Sabina linguaefolia* (LESQUEREUX) COCKERELL, Univ. Colorado Studies, vol. 3, 1906, p. 175.

*Widdringtonia linguaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 139, pl. 21, figs. 14, 14a.

*Glyptostrobus europaeus* HEER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 74, pl. 7, figs. 1, 2.

This beautiful species is exceedingly abundant in all collections from Florissant. The Scudder collection contains a specimen covering an area 25 cm. in length by 12 cm. in width.

**JUNIPERUS? HAYDENII (Lesquereux), new combination.**

*Hypnum haydenii* LESQUEREUX, U. S. Geol. and Geogr. Surv. Terr. Bull., vol. 1, 1875, p. 383; U. S. Geol. and Geogr. Surv. Terr. Ann. Rept., 1874 [1876], p. 309; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.) 1878, p. 44, pl. 5, figs. 14, 14b; vol. 8 (Cret. and Tert. Fl.) 1883, p. 136.—BRITTON and HOLLICK, Bull. Torr. Bot. Club, vol. 34, 1907, p. 139, pl. 9, fig. 2, 2a.

*Type*.—Cat. No. 37, U.S.N.M.

The type, and so far as known the only specimen, of this form is preserved in the United States National Museum, and has proved to be more or less of a puzzle to all who have studied it. As it was described as a moss by Lesquereux, who was a recognized authority on this group of plants, it was for many years accepted as one of the extremely few fossil American representatives of this group. It has always appeared anomalous and not closely comparable to any known living species.

In 1907, when Mrs. E. G. Britton, and Dr. Arthur Hollick were collecting all available information regarding American fossil mosses,

<sup>1</sup> U. S. Geol. and Geogr. Surv. Terr. Bull., vol. 1, 1875 [1876], p. 383; Ann. Rept., 1874 [1876], p. 309; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 44, pl. 5, figs. 14-14b.

<sup>2</sup> Bull. Torr. Bot. Club, vol. 34, 1907, p. 140.

they took special occasion to reinvestigate this "*Hypnum haydenii*," the type being sent them for this purpose. Their conclusion regarding it is as follows:<sup>1</sup>

We are satisfied that it is not a moss, and Dr. L. M. Underwood, of Columbia University, has expressed his opinion that it can not be a *Lycopodium*. The closest comparisons which we have been able to make are with certain conifers, especially with forms of *Juniperus communis* L., in which the young growing branchlets often present a striking similarity in general appearance to this specimen.

It is on the basis of the above statement that it is referred tentatively to *Juniperus*, with the frank admission that it does not agree very clearly with the well-known forms of this genus, since it can not be referred either to the *Musci* or to the *Lycopodiaceae*. It is quite well marked and will be easily recognized should it be found again.

MUHLENBERGIA FLORISSANTI, new species.

Plate 13, figs. 1-3.

In the Hambach collection several beautifully preserved spikelets of a grass were found. They were shown to Mrs. Agnes Chase, the well-known graminologist, who recognized at once their reference to the genus *Muhlenbergia*. Mrs. Chase kindly consented to prepare brief notes and measurements from which the following characterization is compiled:

Stems and leaves unknown; axis of inflorescence not well defined; spikelets borne on pedicels about 1.5 mm. long, the body of the spikelet being spindle-shaped, about 2.8 mm. long, and 0.6 to 0.7 mm. wide; awn slender, 2 to 3 times as long as the body, being fully 7 mm. long. In one of the specimens [34,751] in which there are fewer, more scattered spikelets, some of the florets have apparently fallen from their glumes, the body of the floret being about 2 mm. long.

*Type*.—Cat. Nos. 34,750 [=fig. 1]; 34,751 [=fig. 3], U.S.N.M.

These specimens happen to be preserved on very fine-grained shale with the result that they are retained with a great degree of fidelity. They consist simply of little groups of spikelets broken from the panicle or inflorescence, and they exhibit no trace of the axis to which they were attached. The figures, of which figure 1 is nearly natural size and figures 2 and 3 are multiplied 3 times, give an excellent idea of the characters.

This species appears to be very near to the living *Muhlenbergia porteri* Scribner, a species ranging from Colorado and western Texas to California and Mexico. This species, known as the mesquite grass, is especially common in many parts of New Mexico, where it almost always grows in the shade of mesquite bushes. It has slender, lax stems and open spreading panicles.

<sup>1</sup> Bull. Torr. Bot. Club, vol. 34, 1907, p. 140.

The only other grass described from Florissant is *Stipa laminarum* Cockerell,<sup>1</sup> based on isolated long-awned grains similar to those of the living *Stipa connata* Trinius and Ruprecht. The grain is said to be 10–11 mm. long and about 2 mm. broad, while the awn is “quite 60 mm.” long. It is obviously very distinct from the species here described.

### Family TYPHACEAE.

#### TYPHA LESQUEREUXI Cockerell.

*Typha lesquereuxi* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 307.

*Typha latissima* AL. BRAUN. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 141, pl. 23, figs. 4, 4a. [Not *T. latissima* Al. Braun.]

A single characteristic example showing the complete apical portion of a leaf; from the Scudder collection.

### Family POTAMOGETONACEAE?

#### PALAEOPOTAMOGETON, new genus.

#### PALAEOPOTAMOGETON FLORISSANTI, new species.

Plate 16, fig. 1; plate 17, fig. 3.

Stems slender, erect, weak, possibly aquatic; leaves opposite, short, grass-like, acuminate at apex, probably sheathing at the base, nervation obscure, a midrib only discernible; fruit borne on long, slender almost filiform, axillary peduncles, the fruits spheroid, short-pedicel, apparently indehiscent.

*Types*.—Cat. Nos. 34,748, 34,749, U.S.N.M.

This form is represented by the two specimens figured and by a number of isolated fruits. With the exception of the fruits, they are very faintly impressed on the matrix, as though the stems were soft and weak, suggesting an aquatic habitat. The best preserved specimen (fig. 1), representing the upper portion of a stem now about 11 cm. in length, which bears at the apex a number of leaves that are apparently broader than the other leaves and suggest the possibility that they were floating.

The fruits, as already pointed out, are the most definite parts preserved. They are spheroid or ovoid, about 2 mm. in diameter, and evidently had a very hard “shell” or test. There is evidence of the presence of rather strong ridges, but nothing to indicate that they were dehiscent, in fact they suggest akenes rather than capsules. Each fruit is short-pedicel and borne on a long, slender, axillary peduncle. The peduncles are clearly alternate, but this is probably an incident rather than a point of significance.

<sup>1</sup>Cockerell, T. D. A., Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 79, pl. 6, figs. 1, 3.

The affinity of this plant has not been recognized with certainty. In some ways it certainly suggests *Potamogeton*, to which it was referred by Lesquereux, but its opposite leaves and pediceled fruits are not wholly in accord with this genus. It has been shown to many botanists and no one has been able to suggest anything like an obviously close relationship for it. It is not at all certain that the implication in the generic name given it is the correct one, for it may not really be allied to *Potamogeton*, and it is published at this time simply to make it a matter of record and in the hope that some one may be able to place it more definitely.

### Family NAIADACEAE.

#### NAJADOPSIS RUGULOSA Lesquereux.

*Najadopsis rugulosa* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 142, pl. 23, fig. 7.

A single example in the Scudder material.

### Family LEMNACEAE.

#### SPIRODELLA PENICILLATA (Lesquereux) Cockerell.

*Spirodella penicillata* (LESQUEREUX) COCKERELL, Univ. Colorado Studies, vol. 3, 1906, p. 174; Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 79.

*Lemna penicillata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 143, pl. 23, fig. 8.

*Type*.—Cat. No. 1,628, U.S.N.M.

This specimen, so far as known, still remains unique. It is very obscure and may or may not have been correctly interpreted and figured, and at best it can not be considered of great value.

### Family PALMACEAE?

#### PALMOCARPON? GLOBOSUM Lesquereux.

*Palmocarpon? globosum* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 144, pl. 24, fig. 3.

The Scudder collection contains two well-preserved specimens that are referable to this species. It is extremely doubtful if this fruit has anything to do with the palms, which so far as authentically known did not occur at Florissant.

### Family JUGLANDACEAE.

#### JUGLANS MAGNIFICA, new species.

Plate 15. (About half natural size.)

*Juglans crossii* KNOWLTON. KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 183, pl. 14, fig. 1.

Leaf of large size, at least 30 cm. long and about 25 cm. broad, odd-pinnate, with at least 11 leaflets; rachis thick (3 mm.), especially below; terminal leaflets long-petiolulate (3.5 long), symmetrical.

narrowly obovate, wedge-shaped from above the middle, obtuse at apex; lateral leaflets opposite, nearly or quite sessile; upper pair much the larger, elliptical-lanceolate in shape, very unequal-sided, rather abruptly narrowed at base, pointed at apex (14 cm. long, 5 cm. broad); next pair similar but smaller (9 cm. long, about 4 cm. broad); lower pair smallest, about 6 cm. long and only 2.5 cm. broad, very unequal-sided; all leaflets coarsely, somewhat doubly serrate, the teeth large, rather obtuse; nervation consisting of a very strong midrib and numerous thin, close, slightly arched craspedodrome secondaries; finer nervation obscure.

*Type*.—Cat. No. 33,765, U.S.N.M.

This splendid specimen was contained in the Hambach collection, and as may be seen in the figure, is nearly perfect, the three terminal leaflets being absolutely so, and several of the lower ones nearly complete. In the Florissant material belonging to the United States National Museum there is a specimen [No. 50,288] that was donated by Mr. R. D. Lacoë, which belongs to this species. It shows portions of the terminal parts of two leaves, each with several leaflets, but they are obscure and fail to give the clear exposition of characters to be noted in the type-specimen. This Lacoë specimen had passed through Lesquereux's hands and was noted as a new species of *Juglans*, but it was never published.

The specimen that was identified by Kirchner<sup>1</sup> as *Juglans crossii* Knowlton, is now in the United States National Museum [No.33,682], and is before me. The shape of the best preserved leaflet in this specimen is very much like some of the leaflets in Lesquereux's figure,<sup>2</sup> but it appears that the latter must have been palmately compound, that is the leaflets originated from the top of a common petiole, whereas the present specimen is distinctly pinnately compound. There is no doubt that this Kirchner specimen belongs to *Juglans magnifica*.

The Scudder collection contains three or four leaflets that obviously belong to this species, but it would have been difficult to place them without the specimens showing the leaflets attached.

*Juglans magnifica* appears to be a rather rare species, since only four specimens are contained in the Museum collections, which number many hundreds. It must have been a tree of imposing appearance when living, and doubtless supplied the fruits described under separate name, but they can not yet be placed together. It is clearly not the same as Kirchner's *J. affinis*, which is described from a single, narrowly lanceolate, sparingly toothed leaflet.

<sup>1</sup> Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 183, pl. 14, fig. 7.

<sup>2</sup> Called *J. denticulata* Heer, Tert. Fl., pl. 58, fig. 1.

## JUGLANS FLORISSANTI Lesquereux.

Plate 17, fig. 2.

*Juglans florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 190

*Type*.—Cat. No. 50,355, U.S.N.M. [Original No. 80 of Lacoë's cabinet.]

This species, here figured for the first time, was named and described by Lesquereux in 1883, and became the property of the United States National Museum by the accession of the Lacoë collection. It is possible that it is the same as the species here described as *Juglans magnifica*, but it appears slightly different and is held distinct. It has, as Lesquereux said, a rough surface and is altogether of a coarser aspect than *J. magnifica*; it is also much less unequal-sided at base.

## JUGLANS AFFINIS Kirchner.

*Juglans affinis* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 184, pl. 13; fig. 2.

*Type*.—Cat. No. 33,680, U.S.N.M.

## JUGLANS? SEPULTUS Cockerell.

Plate 17, fig. 4.

*Juglans? sepultus* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 80, pl. 6, fig. 8.

*Juglans costata* UNGER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 190, pl. 39, fig. 5.

A single specimen in the Hambach collection undoubtedly belongs here. It is so preserved as to indicate beyond reasonable doubt that it is really the fruit of *Juglans*.

## Family MYRICACEAE.

## Genus MYRICA.

Of the 200 species of plants, more or less, that have been described from Florissant, the greatest number of nominal species, and probably the greatest number of individuals have been referred to the genus *Myrica*. Almost every blow of the hammer is pretty certain to disclose one or more of the forms that have been referred to this genus. The result has been to bring together very considerable collections, and from which it is now possible to draw fairly definite conclusions as to probable specific limitations, though there are of course some points on which the evidence is not yet complete enough for final decisions. Many of the earlier collections, on which Lesquereux based much of his work, were very small and afforded little or no evidence on the range in specific variation, with the result, as we can now

see, that too many species were established. Most of this original material studied by Lesquereux is preserved in the United States National Museum, together with large recent collections, and all has been reviewed in the present connection with as much thoroughness as time permitted. As at present understood, the earlier-described species of *Myrica* from Florissant are disposed of as follows, those in Roman being the accepted species:

*MYRICA ACUMINATA* UNGER. LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 411; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 130, pl. 17, figs. 1-4.

= *Myrica scottii* (figs. 1, 4).

= *Myrica drymeja* (figs. 2, 3).

*Myrica amygalina* SAPORTA. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 26, figs. 1-4.

= *Myrica coloradensis*.

*MYRICA BOLANDERI* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 133, pl. 17, fig. 17.

= Excluded; from unknown locality.

*Myrica callicomaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 146, pl. 26, figs. 5-14.

= *Myrica drymeja* (Lesquereux) Knowlton.

*MYRICA COPEANA* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 411; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 131, pl. 17, fig. 5.

*Myrica diversifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 148, pl. 25, figs. 6-15.

= *Sorbus diversifolia* (Lesquereux) Cockerell.

= *Sorbus nupta* Cockerell.

= *Ribes?* *florissanti*.

*MYRICA DRYMEJA* (LESQUEREUX) KNOWLTON, Bull. U. S. Geol. Surv. 152, 1898, p. 146.

*Myrica fallax* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 32, figs. 11-16.

= *Myrica drymeja* (Lesquereux) Knowlton.

*MYRICA HENDERSONI* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 308, fig. (in text) 1.

*Myrica insignis* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1874 [1875], p. 312; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 135, pl. 17, figs. 7, 8.

= *Comptonia insignis* (Lesquereux) Cockerell.

*Myrica latiloba acutiloba* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 412; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 134, pl. 17, fig. 13.

= *Crataegus acutiloba* (Lesquereux) Knowlton.

*MYRICA OBSCURA* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 145, pl. 32, figs. 8-10.

= *Myrica drymeja* (Lesquereux) Knowlton.

*Myrica polymorpha* SCHIMPER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 146, pl. 25, figs. 1, 2.

= *Myrica scottii* Lesquereux.

*Myrica rigida* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 145, pl. 25, figs. 3, 4.

= *Myrica drymeja* (Lesquereux) Knowlton.

- MYRICA SCOTTII* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 32, figs. 17, 18.
- Myrica zachariensis* SAPORTA. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 146, pl. 25, fig. 5.  
= *Myrica drymeja* (Lesquereux) Knowlton.

**MYRICA DRYMEJA (Lesquereux) Knowlton.**

Plate 20, figs. 1, 2.

- Myrica drymeja* (LESQUEREUX) KNOWLTON, Bull. U. S. Geol. Surv. 152, 1898, p. 146.
- Rhus? drymeja* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr. 1873 [1874], p. 416.
- Callicoma microphylla* ETTINGSHAUSEN. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 246, pl. 43, figs. 2-4.
- Myrica callicormaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 146, pl. 26, figs. 5-14.
- Myrica obscura* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 145, pl. 32, figs. 8-10.
- Myrica rigida* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8, 1883, p. 145, pl. 25, figs. 3, 4.
- Myrica fallax* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8, 1883, p. 147, pl. 32, figs. 11-16.
- Myrica zachariensis* SAPORTA. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8, 1883, p. 146, pl. 25, fig. 5. [Not pl. 45A, figs. 6-9.]
- Myrica acuminata* UNGER. LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 411; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 130, pl. 17, figs. 2, 3. [Not figs. 1, 4, which = *M. scottii*.]

Most of the type-specimens of *Myrica callicormaefolia*, *M. rigida*, and *M. fallax* are preserved in the United States National Museum, together with a great number of other fine examples that would ordinarily be referred to the first mentioned species. A careful study of this material has failed to disclose any satisfactory line by which they may be essentially separated, and hence, following Cockerell's suggestion, they have all been combined under the name of *Myrica drymeja*, which is the earliest specific name applied to what was later called *M. callicormaefolia*. Lesquereux himself suggested the possibility of his *M. fallax* being referable—perhaps as a variety—to *M. callicormaefolia* or *M. drymeja*, as it is now called. The species may be known by the narrow shape with more or less inequilateral base and numerous regular teeth which may be low or sharp and distinct.

The single specimen from Florissant that was referred by Lesquereux<sup>1</sup> to *Myrica zachariensis* Saporta, has not been found in the collections of the United States National Museum. It is believed to be nothing but a large, nearly equal sided leaf of *M. drymeja*; in any event, it is not to be distinguished from some in the collection that were so referred by Lesquereux himself.

The status of the four leaves from Elko, Nevada, that were described and figured by Lesquereux<sup>2</sup> under the name of *Myrica zach-*

<sup>1</sup> Lesquereux, Leo, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 145, pl. 25, fig. 5.

<sup>2</sup> Idem, p. 149, pl. 45A, figs. 6-9.



*ariensis* Saporta, will have to be settled later. They do not appear to be referable to *M. drymeja*, nor do they seem to be anything like the one above mentioned from Florissant.

The leaves described and figured by Lesquereux under the name of *Myrica acuminata* Unger, are all preserved in the United States National Museum [Nos. 143-145], and appear referable to two species. Figures 2 and 3 [144 and 145] appear to be best referred to *M. drymeja*, while figures 1 and 4 [143, 145a] are referred to *M. scottii*. Shortly after the publication of Lesquereux's Tertiary Flora (1878), Ettingshausen<sup>1</sup> took occasion to change the names of a number of his (Lesquereux's) species, among them being the four leaves referred to *Myrica acuminata* Unger. These Ettingshausen called *Ceratopetalum americanum*, but it seems best to dispose of them as indicated above.

MYRICA COLORADENSIS, new species.

Plate 21, fig. 1.

*Myrica amygdalina* SAPORTA. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 26, figs. 1-4.

*Types*.—U.S.N.M., figs. 1 [1,654], 2 [1,655], 3 [1,654a], 4 [1,653], cotypes, Cat. Nos. 1,657, 1,658, U.S.N.M.

I believe this to be a good species and well entitled to recognition. It has small leaves, 2.5 to 5.5 cm. in length, submembranaceous in texture, oblong-lanceolate, enlarged toward the upper part, where they are obtuse or apiculate, and narrowed below to a short petiole. The margin is denticulate or subentire, becoming quite entire below. The midrib is rather slender, while the secondaries are very numerous, at an angle of about 50°, much curved outward, obliquely branching and reticulate, with the nervilles oblique to the secondaries.

This species was referred by Lesquereux to *Myrica amygdalina* Saporta,<sup>2</sup> from the Eocene of France, and it must be confessed it has a very strong resemblance to at least one of Saporta's figures (fig. 8), though the other figures are perfectly entire and look much more like leaves of *Salix* than leaves of *Myrica*. The teeth in the French species are very slight and remote, and the secondaries emerge at a more open angle than in the Florissant leaves and are curved upward instead of outward.

I have refigured one of the types of the Florissant species,<sup>3</sup> which brings out very clearly the differences between it and Saporta's species. The margin is provided with numerous regular, small, sharp

<sup>1</sup> Ettingshausen, C. von, Denks. d. k. Akad. d. wiss. math.—nat. classe, vol. 47, 1883, p. 137 [37]; Geol. Surv. N. S. W., Mem. Pal., No. 2 [Tert. Fl. Australia], 188, p. 58.

<sup>2</sup> Saporta, Gaston de, Études sur la Vég. sud-est France: Ann. Sci. Nat. (5 ser.) bot., vol. 9, 1867, p. 153 211, pl. 1, figs. 8-10.

<sup>3</sup> Lesquereux's fig. 3, Rept. U. S. Geol. Surv. Terr., vol. 8, 1883, pl. 26.

teeth, and as may be seen, the secondaries, while arising at a somewhat more acute angle, are distinctly curved outward, and are often branched. The peculiar oblique nervilles are also well brought out in the new figure.

In view of the above differences, as well as the improbability of a European Eocene species persisting into the American upper Miocene, it has seemed best to separate these leaves under a new name. It has not been observed in any of the later collections.

**MYRICA HENDERSONI** Cockerell.

*Myrica hendersoni* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 308, fig. (in text) 1; Univ. Colorado Studies, vol. 3, 1906, p. 176, fig. 7.

*Morella hendersoni* (COCKERELL) COCKERELL, Univ. Colorado Studies, vol. 3, 1906, p. 173.

It has been found that *Morella* is untenable as a name for certain species of *Myrica*, and as there appears to be so much uncertainty regarding the nomenclature of this genus it seems best to employ the better known term *Myrica*, at least until some agreement can be reached.

I have not seen specimens of this species, which, to judge from the description and rather faint figure, appears to be quite distinct from the other forms of *Myrica*. Concerning it Cockerell says:

At first sight, the leaves seem to be entire, and the plant looks like a *Salix* closely allied to *S. myrtilloides*; on close inspection, however, the apical halves of the larger leaves are seen to be sparingly dentate, irregularly and sharply, not at all in the manner of *Salix*, but entirely as in *Myrica cerifera*.

**MYRICA OBSCURA** Lesquereux.

*Myrica obscura* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 145, pl. 32, figs. 8-10.

*Types*.—Cat. Nos. 1,630 [fig. 9], 1,629 [fig. 10], U.S.N.M.

Lesquereux described this form as follows:

Leaves linear-lanceolate, coarsely serrate, rounded in narrowing to the petiole, unequilateral at base; nervation obsolete.

Two of the types of this species are in the United States National Museum, and while they have a degree of likeness to *Myrica drymeja*, and incline to retain it as a valid species, they certainly have quite a different facies from *M. drymeja* and may at least be held as distinct until further corroborative information one way or the other.

Since the above was written I have just noted that Cockerell,<sup>1</sup> in a postscript to his largest paper, has reached a similar conclusion. He says:

The collection of 1907 contains good material of *Myrica obscura* Lx., which proves to be a perfectly valid species, probably referable to *Comptonia*.

I have not seen additional specimens, but so far as the types go it does not seem that it should be referred to *Comptonia*.

<sup>1</sup> Cockerell, T. D. A., Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 108.

## MYRICA SCOTTII Lesquereux.

Plate 20, figs. 3, 4.

*Myrica scottii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 32, figs. 17, 18.—COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 81.

*Myrica polymorpha* SCHIMPER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 146, pl. 25, figs. 1, 2.

*Myrica acuminata* UNGER. LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 411; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.) 1878, p. 130, pl. 17, figs. 1, 4 [not figs. 2, 3, which = *M. drymeja*].

One of the two type specimens of *Myrica scottii*<sup>1</sup> is preserved in the United States National Museum (No. 1,660), and also one of the two specimens illustrated under the name of *Myrica polymorpha* Schimper,<sup>2</sup> and as there seems to be no essential difference between them they have been combined as above indicated. The teeth in the original *M. scottii* are perhaps a little longer and sharper than is shown in the figures of *M. polymorpha*, but the latter are not quite correctly shown in Lesquereux's figures, being as sharp in many cases as in the other. This species may be distinguished by the long, very slender shape and the conspicuously sharp teeth.

The Lacoë collection contains a single small narrow leaf (U.S.N.M., 50,239) that was identified by Lesquereux as *Myrica zachariensis* Saporta, but it clearly belongs with *M. scottii*. It is wholly unlike the Florissant leaf referred to *M. zachariensis* by Lesquereux.<sup>3</sup>

I have also referred here two of the leaves figured by Lesquereux under the name of *Myrica acuminata* Unger, namely figures 1 and 4 of his plate 17. These are Nos. 143 and 145a in the United States National Museum collections. The other two figures are referred to *M. drymeja*. The two leaves here referred to *M. scottii* have been refigured (pl. 21, figs. 3, 4).

## MYRICA COPEANA Lesquereux.

*Myrica copeana* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 411; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 131, pl. 17, fig. 5.—COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 81.

*Type*.—Cat. No. 147, U.S.N.M.

This, as Lesquereux stated, is a fine, large, well-characterized species, described originally from a single specimen. It is not contained in any of the collections studied in the United States National Museum, but Cockerell mentions its occurrence at his station 9, so the type-specimen evidently is not unique. It must, however, be considered as a rare species.

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, pl. 32, fig. 17.

<sup>2</sup> Idem, pl. 25, fig. 1.

<sup>3</sup> Idem, pl. 25, fig. 5.

## COMPTONIA INSIGNIS (Lesquereux) Cockerell.

*Comptonia insignis* (LESQUEREUX) COCKERELL, Univ. Colorado Studies, vol. 3, 1906, p. 173.—BERRY, Amer. Nat., vol. 40, 1906, p. 499.—COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 81.

*Myrica insignis* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1874 [1875], p. 312; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 135, pl. 65, figs. 7, 8; vol. 8 (Cret. and Tert. Fl.), 1883, p. 150.

The type-specimens of Lesquereux's *Myrica insignis* are preserved in the United States National Museum (No. 538, both being on the same piece of matrix), and apparently remain unique. It is not present in any of the recent collections that have passed under my eyes.

This species is undoubtedly most closely related to *Myrica alkalina* Lesquereux<sup>1</sup> from Alkali Station, a few miles north of Green River, Wyoming, and in fact Berry<sup>2</sup> has already united them, stating that he is "inclined to think that the leaves which Lesquereux called *alkalina* are simply the young leaves of which *insignis* is the mature leaf, for they are (1) much more variable in lobation, (2) smaller in size and definiteness and in the extent of their lobes, combined with narrower lamina, and (3) they have a much thicker midrib."

*Comptonia insignis* has also some resemblance to certain of the figures given by Lesquereux<sup>3</sup> of his *Myrica diversifolia*, which in this paper is called *Crataegus acutilobus*.

## Family SALICACEAE.

## SALIX, species.

Plate 13, figs. 4, 5.

The Hambach collection includes three leaves, two of which are here figured, which are obviously those of *Salix*, but which I have hesitated either to identify with a known species, or to describe as new. They are narrowly linear-lanceolate but with a short petiole and long wedge-shaped base. The nervation is nearly obsolete in the smaller specimen, but in the other it consists of a relatively strong midrib and about four or five pairs of slender secondaries at a very acute angle of divergence.

*Types*.—Cat. Nos. 33,744, 33,745, U.S.N.M.

This form has a resemblance to a number of species, such for instance as a very small, narrow leaf of *S. angusta*, but the nervation differs somewhat.

<sup>1</sup> Lesquereux, Leo, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 149, pl. 45A, figs. 10-15.

<sup>2</sup> Berry, Edward W., Living and fossil species of *Comptonia*, Amer. Nat., vol. 40, 1906, p. 499.

<sup>3</sup> Lesquereux, Leo, Rept. U. S. Geol. Surv. Terr., vol 3, 1883, p. 148, pl. 25, figs. 6, 11, 12, etc.

## POPULUS LESQUEREUXI Cockerell.

*Populus lesquereuxi* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 307; Univ. of Colorado Studies, vol. 3, 1906, p. 172.

*Populus heerii* SAPORTA. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 157, pl. 30, figs. 1-8; pl. 31, fig. 11. [Not *P. heerii* Saporta].

This common and well-known Florissant species, which has been correctly segregated by Cockerell, is represented by a considerable number of well-preserved examples in the several collections.

## POPULUS PYRIFOLIA Kirchner.

*Populus pyrifolia* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 185, pl. 15, fig. 4.

*Populus oxyphylla* SAPORTA. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 159, pl. 33, figs. 9-11.

Type of *P. pyrifolia*.—Cat. No. 33,687, U.S.N.M.

After a comparison of all these specimens I have come to the conclusion that there is only a single species represented. The leaf described by Kirchner as *Populus pyrifolia* is of precisely the same character as the leaves figured by Lesquereux as *P. oxyphylla*, the only difference being in the size, the former being about twice as large as the latter. The margin is not preserved in *P. pyrifolia*, but there is every reason to suppose that it was toothed, as in the others.

The proper name that should be given this species may be briefly considered. If one could be certain that the leaves referred by Lesquereux to *P. oxyphylla* were really Saporta's species, then of course Kirchner's *P. pyrifolia* would become a synonym of it, but, as Cockerell has said,<sup>1</sup> "in view of the general improbability of our species being identical with that of Saporta, I should prefer to use Kirchner's name," I have acceded to this view and have placed these leaves under the name given by Kirchner, where they may remain until evidence to the contrary is forthcoming.

There are two other specimens in the Hambach collection that I refer here, though neither is as well preserved as the one figured.

## POPULUS MICRO-TREMULOIDES, new species.

Plate 19, fig. 2.

A branch (4.5 cm. long) bearing prominent leaf scars and indicating a growth of three, and possibly four, seasons; the presence of six leaves is shown by the petioles which are crowded in a short space, and are alternate in insertion; leaves apparently circular or short-elliptical in outline, truncate or slightly heart-shaped at base, and there entire, possibly slightly toothed or undulate above; nervation with a relatively strong midrib and several pairs of opposite, or sub-

<sup>1</sup> Univ. of Colorado Studies, vol. 3, 1906, p. 173.

opposite, thin apparently camptodrome secondaries; finer nervation not preserved.

*Type*.—Cat. No. 34,738. Counterpart 34,739, U.S.N.M.

This specimen with its counterpart is all that has been observed in the collections, and unfortunately it is not perfectly preserved. It consists of a short stocky branch rather closely set with large leaf-scars, and, judging from its similarity to the living species, indicates the growth of four seasons. No very satisfactory measurements of the leaves can be given. The petioles are about 1.5 cm. long, and the leaves about 2 cm. broad, but the full size and shape of the latter can not be ascertained.

This species is thought to be most closely related to the living *Populus tremuloides* Michaux, the well-known trembling aspen, being especially like the short stunted branches and small leaves of trees or bushes which have grown in very dry situations. The nervation of this species is not quite typical for *Populus tremuloides*, and it is, of course, possible that the characters above set forth may not indicate this genus, but in any event, it seems distinct from described forms, and may stand until more perfect material is obtained. It has some superficial resemblance to *Panax andrewsii* Cockerell,<sup>1</sup> especially in the clustering of the leaves and their size and probable nervation, but the latter is interpreted as being a compound leaf of five leaflets, and moreover, the petioles are provided with prickles.

POPULUS CRASSA (Lesquereux) Cockerell.

Plate 18.

*Populus crassa* (LESQUEREUX) COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 83, pl. 8, fig. 22; pl. 10, fig. 42.

*Macreightia crassa* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 175, pl. 34, figs. 16, 17.

*Diospyros cuspidata* KIRCHNER. Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 185. pl. 12, fig. 1.

*Type of Diospyros cuspidata*.—Cat. No. 33,675, U.S.N.M.

The type and only specimen of Kirchner's *Diospyros cuspidata* is absolutely identical with the figures of *Macreightia crassa* Lesquereux, and it is probable that all were equally four-valved, notwithstanding the appearance of the figures. That they have apparently been correctly referred to *Populus*, is well shown by the splendid specimen figured (U.S.N.M., 50,332), which was contained in the paleobotanical collections donated to the United States National Museum by Mr. R. D. Lacoë. This is an absolutely complete drooping raceme 18 cm. long, with the rachis about 3 mm. thick, and showing about thirty of the capsules attached by the short thick pedicels. The point where the raceme was attached is broad, enlarged, circular

<sup>1</sup>Amer. Nat., vol. 42, 1908, p. 581, fig. (in text) 12.

(6 mm. in diameter), and slightly concave, and presents an appearance identical with that to be observed in the twigs and small branches that are so abundantly "cast" by the living cottonwood trees (*Populus monilifera*, etc.).

The appearance of branching to be observed in this specimen is undoubtedly due to the presence of another raceme which lies under the larger example in such a manner as to make it appear as a branch of it.

**POPULUS, species.**

Plate 16, fig. 4.

*Type*.—Cat. No. 34,753, U.S.N.M.

The specimen here shown, which is from the Hambach collection, appears to be a large though evidently immature catkin of *Populus*. It is from the base of the catkin, as evidenced by the 1 cm. long portion of the stem below the last or first pair of capsules. The portion preserved is about 5 cm. in length, but it is difficult to decide whether or not it is all present, and it is probable that it was very much longer when perfect.

It is quite possible that this may represent the immature stage of *Populus crassa*, since, as may be seen on comparing the two figures, it is evident that the main rachis is of about the same size, though the individual pedicels are much shorter than they are in *P. crassa*. It is not of very great importance in any event, and is given merely to show that the various stages of the fruits of *Populus* were preserved.

**Family BETULACEAE.**

**CARPINUS ATTENUATA Lesquereux.**

*Carpinus attenuata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 152, pl. 27, fig. 10.

A single example in the Hambach collection. It is smaller than the figure given by Lesquereux but does not otherwise differ essentially.

**CARPINUS FRATERNA Lesquereux.**

*Carpinus fraterna* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert.) 1883, p. 152, pl. 27, figs. 12-14.

Several fine specimens in both the Scudder and Hambach collections. One in the former collection is much larger than any of the figures given of this species, but it does not otherwise differ.

**BETULA TRUNCATA Lesquereux.**

*Betula truncata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 150, pl. 28, figs. 7, 8. [*Alnus truncata* on plate]

The Hambach collection contains a single leaf of this species, this being of the same shape and nervation as figure 8 (referred to in the synonymy), but is a little longer.

## BETULA DELTOIDES, new species.

Plate 19, fig. 3.

*Type*.—Cat. No. 34,754, U.S.N.M.

Leaf of medium size, membranaceous in texture, deltoid or truncate-ovate in outline, perfectly truncate across nearly the whole base, apex prolonged and slenderly acuminate; margin coarsely toothed, the teeth very sharp, occasionally with smaller teeth on or between the larger ones; petiole slender, one half the length of the blade; nervation 5-ribbed from the top of the petiole, the midrib straight, with 5 or 6 pairs of subopposite, craspedodrome secondaries; lowest pair of secondaries or ribs at an angle of  $45^\circ$ , each with 4 or 5 craspedodrome tertiary branches on the outside, the lowest ones arising at the top of the petiole; nervilles fairly numerous, mainly percurrent.

This leaf is absolutely perfect. Its length is 6 cm. and its width 3.5 cm., while the petiole is slightly less than 3 cm. long. The peculiarly truncate base, sharply, obscurely doubly serrate margin and 5-ribbed nervation mark it exceedingly well.

The present species if correctly allocated, makes the third made known from Florissant, the others being *Betula florissantii* Lesquereux,<sup>1</sup> and *Betula truncata* Lesquereux.<sup>2</sup> With the first species mentioned the present one has no evident specific relationship; the other is somewhat nearer but differs in its much smaller size, less truncate base, a different marginal dentition and above all in the nervation.

## ALNUS PRAECORDATA Cockerell.

Plate 19, fig. 1.

*Alnus praecordata* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 84.

*Alnus cordata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert., Fl.), 1883, p. 151. [Homonym of *A. cordata* Desf. 1827.]

*Type*.—Cat. No. 50,357, U.S.N.M. [No. 83 of Lacoë's cabinet].

The type and only known specimen of this species, which became the property of the United States National Museum through the acquisition of the Lacoë collection, is here figured for the first time.

## ALNUS, species.

Plate 16, fig. 2.

*Type*.—Cat. No. 34761, U.S.N.M.

The Hambach collection contains a single example apparently of the mature strobiles of a species of *Alnus*. It has a very thick pedicel and bears two "cones" about 1 cm. long. The form of the scales of the "cones" can not be made out.

<sup>1</sup> Lesquereux, Leo, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 150, pl. 27, fig. 11.

<sup>2</sup> Idem, p. 150, pl. 27, figs. 7, 8.



## Family FAGACEAE.

## FAGOPSIS LONGIFOLIA (Lesquereux) Hollick.

Plate 20, fig. 5.

*Fagopsis longifolia* (LESQUEREUX) HOLLICK, Torrey, vol. 9, 1909, p. 2, figs. (in text) 1, 2.

*Planera longifolia* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr. 1872 [1873], p. 371; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 189, pl. 27, figs. 4-6; vol. 8 (Cret. and Tert. Fl.), 1883, p. 161, pl. 29, figs. 1-13.

*Fagus longifolia* (LESQUEREUX) HOLLICK and COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 88 (footnote).

*Quercus semi-elliptica* GÖPPERT. LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1871 [1872], p. 286.

This is one of the most abundant plants found in the Florissant deposits, occurring literally by thousands. It is found usually as detached leaves, though branches having leaves attached occur occasionally, and yet in spite of this abundance it was not until a few years ago that specimens were found showing the fruit. From these it becomes plain that it is closely allied to, if not indeed identical with, *Fagus*.

## QUERCUS DRYMEJA? Unger.

*Quercus drymeja* UNGER, Chloris Prot., 1847, p. 113, pl. 32, figs. 1-4.—LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 157, pl. 19, fig. 19; vol. 8 (Cret. and Tert. Fl.), 1883, p. 154, pl. 28, fig. 12.

The Scudder collection contains a single specimen representing the basal portion of a leaf with its long, slender petiole that is evidently the same as the figure given by Lesquereux in his Cretaceous and Tertiary Floras (pl. 28, fig. 12).

## QUERCUS SCUDDERI, new species.

Plate 21, fig. 3.

Leaf of small size, coriaceous in texture, oblong and slightly obovate, about equally rounded at both base and apex; margin entire for lower half of leaf, thence provided with four or five rather large teeth; petiole very short, stout; midrib stout, especially below; secondaries about five pairs, alternate, at an angle of about 45°, little curved upward, crospeodrome and ending in the marginal teeth; nervilles irregular, much broken, producing large irregularly quadrangular areas.

*Type*.—Cat. No. 34,758, U.S.N.M.

This little leaf, which is evidently thick and coriaceous in texture, is slightly oblong-obovate in shape, being broadest just above the middle. The length is 23 mm., and the width about 9 mm., while the petiole is only 2 mm. long.

This species, which is preserved on the same piece of matrix with *Typha lesquereuxii*, is apparently quite unlike any oak previously

described from Florissant. It belongs evidently to the *Quercus virginiana* group or so-called live oaks, being, for instance, not unlike certain forms of *Q. affinis* (Lesquereux) Knowlton, from the John Day Basin of Oregon. The latter, however, has more teeth and a greater number of secondaries. It also suggests some of the small leaves of *Q. consimilis* Newberry,<sup>1</sup> but here, again, the teeth and secondaries are more numerous.

### Family ULMACEAE.

#### ULMUS TENUINERVIS Lesquereux.

*Ulmus tenuinervis* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 412; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.) 1878, p. 188, pl. 26, figs. 1-3.

A single fine leaf in the Scudder collection.

#### PLANERA MYRICAEOFOLIA (Lesquereux) Cockerell.

Plate 21, fig. 2.

*Planera myricaefolia* (LESQUEREUX) COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 87.

*Planera longifolia myricaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 161, pl. 29, figs. 15-27.

*Podocarpus eocenica?* UNGER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 140.

The Lacoë collection of Florissant plants, now the property of the United States National Museum, contains the specimen (U. S. N. M., 50,339; original No. 68, Lacoë collection) referred by Lesquereux to *Podocarpus eocenica?* Heer, and which he says is "narrowly linear-lanceolate, acute, narrowed into a short petiole." A careful examination of this leaf, which is here figured for the first time, discloses that it is not entire, but has several distinct, very sharp teeth near the apex, and two or three obscure teeth along the sides to a point at or below the middle. The nervation consists of the rather strong straight midrib, and numerous thin secondaries at a very acute angle with it which enter the teeth. This of course excludes it from *Podocarpus*, and it is probably a narrow, sparsely toothed leaf of *Planera myricaefolia*, being, for instance, very much like figures 21 and 22 of Lesquereux's plate of this species.

#### CELTIS MCCOSHII Lesquereux.

CELTIS MCCOSHII LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.) 1883, p. 163, pl. 38, figs. 7, 8.

A specimen in the Scudder collection that undoubtedly belongs here, though the marginal teeth are slightly coarser and more distant. The shape of the leaf and its nervation are identical.

<sup>1</sup> Newberry, J. S., Mon. U. S. Geol. Surv., No. 35, 1898, pl. 43, fig. 4.

## Family MORACEAE.

## FICUS FLORISSANTIA, new species.

*Ficus haydenii* LESQUEREUX. KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 179, pl. 12, fig. 3.

*Type*.—Cat. No. 33,677, U.S.N.M.

After an examination of the originals of both these forms I am convinced that the Florissant leaf referred by Kirchner to Lesquereux's *Ficus haydenii* is not the same as the Black Buttes leaf. The former differs in being more heart-shaped at base and markedly in the secondary nervation. In *F. haydenii* the secondaries are all alternate and emerge at about the same angle, while in *F. florissantia* the three lower pairs are crowded at the base and at very different angles. The second pair is nearly at right angle to the midrib, and the first and third pairs are below, and about equally above, a right angle respectively. The upper pairs of secondaries are about the same in both species, though they appear to arch more strongly in *F. florissantia*. It therefore seems best to consider them as distinct.

## Family PROTEACEAE.

## LOMATIA INTERRUPTA Lesquereux.

Plate 25, fig. 5.

*Lomatia interrupta* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 167, pl. 43, figs. 18, 19.

The Hambach collection includes a single absolutely perfect leaf of this species (U.S.N.M. 33,703), which is here figured as it supplements to some extent the type-specimens.

## LOMATITES HAKEAEFOLIA (Lesquereux) Cockerell.

Plate 26, figs. 1, 2.

*Lomatites hakeaeifolia* (LESQUEREUX) COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 89.

*Lomatia hakeaeifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 166, pl. 32, fig. 19.

*Carduus florissantensis* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 311, fig. (in text) 6.

The specimen here figured, which comes from the Hambach collection, is undoubtedly identical with the *Carduus florissantensis* of Cockerell, and further, it does not seem to be separable from *Lomatia hakeaeifolia* of Lesquereux. The latter, known only from the single example figured, has plainly the same configuration at the base and only differs in not having the upper lobes large. The long slender terminal lobe is the same in all the specimens.

It is possible that *Quercus balaninorum* Cockerell<sup>1</sup> should also be referred here. The upper portion is the same, but the basal portion is more sharply wedge-shaped.

<sup>1</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 86, pl. 8, fig. 21.

## BANKSITES LINEATUS Lesquereux.

*Banksites lineatus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 165, pl. 32, fig. 21.

There are half a dozen good specimens in the Scudder material.

## Family ARISTOLOCHIACEAE.

## ARISTOLOCHIA WILLIARDIANA, new species.

Plate 22, figs. 1, 2.

Leaf of medium size and membranaceous texture, broadly ovate-cordate, the basal sinus deep and rounded, the lobes broadly rounded; apex of blade obtuse; midrib strong, straight; secondaries on the midrib 6 or 7 pairs, at an angle of about 45°, parallel, camptodeome, joining the one next above by broad loops just below the margin; a pair of secondary branches or ribs arise at the very base of the blade and turn abruptly downward, with small forking camptodeome branches on either side to supply the basal lobes; nervilles numerous, very distinct, mainly unbroken, but occasionally broken and forked.

*Type*.—Cat. No. 34,756, U.S.N.M.; cotype, Cat. No. 50,271, U.S.N.M. [No. 30 of Lacoë collection].

The example selected as the type (fig. 1) is a fine leaf lacking only a portion of one side. It is about 9 cm. long, 7 cm. wide, and has the basal sinus a little more than 2 cm. deep. The other specimen (Cat. No. 50,271, U.S.N.M.) is much less perfect, as it lacks practically all of the margin except at the base; its size was about the same as that of the type. This latter specimen had passed through Lesquereux's hands and was indicated by him as a new species of *Cercis*, but it can not belong to this genus.

This species is, in a general way, of the same type as *Aristolochia crassifolia* (Newberry),<sup>1</sup> from the Fort Union formation, but it is of course much smaller and much narrower. It is possible that it may be the same as *Aristolochia mortua* Cockerell,<sup>2</sup> but that species is described as having the leaf thin and the veins not united (camptodrome) on the lateral margins. The length of *A. mortua* is said to be about 105 mm. and the breadth about 70 mm.<sup>3</sup> The figure is so poorly executed that almost nothing can be made out regarding the nervation, and altogether it is impossible to decide whether it is the same as what is here called *A. williardiana*. Leaves that are to be referred to *Aristolochia* are evidently rare as Florissant, since apparently only three have thus far been detected.

<sup>1</sup> Mon. U. S. Geol. Surv., vol. 35, 1898, p. 90, pl. 60, fig. 4.

<sup>2</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 90, pl. 8, fig. 25.

<sup>3</sup> If this size is correct, the figure of it (pl. 8, fig. 25) is less than half natural size, but no mention is made of the reduction in the explanation of plates or elsewhere. This practice of publishing figures that are less than natural size without mentioning the fact, is certainly to be deplored.

This species is named in honor of Mr. T. E. Williard, of the United States Geological Survey, who has done much efficient work in selecting and preparing the Florissant collections for study.

### Family HYDRANGEACEAE.

#### HYDRANGEA? SUBINCERTA Cockerell.

*Hydrangea? subincerta* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 92, pl. 9, fig. 32.

A single example in the Hambach collection that is evidently this species. The original specimen is said by Cockerell to be without nervation, but the present one has faint indications of very thin longitudinal ribs, there being about four in a sepal. The other nervation is obsolete.

#### HYDRANGEA? FLORISSANTIA Cockerell.

*Hydrangea florissantia* COCKERELL, Amer. Journ. Sci., vol. 26, 1908, p. 67, fig. (in text) 2; p. 541.

*Rhus rotundifolia* KIRCHNER, Trans. St. Louis Acad. Sci., vol 8, 1898, p. 184, pl. 12, fig. 2. [Not *Hydrangea rotundifolia* Rafinesque.]

Type of *Rhus rotundifolia*.—Cat. No. 33,676, United States National Museum.

The type-specimen of Kirchner's *Rhus rotundifolia* is so exactly similar to the figure of Cockerell's *Hydrangea florissantia* that the two figures might almost have been made from the one specimen, and there is of course absolutely no question as to their identity. That they are properly referred to *Hydrangea*, however, is by no means so certain. Each of the individual segments, whatever their nature may ultimately be proved to be, is distinctly provided with a short thick petiole 1 or 2 mm. in length, whereas in *Hydrangea* the sepals are sessile or even slightly united at base. In *Hydrangea bendirei* (Ward) Knowlton,<sup>1</sup> from the Mascall formation of Oregon, the the sepals are completely sessile if not indeed slightly united at base. It seems a suspicious circumstance that the only specimens found (or figured) should both lack the fourth "sepal" which was presumably present if it really is a sterile flower of *Hydrangea*. It is just possible that this may be a compound leaf of three leaflets, and not a flower at all.

<sup>1</sup> Bull. U. S. Geol. Surv., No. 204, 1902, p. 60, pl. 9, figs. 6, 7.

## Family CUNONIACEAE.

## WEINMANNIA HAYDENII (Lesquereux) Lesquereux.

*Weinmannia haydenii* (LESQUEREUX) LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 178, pl. 42, figs. 1-7.

*Rhus haydenii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 294, pl. 58, fig. 12.

*Weinmannia phenacophylla* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 93.

According to Professor Cockerell, *Weinmannia haydenii* as figured by Lesquereux in the Cretaceous and Tertiary Flora is not the same as his earlier *Rhus haydenii*, which, if true, would leave the former without a name. An examination of the type of *Rhus haydenii* convinces me that Lesquereux was right in referring the seven figures in the Cretaceous and Tertiary Flora as *Weinmannia haydenii*; hence *W. phenacophylla* becomes superfluous.

Both the Hambach and Scudder collections embrace well-marked specimens that belong here. [Cat. No. 33,748, United States National Museum.]

## WEINMANNIA INTEGRIFOLIA Lesquereux.

*Weinmannia integrifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 178, pl. 42, figs. 8-13.

A single example [Cat. No. 1,809, United States National Museum] is contained in the old Museum collection.

## WEINMANNIA OBTUSIFOLIA Lesquereux.

*Weinmannia obtusifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 2878, pl. 41, figs. 4-10.

The Hambach collection includes two good examples of this very characteristic species (Cat. Nos. 33,714, 33,715, U.S.N.M.).

## Family SOLANACEAE?.

## FLORISSANTIA, new genus.

## FLORISSANTIA PHYSALIS, new species.

*Convolvulaceus?* flower, KIRCHNER, Trans. St. Louis Acad., vol. 8, 1898, p. 187, pl. 15, fig. 2.

Pedice! very slender, bractless, 2.5 cm. long; corolla rotate, slightly five-lobed, the lobes low and obtuse, greatest diameter 2.5 cm.; nervation of corolla strongly marked, consisting of five straight veins which enter the tips of the lobes, then a pair of veins on either side of the straight ones, which arch into the tip of the lobes, then one or two slender veins between the sets of 3's, in all about 20 veins which divide the corolla into approximately equal areas; numerous cross veinlets pass between the veins.

*Type*.—Cat. No. 33,686, U.S.N.M.

It is with some hesitation that the present form is described as a new genus and species, but fossil flowers are so very rare in American deposits, though, on the whole, this is so well preserved, that it seems worthy of a name. The specimen that was figured and described by Kirchner, and by him referred to with some doubt as a convolvulaceous flower, undoubtedly has a strong resemblance to the flowers of certain tropical genera of this family, but there is another specimen that was not seen by Kirchner which makes its reference to the Convolvulaceae now questionable. This latter specimen, it will be noted, has a very slender, delicate pedicel which, while not exactly excluding it from the Convolvulaceae, seems to make its reference to another family desirable, and this family, it seems to me, is the Solanaceae. The slender bractless pedicel and the nearly circular, slightly five-lobed corolla, with its peculiar nervation, are strongly suggestive of this family. In size, shape, and nervation, for instance, it is very suggestive of certain species of *Physalis*. That it actually belongs to any living genus of the Solanaceae is difficult to state with positiveness, and to avoid any unwarranted implication of kinship, it has been given a new and noncommittal generic name, though the specific name [*Physalis*] is intended to signify its probable relationship with this living type.

Since the foregoing was written the specimens here described as *Porana similis* have been studied, and it is difficult to escape the conviction that there may be more than merely superficial resemblance between them. The nervation is certainly very similar in these two forms, but otherwise they differ considerably. In *Florissantia* the corolla—if it be such—is regularly rotate and slightly five-lobed, whereas in *Porana similis* the whole organism is much larger and has strong, rounded, or obtusely pointed lobes which are not always of the same size. The presence of a slender pedicel in *Florissantia* is an argument for its corolloid nature. The nature and possible affinities of this form must be left to the future.

### Family ANONACEAE.

#### ANONA SPOLIATA? Cockerell.

*Anona spoliata* ? COCKERELL, Amer. Journ. Sci., vol. 26, 1908, p. 542, fig. (in text) 7.

A single example in the Scudder collection that seems to belong here, though it is a little smaller and apparently slightly unequal-sided at base.

## Family GROSSULARIACEAE.

## RIBES? FLORISSANTI, new species.

*Myrica diversifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 148, pl. 25, fig. 13. [Not other figures.]

Leaf of small size, about 4 cm. long and 2.5 cm. broad, broadly deltoid in general outline, deeply 3-lobed, lateral lobes obovate, obtuse, decurrent; central lobe ovate, all lobes few toothed; nervation thin, pinnate.

This species, so far as now known, is represented only by the leaf referred by Lesquereux to his *Myrica diversifolia*.<sup>1</sup> This specimen should be in the United States National Museum collections, but it can not now be located, in fact it is not recorded in the catalogue as ever having been present.

Although this leaf was included by Lesquereux in his *Myrica diversifolia*, it does not seem to me that it can possibly be referred to either of the two forms into which that species is now separated (i. e. *Sorbus diversifolia* and *S. nupta*). Its deeply three-lobed outline with the basal portion decurrent are features that can not be made to fit into either of its companion leaves as shown in Lesquereux's plate.

In some respects this leaf suggests species of *Rhus* in the Florissant flora. Thus, it has the same size and much the appearance of *Rhus vexans* Lesquereux,<sup>2</sup> but the latter is distinctly trifoliolate instead of three-lobed. It is also quite like some of the leaves referred to *Rhus hilliae* Lesquereux,<sup>3</sup> but this is an odd-pinnate leaf.

On the whole it appears to agree best with the genus *Ribes*, being, for example, not greatly unlike *R. aureum* Pursh.

## Family ROSACEAE.

## ROSA SCUDDERI, new species.

Plate 22, fig. 4.

Leaves of small size, with seven leaflets, the terminal (odd) leaflet narrowly elliptical, equally narrowed to both base and apex, short petioled, length 20 mm., width 6 mm.; upper pair of leaflets oval, sessile, 12 mm. and 15 mm. long and 4 and 6 mm. wide respectively; middle pair of leaflets much smaller, about 8 mm. long and 3 or 4 mm. wide; lowest pair of leaflets minute, 5 or 6 mm. long, about 2 mm. wide; all leaflets entire at base, then coarsely toothed; nervation obscure with apparently about 5 or 6 pairs of secondaries; stipules obscure, apparently minute and narrow.

*Type*.—Cat. No. 34,765, U.S.N.M.

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8, 1883, pl. 25, fig. 13.

<sup>2</sup> Idem, p. 195, pl. 41, fig. 20.

<sup>3</sup> Idem, p. 194, pl. 41, figs. 12-15.



Three species of *Rosa* have been previously described from Florissant, these being *R. hilliae* Lesquereux,<sup>1</sup> *R. wilmattae* Cockerell,<sup>2</sup> and *R. ruskiniana* Cockerell.<sup>3</sup> The first is characterized by possessing three leaflets, the second by five leaflets and the present species by seven leaflets. In size of leaf and shape of leaflets they do not differ greatly though in the present species the leaflets are all slightly narrower than in either of the others.

This species is named in honor of Samuel H. Scudder, the distinguished authority on fossil insects, who collected the specimens.

**ROSA? INQUIRENDA, new species.**

Plate 17, fig. 1.

Represented by what appears to be a fruit or "hip," consisting of a thick, circular, capsule-like body about 7 mm. in diameter, and five slender, acute radiating calyx lobes. The greatest spread of the lobes is fully 3 cm., the individual lengths of the lobes being 12 or 13 mm.

*Type*.—Cat. No. 34,741, U.S.N.M. Hambach collection.

The exact nature of this specimen is not definitely known as it is not clearly preserved, but it has the appearance of being a rose "hip"; it may, however, be a regular-lobed and somewhat coriaceous calyx of another genus.

**Family MALACEAE.**

**AMELANCHIER PERITULA Cockerell.**

*Amelanchier peritula* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 95, pl. 6, fig. 6.

The Hambach collection contains a single leaf that is referred to this species.

**SORBUS DIVERSIFOLIA (Lesquereux) Cockerell.**

*Sorbus diversifolia* (Lesquereux) COCKERELL, Amer. Jour. Sci., vol. 29, 1910, p. 76, fig. 1.

*Myrica diversifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 148, pl. 25, figs. 6, 10–12.

*Crataegus acerifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 198, pl. 36, fig. 10.

*Crataegus lesquereuxi* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 311; Univ. Colorado Studies, vol. 3, 1906, p. 171.

*Onoclea reducta* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 108, pl. 6, fig. 4.

The type-specimens of all of the leaves referred by Lesquereux, to his *Myrica diversifolia* should be preserved in the United States National Museum, but a careful search fails to disclose only five of the 10 leaves. Of the four leaves (figs. 6, 10–12) which it seems to me

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 199, pl. 40, figs. 16, 17.

<sup>2</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 94, pl. 7, fig. 14.

<sup>3</sup> Amer. Jour. Sci., vol. 26, 1908, p. 540, fig. 5.

may be properly referred to what Cockerell has separated as *Sorbus diversifolia*, only the original of figures 10 (= 1,651), and 12 (= 1,650) have been found. It would seem that figure 10 might well be a small leaf of the type represented in figure 6, which appears to be the only one transferred by Cockerell to *Sorbus diversifolia*. Figures 11 and 12 both lack the apical portion, which might well have been similar to that in figure 6, and consequently I have placed them with *Sorbus diversifolia*. They might have had an apical portion like that shown in figures 7 and 8, but I do not think so, and it seems best to place them as here indicated.

Perhaps a word of explanation may be given as to certain nomenclatorial complications that threatened to arise on transferring the names above mentioned. Thus, *Myrica diversifolia* Lesquereux, 1883, can not be transferred to *Crataegus* on account of the earlier living *Crataegus diversifolia* Steudel, 1847, or *Pyrus diversifolia* Bong 1864. *Crataegus acerifolia* Lesquereux, 1883, is not the same as *C. acerifolia* Moench, 1785. The ineligibility of *diversifolia* in *Crataegus* was the reason for calling it *lesquereuxi* by Cockerell, but this latter name is unnecessary when the species is placed in *Sorbus*.

The basal portion of a leaf described and figured by Cockerell<sup>1</sup> under the name of *Onoclea reducta*, to judge from the indistinct figure, has been properly transferred to *Sorbus diversifolia* by Cockerell himself.

Professor Cockerell considers *Sorbus diversifolia* to be a hybrid between *S. megaphylla* Cockerell, and *S. nupta* Cockerell, after the manner of certain living forms which are known to produce natural crosses. His reasoning for this belief is set forth at some length in the paper above quoted.

#### SORBUS NUPTA Cockerell.

*Sorbus nupta* COCKERELL, Amer. Jour. Sci., vol. 29, 1910, p. 78, fig. 2.

*Myrica diversifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 148, pl. 25, figs. 7, 8, 14.

The description of this species is given by Cockerell as follows:

Leaf-blade about 67 mm. long, and nearly as broad, with short triangular lobes, the margin also sharply dentate.

I have not seen the type of this species, but so far as I can determine from the rather indistinct figure and the above description, it appears to be identical with figure 14 of *Myrica diversifolia* Lesquereux, nor do I see any reason except size for not including also figures 7 and 8 of Lesquereux's plate. These three leaves certainly appear to agree among themselves and also to be different from the other leaves not referred to *Sorbus diversifolia*.

<sup>1</sup> Cockerell, T. D. A., Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 108, pl. 6, fig. 4.

Cockerell considers *Sorbus nupta* to be one of the parents, which, crossed with *Sorbus megaphylla* Cockerell, has produced a hybrid called *Sorbus diversifolia*.

CRATAEGUS, species.

Plate 21, fig. 4.

A single segment of a branch 4 cm. in length showing two oppositely inserted leaves (base of petioles alone preserved) and a single strong, sharp thorn 1 cm. in length, near the base.

Type.—Cat. No. 34,763, U.S.N.M.

This specimen, although a mere fragment, is unmistakably that of *Crataegus*, as shown not only by the presence of a characteristic thorn, but by the alternate insertion of the leaves. It is very much to be regretted that only the petioles are preserved, for otherwise it might be possible to connect it with one of the two species already described from the leaves. These are *Crataegus lesquereuxi* Cockerell (*C. acerifolia* Lesquereux, 1883, not Moench, 1785), and *C. acutiloba* (Lesquereux). It is useless to attempt to work out possible affinities between either of the Florissant species and the thousand (more or less) living species now recognized in North America, and even the propriety of giving a name to such an uncharacteristic portion as a thorny branch, may well be questioned.

Family RUTACEAE.

PTELEA MODESTA (Lesquereux) Cockerell.

*Ptelea modesta* (LESQUEREUX) COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 98.

*Cytisus modestus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 200, pl. 39, figs. 9-11.

*Leguminosites serrulatus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8, 1883, p. 202, pl. 39, figs. 7, 8.

The Scudder material includes four trifoliolate leaves preserved on two pieces of matrix that apparently belong here. The better of these specimens has three leaflets that exhibit great extremes in size, yet they must all be attributed to the same species, since they are either connected or so lie as to make it practically certain that they were joined when living. The smallest leaf has the leaflets only about 7 mm. long and 3 mm. broad; the next in size has them from 17 to 25 mm. in length and from 5 to 7 mm. in width, while in the largest leaf the leaflets are from 30 to 40 mm. long and about 10 mm. wide. The leaflets in the two smaller leaves are perfectly entire, while in the other they are entire on one side and provided with a few scattered low teeth on the other side. In the leaf not figured, which is about the size of the middle-sized leaf just described, the leaflets are all entire.

There can be no reasonable doubt that the specimens here described are the same as those described by Lesquereux under the name of *Cytisus modestus*. The leaflets in this species are said by Lesquereux to be entire.

Cockerell<sup>1</sup> has expressed the opinion that the two leaves figured by Lesquereux<sup>2</sup> under the name of *Leguminosites serrulatus* also belong here, and this is possibly true, but they are somewhat larger and the teeth appear to be of a different character.

It seems not impossible that the smaller specimen figured by Lesquereux<sup>3</sup> under the name of *Staphylea acuminata* may also belong with this aggregation. This is also suspiciously like *Menyanthes coloradensis* Cockerell.

**DODONEA, species, Lesquereux.**

*Dodonea* species, [Seeds of] LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 182, pl. 36, fig. 5.

Cat. Nos. 33,751, 33,752, U.S.N.M.

A single specimen with its counterpart is contained in the Hambach collection.

**Family MIMOSACEÆ.**

**CERCIS PARVIFOLIA Lesquereux.**

Plate 25, figs. 1, 2.

*Cercis parvifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 201, pl. 31, figs. 5-7.

This fine species is represented by several examples in the Scudder collection that are of about the size as those figured by Lesquereux. In the Florissant material belonging to the Lacoë collection, I find a single, nearly perfect leaf [No. 50,273, U.S.N.M.], with its counterpart that was identified by Lesquereux, through whose hands this material passed, as *Cercis truncata* Lesquereux. A reference to the literature discloses that *Cercis truncata* was named and described but not figured by Lesquereux<sup>4</sup> from the Bad Lands of North Dakota, in beds now known to be of Fort Union age. Concerning it, he says:

This leaf has exactly the same form and nervation as the leaves figured on plate 31, figs. 5-7 [Cret. and Tert. Fl.], and described as *C. parvifolia*. But it greatly differs by its size being 8 cm. broad and more distinctly pointed. As the leaves of *Cercis* are extremely variable in size, this may represent a large and more developed form of the species of Florissant.

The specimen under consideration is only about 6 cm. broad and 5 cm. long, which is nearly twice the size of the leaves ordinarily found of *C. parvifolia*, but as it does not differ essentially in any other particular, it seems best to refer it to this species and not to *C. trun-*

<sup>1</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, p. 98.

<sup>2</sup> Cret. and Tert. Fl., pl. 39, figs. 7, 8.

<sup>3</sup> Idem, pl. 36, fig. 4.

<sup>4</sup> Idem, p. 237.

*cata*. The present location of the type of *C. truncata* is unknown, though it should not be difficult to identify it if found in Fort Union material, when its identity with, or distinctness from *C. parvifolia* will have to be determined.

VICIA, species.

Plate 23, fig. 4.

The Hambach collection includes a specimen—the one here figured—that appears referable to a tendril-bearing plant of the type of *Vicia*, and it is so referred.

*Type*.—Cat. No. 34,740, U.S.N.M.

ROBINIA BRITTONI Cockerell.

Plate 24, fig. 2.

*Robinia brittoni* COCKERELL, Amer. Jour. Sci., vol. 36, 1908, p. 543, fig. (in text) 8.

Cat. No. 34,767, U.S.N.M.

The Scudder collection contains the splendid specimen here figured, which is much more complete than the type.

CYTISUS FLORISSANTINUS Lesquereux.

Plate 21, fig. 5; plate 23, fig. 3; plate 24, fig. 4.

*Cytisus florissantinus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 200, pl. 39, fig. 14.

*Cassia fischeri* HEER, LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 202.

Cat. Nos. 50,296, 50,297, 50,298, U.S.N.M.

This species is introduced for the purpose of showing that the leaves described by Lesquereux from the Lacoë collection as *Cassia fischeri* Heer, are really leaflets of *Cytisus florissantinus* Lesquereux, which are described and figured on another page of the Cretaceous and Tertiary Floras. There are three specimens representing two leaflets and a counterpart, all bearing the original No. 42 of the Lacoë collection; they are here figured for the first time.

DALBERGIA? MINUTA, new species.

Plate 24, fig. 3.

Leaflet long-petioled, membranaceous, obcordate in shape, cuneate to the slightly decurrent base, deeply emarginate at apex, margin perfectly entire; secondaries about four pairs, the lowest pair arising near the base and ascending along the margin; other pairs above the middle of the blade, at a lower angle of divergence.

*Type*.—Cat. No. 34,742, U.S.N.M.

This little leaflet, which is nearly perfect, is only 18 mm. long, including the petiole 6 mm. long; the width is 11 mm. It is exactly obcordate in shape, with the base slightly decurrent halfway down the petiole.

I am uncertain as to the generic reference of this specimen. It seems to be most closely related to *Dalbergia cuneifolia* Lesquereux,<sup>1</sup> from which it differs in its smaller size, relatively shorter and broader form with the base decurrent on the slender petiole.

**DALBERGIA? COLORADENSIS, new species.**

Plate 19, fig. 4.

Fruit a compressed indehiscent pod, elliptical in shape, about equally narrowed below to the stout pedicel and above to the acuminate apex, margin thickened.

*Type*.—Cat. No. 50,330, U.S.N.M. [Original No. 61, Lacoë collection].

The example figured, which was contained in the Lacoë collection (No. 61), is the only one observed. It is rather broadly elliptical in shape, being 3.5 cm. in length and 1.4 cm. in width, with about 4 mm. taken up by the basal or attached portion. There is a thickened marginal rim about 2 mm. in width. In the narrowed basal portion there are five little bodies serially arranged that have the appearance of being aborted ovules, but whether the larger expanded portion was one-seeded or not it is difficult to ascertain.

This species does not agree very closely with any of the living species of *Dalbergia* it is possible to consult in the National Herbarium, being perhaps closest to *D. polyphylla* Miquart from the East Indies. Among fossil species, however, it is very much like *Dalbergia primaeva* Unger,<sup>2</sup> from the upper Eocene of Sotzka, from which it differs in its smaller size, less pointed and toothed apex, and abruptly narrowed basal portion.

Since the above was written Professor Cockerell visited my laboratory and on being shown this specimen immediately called attention to its resemblance to, or possible identity with, his *Acerates fructifer*.<sup>3</sup> Superficially the resemblance between these two specimens is rather strong, but this is confined to the shape and size, for the figure of *A. fructifer* is so obscure that nothing can be determined regarding its structure. The specimen under consideration may or may not properly be referable to *Dalbergia*, but it certainly is not a foliicle of *Acerates*.

Family ANACARDIACEAE.

**RHUS HILLIAE Lesquereux.**

*Rhus hilliae* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 194, pl. 41, figs. 12-15.

Several specimens in the Hambach collection [Cat. Nos. 33,734, 33,735, 33,738, U.S.N.M.]

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 200, pl. 34, figs. 6, 7.

<sup>2</sup> Terr. Fl. v. Sotzka, 1850, p. 55 [185], pl. 39 [40], figs. 8-10.

<sup>3</sup> Amer. Nat., vol. 42, 1908, p. 580, fig. 10.

## RHUS? TRIFOLIOIDES Lesquereux.

*Rhus trifolioides* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 196.

*Type*.—Cat. No. 50,325, U.S.N.M. [Original No. 58 of Lacoë's cabinet].

Leaf trifoliolate; leaflets sessile or nearly so, oval, elliptical-oval, or slightly elliptical-obovate, the terminal one slightly the larger, abruptly narrowed to a very short petiolule; margin spinose-serrate nearly to the base of the blade; midrib very strong and hard; secondaries numerous, about a dozen pairs, very thin and delicate, at an angle of about 45°, entering the spinose marginal teeth; finer nervation obscure.

This species had not been previously figured, but as the type came to the United States National Museum through the Lacoë collection this opportunity is embraced to figure it, and also to amplify and perfect the description. For instance, in the original characterization the leaflets are said to be "apiculate and dentate to the middle," but the present figure shows they are rather obtuse and are beset with numerous sharp, spiny teeth which extend almost to the base. The nervation is said to be obsolete, but as shown in the figure it consists of a prominent flat midrib and numerous very thin secondaries, most of which enter the teeth.

The character of the teeth as well as the general appearance incline one to the opinion that this form is not correctly placed in *Rhus*—at least it is unlike any living form with which I am familiar—but in absence of a more positive reference it is left as disposed by Lesquereux. I have, however, ventured to question the generic reference.

## COTINUS FRATERNA Lesquereux.

Plate 24, fig. 1.

*Cotinus fraterna* (Lesquereux) COCKERELL, *Torreya*, vol. 5, 1905, p. 12; *Univ. Colorado Studies*, vol. 3, 1906, p. 170.

*Rhus fraterna* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 192, pl. 41, figs. 1, 2.

*Andromeda rhomboidalis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 176.

*Type of "Andromeda rhomboidalis"* LESQUEREUX.—Cat. No. 50,343, U.S.N.M. [Original No. 70 of Lacoë's cabinet.]

The Scudder collection contains about a dozen finely preserved examples of this species.

*Andromeda rhomboidalis* Lesquereux was named and described, but not figured, by Lesquereux in 1883. The type of this form came to the possession of the United States National Museum through the Lacoë collection. A comparison of this with the figures of *Rhus fraterna* shows them to be the same, and *Andromeda rhomboidalis* is consequently referred to this species.

## Family AQUIFOLIACEAE.

## ILEX KNIGHTIAEFOLIA Lesquereux.

Plate 26, fig. 3.

*Ilex knightiaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 188, pl. 40, figs. 4, 5.

*Ilex rigida* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 182, pl. 14, fig. 2.

*Type of I. rigida*.—Cat. No. 33,683, U.S.N.M.

An examination of the type of *Ilex rigida* Kirchner convinces me that it is referable to *I. knightiaefolia* Lesquereux, as suspected by Cockerell.<sup>1</sup> There is an additional example in the Hambach collection [Cat. No. 33,705, U.S.N.M.].

## ILEX PSEUDO-STENOPHYLLA Lesquereux.

Plate 25, figs. 3, 4.

*Ilex pseudo-stenophylla* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 185.

*Types*.—Cat. Nos. 50,326, 50,327; U.S.N.M.

As this species has never been figured, and as the type-specimens have become the property of the United States National Museum through the Lacoë collection, I take this opportunity of figuring the type-specimen which is number 59 of Lacoë's cabinet, and which served as the basis for the species. They are very well described by Lesquereux, and obviously belong to the type of the living *Ilex cassine* Linnaeus. The length is 20 to 26 mm., and the width about 6 mm.

## ILEX MICROPHYLLA Lesquereux.

Plate 21, fig. 6.

*Ilex microphylla* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 186.

This species, like the last, has never been figured, and as the type is now in the United States National Museum, having come through the Lacoë collection, the opportunity is taken to figure it. It has been well described by Lesquereux.

*Type*.—Cat. No. 50,329, U.S.N.M. (Original Lacoë No. 60.)

## Family CELASTRACEAE.

## CELASTRUS FRAXINIFOLIUS Lesquereux.

*Celastrus fraxinifolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 184, pl. 40, fig. 10.

A specimen in the Scudder collection which seems to belong here, though it is a very little broader and has rather finer teeth.

<sup>1</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 101.



## CELASTRUS LACOEI Lesquereux.

Plate 24, fig. 6.

*Celastrus lacoeï* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 184.

*Type*.—Cat. No. 50,309, U.S.N.M. (Original No. 49 in Lacoë's cabinet.)

Leaf subcoriaceous in texture, obovate or spatulate in shape, obtuse and rounded at apex, narrowed below to a wedge-shaped entire base and a short, thick, petiole, length 3.5 cm., width 1.3 cm.; margin for two-thirds or more of length above the base, undulate-toothed, the teeth relatively large, rounded; midrib relatively thick, straight; secondaries numerous, alternate, at an acute angle, thin, apparently camptodrome but details obscure.

This species, which is here figured for the first time, was named and described by Lesquereux in 1883. The type-specimen, which remains unique, came to the United States National Museum through the collection of R. D. Lacoë.

This species has some resemblance to certain small obtuse leaves of *Fagopsis longifolia* (Lesquereux) Hollick, but may be known by the obtuse apex, undulate-toothed margin and indistinct secondaries.

## CELASTRINITES ELEGANS Lesquereux.

Plate 21, fig. 7.

*Celastrinites elegans* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 185, pl. 31, figs. 9, 10.

*Celastrus greithianus* HEER. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 184.

Cat. No. 50,348, U.S.N.M., as *Celastrus greithianus* Heer. Not before figured. Lesquereux referred two leaves from Florissant to Heer's *Celastrus greithianus*, both of which are before me, and which are certainly not con-generic. One specimen [Cat. No. 50,347, U.S.N.M., Lacoë collection No. 74], is a deformed leaf of some kind, probably a leaflet of *Sapindus*, but it is quite impossible to be certain of its affinity and it is not further considered.

The other leaf [Cat. No. 50,348, U.S.N.M., Lacoë collection No. 74], is undoubtedly a small example of *Celastrinites elegans*, or rather it is identical with figure 9<sup>1</sup> referred to this species, for I quite agree with Cockerell that the two figures under this name can not be con-generic. Notwithstanding Lesquereux has said of the leaves referred to *C. greithianus* that they are "very entire," on clearing away the matrix around the margin in the one-figured it is seen to be plainly crenulate, and except for being a little smaller is identical with the figure mentioned.

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, pl. 31, fig. 9.

I have not seen the types of the two figures of *Celastrinites elegans*, which are said to be in Princeton University, but it is suspected that figure 10<sup>1</sup> will be found to belong to *Cercis parviflora*. The nervation certainly suggests this reference, the only obstacle in the way being the apparently crenulate margin, which may not have been completely exposed.

### Family STAPHYLEACEAE.

#### STAPHYLEA ACUMINATA Lesquereux.

*Staphylea acuminata* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv., Terr., 1873 [1874], p. 415; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 267, pl. 48, figs. 4, 5; vol. 8 (Cret. and Tert. Fl.), 1883, p. 183, pl. 36, figs. 1-4.

Specimens of this species are contained in all three of the collections under examination.

### Family ACERACEAE.

#### ACER FLORISSANTI Kirchner.

*Acer florissanti* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 181, pl. 11, fig. 1.

*Type*—Cat. No. 33,673, U.S.N.M.

This splendid species, which is clearly of the type of the eastern silver maple (*Acer saccharinum*), has been well described and figured by Kirchner. Although the leaves of *Acer* appear to be rather rare at Florissant, Cockerell<sup>2</sup> has reported finding this species at two stations, and the United States National Museum has a very fine specimen [Cat. No. 50,346, U.S.N.M.] from the collection of R. D. Lacey, which was identified by Lesquereux as *Acer trilobatum cuspidatum*.

#### ACER KIRCHNERIANUM, new species.

Leaf of small size, of the type of *Acer florissanti* but only one-fourth the size, three-lobed, the central lobe large, strongly toothed above; lateral lobes oblong-acute, with several strong teeth; nervation with three ribs arising at the base of the blade, the middle one with about 4 or 5 pairs of secondaries which pass to the sharp marginal teeth, lateral ribs passing to the tips of the lateral lobes, each with 5 or 6 pairs of arching secondary branches which enter the teeth.

*Type*.—Cat. No. 33,761, U.S.N.M.

This little leaf, which is nearly perfect, has the blade a little over 2.5 cm. long, while the petiole which is complete is slightly over 1 cm. long. Its outline and nervation are well shown in the figure.

It is possible that this is only a very small leaf of *Acer florissanti* Kirchner, but as it is only one-fourth its size and moreover is three-

<sup>1</sup> Cret. and Tert. Fl., pl. 31.

<sup>2</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 101.

ribbed instead of five-ribbed, it has been described as new. As lending weight to the idea that it really may be distinct from the larger species, it may be mentioned that there is another example in the same collection that is of exactly the same size; it is not as well preserved as the one taken as the type, hence has not been figured.

This species is named in honor of Mr. Walter C. G. Kirchner, who described the first well authenticated maple from Florissant.

**ACER MYSTICUM Kirchner.**

*Acer mysticum* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 181, pl. 11, fig. 2.

*Type*.—Cat. No. 33,674, U.S.N.M.

This species, contained in the Hambach collection, is doubtless the fruit of *Acer florissantii* Kirchner, but as they are found in association and not in actual connection, they must be held as distinct. The fruit is hardly to be distinguished from a number of described species, such, for instance, as that referred to *Acer indivisum* by Lesquereux.<sup>1</sup>

**Family SAPINDACEAE.**

**SAPINDUS LANCIFOLIUS Lesquereux.**

*Sapindus lanicfolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 182, pl. 32, figs. 3-6; pl. 37, fig. 9.

Several very perfect specimens are contained in the Hambach collection.

**SAPINDUS COLORADENSIS Cockerell.**

*Sapindus coloradensis* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 101, pl. 9, fig. 31.

*Sapindus angustifolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, pl. 49, fig. 2; vol. 8 (Cret. and Tert. Fl.), 1883, p. xxxvii, figs. 3-5.

Several good specimens in the Hambach collection that must be referred here.

**Family RHAMNACEAE.**

**RHAMNUS KIRCHNERI Cockerell.**

*Rhamnus kirchneri* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 311; University Colorado Studies, vol. 3, No. 3, 1906, p. 170.

*Rhamnus ellipticus* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 183, pl. 15, fig. 3 [Not *Rhamnus ellipticus* Swartz, 1788].

*Type*.—Cat. No. 33,688, U.S.N.M.

The specimen remains unique, at least so far as the present collections are concerned.

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, pl. 36, fig. 9.

## ZIZYPHUS OBTUSA Kirchner.

Plate 16, fig. 3.

*Zizyphus obtusa* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8 1898, p. 182, pl. 13, fig. 1.

Type.—Cat. No. 33,679, U.S.N.M.

As the original figure of this species is rather poor, not being quite correct as regards certain details of the nervation, it has been refigured. It is certainly strongly suggestive of Lesquereux's *Xanthoxylon spiraefolium*,<sup>1</sup> especially his figure 2.

## Family VITACEAE.

VITIS HESPERIA, new species.

Plate 26, fig. 4.

Leaf membranaceous in texture, strongly five-lobed, the lobes ovate, acuminate, separated by deep rounded sinuses; base of leaf deeply cordate, the sinus broad and rounded; margins of lobes entire in the sinuses, coarsely toothed elsewhere, the teeth rather obtuse; petiole strong, 3.5 cm. long; nervation palmately 5-ribbed from the top of the petiole, the ribs straight, each ending in a large lobe, and each provided with a few acute-angled secondary branches; finer nervation obscure.

Type.—Cat. No. 33,723, U.S.N.M.

This splendid, nearly perfect specimen is 7 cm. in length, about 8 cm. broad between the tips of the two upper lobes, and 5.5 cm. between the tips of the basal lobes. The strong petiole was at least 3.5 cm. in length, for at this point it passes off the matrix, but doubtless this was nearly or quite the end; it is a little more than 2 mm. thick at the base and for the lower third of its length.

This leaf is by all odds one of the handsomest and best characterized of the many beautifully species from Florissant. It differs from the only previously known Florissant species, *Vitis florissantella* Cockerell,<sup>2</sup> in being nearly three times the length, and in having five instead of only three lobes. It is just possible that Cockerell's species may be a very small leaf of the present form, but they are so different in size and general appearance that it is undoubtedly best to keep them as distinct until the evidence for uniting them is stronger than at present.

So far as can be made out from the indistinct figure, the leaf described as *Ribes protomelaenum* Cockerell,<sup>3</sup> might well belong to *Vitis*.

This leaf is also suggestive of certain leaves of *Morus cannabinus*, etc., but its agreement with *Vitis* is held to overbalance the others.

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 196, pl. 40.

<sup>2</sup> Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 102, pl. 7, fig. 18.

<sup>3</sup> Idem, p. 93, pl. 7, fig. 15.

## Family STERCULIACEAE.

## STERCULIA ENGLERI Kirchner.

*Sterculia engleri* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 180, pl. 14, fig. 3.

*Type*.—Cat. No. 33,684, U.S.N.M.

An examination of the type of this species, contained in the Hambach collection, shows it to be very clearly related to *S. rigida* Lesquereux,<sup>1</sup> also from Florissant, and it seems not unlikely that a series of specimens, if such should ever be found, would show them to be the same.

The Lacoë collection contains a single example [original Lacoë No. 44, Cat. No. 50,300, U.S.N.M.] that is undoubtedly the same as *S. engleri* Kirchner, although it bears on the back a label reading "*Sterculia rigida* Lesq., Cotype," and had passed through Lesquereux's hands. Leaves of *Sterculia* appear to be very rare in the Florissant lake beds, in fact but three specimens have passed under my notice, one being the type of *S. rigida*, another the type of *S. engleri*, and the other the one under discussion which is, as stated, identical with *S. engleri*. As already pointed out, a series might show them to intergrade as regards size, which is about the only difference, but so far they hold good.

## Family EBENACEAE.

## DIOSPYROS BRACHYSEPALA Al. Braun.

*Diospyros brachysepala* AL. BRAUN. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 174, pl. 34, figs. 1, 2.

*Diospyros princetonia* COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 105, pl. 10, fig. 36.

The Hambach collection includes a single very perfect leaf that is absolutely indistinguishable from *Diospyros brachysepala* as figured and described by Lesquereux. Whether or not it is properly referred to the European species is another matter, but certain it is that it can not be separated from the Florissant leaf so identified. I am also unable to separate *Diospyros princetonia* Cockerell from these leaves.

## Family OLEACEAE.

## FRAXINUS LIBBEYI Lesquereux.

Plate 24, fig. 5.

*Fraxinus libbeyi* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 171, pl. 27, figs. 5-7, 9.

*Ostrya betuloides* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 151.

*Type of "Ostrya betuloides" Lesquereux*.—Cat. No. 50,266, U.S.N.M. [original No. 26 of Lacoë's cabinet].

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 179, pl. 34, fig. 12.

No specimens referable to *Fraxinus libbeyi* were found in the unworked collection, but in the Lacoë material, now the property of the United States National Museum, was found the type of *Ostrya betuloides* Lesquereux, the careful examination of which convinces me should be referred to this species. As Lesquereux did not figure the type of his *Ostrya betuloides*, this occasion is taken to illustrate it [pl. 24, fig. 5]. It may be seen from this figure that it is practically indistinguishable from the smaller leaflets of *Fraxinus libbeyi*, and consequently it is referred to that species.

**FRAXINUS UNGERI** Lesquereux.

Plate 22, fig. 3; plate 23, figs. 1, 2.

*Fraxinus ungeri* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 171.

*Types*.—Cat. Nos. 50,321, 50,322, 50,323; U.S.N.M. [Lacoë No. 57.]

This species was described but not figured by Lesquereux, and as the three specimens upon which it is based are now in the United States National Museum, they are here illustrated for the first time. Of these figures, 1 and 3 of the above-mentioned plates are probably conspecific, but it is perhaps doubtful if the other specimens belongs with them. Figure 3 is very much like what Lesquereux<sup>1</sup> has figured as *Diospyros brachysepala* Al. Braun, except it is more wedge shaped at base. It also resembles *Andromeda delicatula* Lesquereux, as figured on the same plate.

**Family CONVULVULCEAE.**

**PORANA TENUIS** Lesquereux.

Plate 27, figs. 4-6.

*Porana tenuis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 173.

*Type*.—Cat. No. 50,344, U.S.N.M. [Lacoë's cabinet, No. 71] fig. 6.

This species was described as follows by its author:

Calyx large, thin; sepals distinct to the base, oblong, obtuse; veins distinct, distantly obliquely branched.

The type of this species, now figured for the first time, is seen to be a very perfect specimen indeed, the 5 oblong, rather obtuse sepals being practically of equal size, and distinct nearly or quite to the base. The individual sepals are about 15 mm. long and about 5 mm. wide, each being provided with about three distinct nerves, which arise at the base and are sparingly once-forked at or above the middle. In the exact center where the sepals come together there is a circular scar about 2 mm. in diameter which may represent the point of attachment to the pedicel or the attachment of the capsule.

<sup>1</sup> Lesquereux, Leo, Cret. and Tert. Flora, pl. 34, fig. 2.

This form was referred to the genus *Porana* of the Convolvulaceae, by Lesquereux on the ground of its undoubted resemblance to certain European Miocene forms, such as *Porana micrantha* Ludwig, *P. oeningensis* (Al. Braun) Heer, etc., in some of which, but especially the last-mentioned species, the characteristic fruit has been obtained. Up to the present time, so far as known to the writer, no American specimen has been recorded which has the fruit preserved, which would prove absolutely the correctness of the generic reference. It is with great pleasure, therefore, that I am able to state that two splendidly preserved specimens in the Hambach collection supply this missing character. As may be seen from the figures (pl. 27, figs. 4, 5), the sepals are identical in number, shape, size, and nervation with *Porana tenuis*, and in addition each has the globular capsule preserved *in situ*. The capsule is about 7 mm. in long, and 6 mm. in short diameter, and was evidently very firm and of considerable strength since the depression in the matrix is fully 1 mm. deep. In one of the specimens (pl. 24, fig. 5) there is some evidence of the presence of seeds, but this may be only an accident of preservation.

This species is, of course, entirely distinct from *Porana speirii* Lesquereux, and *P. similis* Knowlton, being approached only by *P. cockerelli*, the description of which follows.

PORANA COCKERELLI, new species.

Plate 27, fig. 3.

*Porana tenuis* LESQUEREUX. COCKERELL, Bull. Amer. Mus. Nat. Hist., vol. 24, 1908, p. 107, pl. 6, fig. 10.

Similar to *P. tenuis*, but with the sepals shorter, obovate instead of oblong, and with the apices much more obtuse and rounded; capsule oblong, rounded at apex.

*Type*.—Cat. No. 34,747, U.S.N.M.

The sepals are about 13 mm. long and about 6 mm. wide at the broadest point which is near the apex. They are distinctly obovate in shape and nearly or perhaps quite free at base. The nervation is very distinct, consisting of about 5 veins which arise at the base, about 5 mm. apart, and with one or two branches above. The finer nervation, if present, is now obsolete. The size and character of the capsule is well shown in the figure.

This species is so very closely related to *P. tenuis* that it is perhaps with doubtful propriety that it is held as distinct from it. It differs from *P. tenuis* as above indicated by its slightly smaller size, and obovate, very obtuse sepals.

This form is undoubtedly the same as the example figured by Cockerell under the name of *Porana tenuis*, and by a curious coincidence, which may be with or without significance, each of these specimens has only four sepals as at present preserved. The natural inference

would be that it originally had five sepals, as there is about room enough in the empty space for another sepal the size of the others. There is also some evidence that the sepals in the type-specimen are of two sizes, that is in the figure as now oriented the two lower sepals are slightly smaller than the two upper ones. The specimen figured by Cockerell also shows this tendency, though they are disposed in a little different manner.

I take pleasure in naming this species in honor of Prof. Theodore D. A. Cockerell, of the University of Colorado, who has done so much to extend our knowledge of the plants and insects of the Florissant lake beds.

**PORANA SIMILIS, new species.**

Plate 27, figs. 1, 2.

Calyx of large size (about 3.5 cm. in diameter), coriaceous in character, strongly 4 or 5 lobed, the lobes unequal size, broadly deltoid, very obtusely pointed or almost rounded; each lobe with 5 or 6 rather thin veins which arise at the central point and converge in the tip of the lobe; cross veinlets at right angles to the veins, somewhat irregular, often broken, producing irregular quadrangular areas.

*Type*.—Cat. No. 34,736, U.S.N.M.; Cotype, Cat. No. 34,737, U.S.N.M., both from the Hambach collection.

This species is very well represented by the two examples figured. It is obviously very closely related to *Porana speirii* Lesquereux,<sup>1</sup> also from Florissant, from which it differs in the strong and well-marked lobes which are obtusely pointed instead of low and perfectly rounded, and in the nervation. The veins are represented as diverging from the center, often forked and passing straight to the margin, while in *P. similis* the veins are fewer in number, not forked and all converge in the tips of the lobes. The cross veinlets are very much the same in both forms.

The type of *Porana speirii* is preserved in the Princeton Museum, and, so far as known to the writer, it remains unique. It is very different from *P. tenuis* Lesquereux, the only other previously published species from Florissant. In shape the form here described as *P. similis* is intermediate between the two previous species as regards lobation, being more markedly lobed than *P. speirii*, and with broader, less deeply cut lobes than *P. tenuis*.

**Family MENYANTHACEAE.**

**MENYANTHES COLORADENSIS Cockerell.**

*Menyanthes coloradensis* COCKERELL, Amer. Jour. Sci., vol. 26, 1908, p. 543, fig. 9.

Under this name Cockerell has described a so-called crown bearing five leaves, two of which are entire and the others trifoliolate. I

<sup>1</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 172, pl. 28, fig. 15.



have not seen this specimen, and the reproduction of the figure is so poor that little of the nervation can be made out, but I do not believe I should ever have thought of referring it to *Menyanthes*. The sheathing bases of the petioles, so marked a feature in the living species, are certainly not clear in the fossil, and this coupled with the two entire (unifoliolate?) leaves make it seem improbable that it has been correctly placed in *Menyanthes*.

In this connection I may say that I am not able to distinguish the trifoliolate leaves of *Menyanthes coloradensis* from *Cytisus modestus* Lesquereux<sup>1</sup> now called *Ptelea modesta*.

The types of the latter species are in the National Museum (fig. 9=1915; fig. 10=1914; fig. 11=1913), and all are correctly drawn except figure 9, which has the leaflets entire, instead of toothed, as shown in the drawing. So far as can be made out from the figure of *Menyanthes coloradensis* the leaves are not essentially different from Lesquereux's species.

### Family TILIACEAE.

#### TILIA POPULIFOLIA Lesquereux.

*Tilia populifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 179, pl. 34, figs. 8, 9.

The Hambach collection contains one very good leaf of this species.

#### CARPOLITHES MACROPHYLLUS Cockerell.

Plate 27, fig. 7.

*Carpolithes macrophyllus* COCKERELL, Torreya, vol. 11, 1911, p. 235, text fig. 1.

The Hambach collection contains a single specimen that, presumably, should be referred to Cockerell's *Carpolithes macrophyllus*, though it differs considerably in size. Thus, Cockerell describes the sepals as being about 16 mm. long and 4 mm. broad in the middle, while in the present specimen the sepals are only 10 or 12 mm. long and 2.5 mm. or 3 mm. wide. The shape of the sepals is the same, and so far as can be made out the nervation is identical. There is no trace of the follicles in the present example, in fact it appears to have the basal side exposed, as there is some evidence of a scar of attachment. It would seem that if the side exposed was the same as in the Cockerell specimen, some trace of the woody follicles would be likely to remain.

In the original figure of *Carpolithes macrophyllus* the follicles appear to be four in number, "so far as can be seen like those of *Lynnothamnus*," Cockerell writes, but according to Sargent's *Sylva* (vol. 4, p. 133) the fruit of *Lynnothamnus* is "composed of two woody ovate four-seeded follicles, dehiscent on the ventral and partially dehiscent on the dorsal suture," which would exclude the fossil from this genus.

<sup>1</sup> Lesquereux, Leo, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 200, pl. 39, figs. 9-11.

There appears to be some uncertainty as to whether *Lyonothamnus* belongs to the Rosaceae or Saxifragaceae. Engler and Prantl place it doubtfully with the former, while Sargent, Rydberg, and other American authors place it in the Saxifragaceae.

LIST OF TYPES OF FOSSIL PLANTS FROM FLORISSANT, COLORADO, IN THE UNITED STATES NATIONAL MUSEUM.

- Acacia septentrionalis* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873 [1874], p. 418; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 299, pl. 59, fig. 9 [486].<sup>1</sup>
- Acer florissanti* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 181, pl. 11, fig. 1 [33,673].
- Acer kirchnerianum* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 282 [33,761].
- Acer mysticum* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 181, pl. 11, fig. 2 [33,674].
- Adiantites gracillimus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 137, pl. 21, fig. 8 [1,615].
- Alnus cordata* LESQUEREUX,<sup>2</sup> Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 151 [50,357]. KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 264, pl. 19, fig. 1 = *Alnus praecordata* COCKERELL.
- Alnus*, species, KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 264, pl. 16, fig. 2 [34,761].
- Andromeda rhomboidalis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 176 [50,343]. KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 279 (as *Cotinus fraterna*).
- Amelanchier typica* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 198, pl. 40, fig. 11 [1,908].
- Antholithes improbus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 204, pl. 40, figs. 20 [1,566], 21.
- Aristolochia williardiana* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 268, pl. 22, figs. 1, 2 [34,756].
- Banksites lineatus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 165, pl. 32, fig. 21 [1,781].
- Betula deltoides* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 264, pl. 19, fig. 3 [34,754].
- Betula florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 150, pl. 27, fig. 11 [1,670].
- Betula truncata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 150, pl. 28, figs. 6 [1,671], 7 [1,742].
- Bumelia florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 174, pl. 34, figs. 4 [1,797], 5 [1,798].
- Cacsalpinia? linearis* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1873, [1874], p. 417; Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 300, pl. 59, fig. 7 [526].  
= *Mimosites linearis*.
- Callicoma microphylla?* ETtingshausen. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 246, pl. 43, figs. 2, 3, 4.  
= *Myrica drymeja*.

<sup>1</sup> The number of the type-specimens in the catalogue of the paleobotanical collection is given in square brackets after each figure, e. g., pl. 59, fig. 9 [486].

<sup>2</sup> A number of species described but not figured in the Cretaceous and Tertiary Floras are here figured for the first time.

- Carpinus fraterna* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 152, pl. 27, figs. 12 [1,673], 13 [1,674], 14 [1,672].
- Carpites ligatus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 307, pl. 60, fig. 36 [515].
- Carpites pealei* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 306, pl. 60, fig. 31 [509].
- Castanea intermedia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 164, pl. 21, fig. 7 [194]. Locality given as Middle Park, but probable error for Florissant.
- Celastrus fraxinifolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 184, pl. 33, figs. 2 [1,856], 3 [1,855], 4 [1,854].
- Celastrus lacoei* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 184 [50,309]. KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 281, pl. 24, fig. 6.
- Cercis parvifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 201, pl. 31, fig. 7 [1,918].
- Chara? glomerata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 135, pl. 31, fig. 12 [1,611].
- Crataegus*, species KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 275, pl. 21, fig. 4 [34,763].
- Cytisus florissantinus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 200, pl. 39, fig. 14 [1,916].
- Cytisus modestus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 200, pl. 39, figs. 9 [1,915], 10 [1,914], 11 [1,913].  
= *Ptela modesta*.
- Dalbergia? coloradensis* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 278, pl. 19, fig. 4 [50,330].
- Dalbergia? minuta* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 277, pl. 24, fig. 3 [34,742].
- Diospyros cuspidata* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 185, pl. 12, fig. 1 [33,675].  
= *Populus crassa*.
- Ficus florissantia* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 267. Based on *Ficus haydenii* LESQUEREUX. KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 179, pl. 12, fig. 3 [33,677].
- Florissantia physalis* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 270 [33,686].
- Fraxinus abbreviata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 170, pl. 28, fig. 5 [1,796].
- Fraxinus heerii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 169, pl. 33, figs. 5 [1,794], 6 [1,793].
- Fraxinus libbeyi* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 171, pl. 27, fig. 7 [1,795].
- Fraxinus mespilifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 169, pl. 33, figs. 7 [1,787], 8 [1,784], 9 [1,785], 11 [1,789], 12 [1,790, 1,791 counterparts].
- Fraxinus ungeri* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 171 [50,321, 50,322, 50,323]. KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 286, pl. 22, fig. 3; pl. 23, figs. 1, 2.
- Hedera marginata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 177, pl. 40, fig. 8 [1,804].
- Hypnum brownii* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 178, pl. 12, fig. 4 [33,678].

- Hypnum haydenii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 44, pl. 5, fig. 14 [37].  
 = *Juniperus? haydenii* (LESQUEREUX) KNOWLTON.
- Ilex grandifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 187, pl. 38, fig. 1 [1,868].
- Ilex knightiaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 188, pl. 40, figs. 4 [1,861], 5 [1,859].
- Ilex microphylla* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 186 [50,329].—KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 280, pl. 21, fig. 6].
- Ilex pseudo-stenophylla* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 185 [50,326, 50,327].—KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 280, pl. 21, fig. 7.
- Ilex rigida* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 182, pl. 14, fig. 2 [33,683].  
 = *Ilex knightiaefolia*.
- Ilex quercifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 186, pl. 37, fig. 2 [1,862], 3 [1,863], 4 [1,865], 5 [1,867].  
 = *Ilex leonis*.
- Ilex subdenticulata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 271, pl. 50, figs. 5 [402], 6 [406].
- Isoetes brevifolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 136 [—].
- Juglans affinis* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 184, pl. 13, fig. 2 [33,680].
- Juglans florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 190 [50,355].
- Juglans magnifica* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 252, pl. 15 [33,765].
- Lemna penicillata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 143, pl. 23, fig. 8 [1,628].  
 = *Spirodella penicillata*.
- Lomatia acutiloba* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 167, pl. 43, figs. 13 [1,747], 14 [1,745], 15 [1,742], 16 [1,748].
- Lomatia spinosa* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 166, pl. 43, fig. 1 [1,779].  
 = *Lomatites spinosa*.
- Lomatia terminalis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 166, pl. 43, figs. 2 [1,772], 4 [1,770], 5 [1,771], 6 [1,773], 7 [1,769].
- Lomatia tripartita* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 166, pl. 43, figs. 8 [1,749], 9 [1,775], 10 [1,777].
- Macreightia crassa* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 175, pl. 34, fig. 17 [1,802].  
 = *Populus crassa*.
- Muhlenbergia florissanti* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 250, pl. 13, figs. 1-3, [34,750, 34,751].
- Myrica callicomaeifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 146, pl. 26, figs. 6 [1,640], 8 [1,646], 9 [1,634], 10 [1,639], 11 [1,639], 12 [1,639], 14 [1,636].  
 = *Myrica drymeja*.
- Myrica copeana* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 131, pl. 17, fig. 5, [147].

- Myrica diversifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 148, pl. 25, figs. 7 [1,649], 8 [1,647], 10 [1,651], 12 [1,650], 14 [1,648].  
 = *Crataegus*.  
 = *Sorbus diversifolia*.  
 = *Sorbus nupta*.
- Myrica fallax* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 32, figs. 11 [1,665], 13 [1,662], 14 [1,664], 15 [1,661], 16 [1,663].
- Myrica insignis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 135, pl. 65, figs. 7, 8 [538 both on same stone].  
 = *Comptonia insignis*.
- Myrica latiloba acutiloba* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 134, pl. 17, fig. 13 [153].  
 = *Crataegus acutiloba*.
- Myrica obscura* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 145, pl. 22, figs. 9 [1,630], 10 [1,629].
- Myrica scottii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 147, pl. 32, fig. 17 [1,660].
- Ophioglossum alleni* LESQUEREUX, Ann. Rept. U. S. Geol. and Geogr. Surv. Terr., 1872 [1,873], p. 371 [1,617]=*Salvinia alleni* (LESQUEREUX) LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 65, pl. 5, fig. 11 [1,617].  
 = *Tmesipteris alleni*.
- Ostrya betuloides* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 151 [50,266].—KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 285, pl. 24, fig. 5.  
 = *Fraxinus libbeyi*.
- Palaeopotamogeton florissanti* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 251, pl. 16, fig. 1; pl. 17, fig. 3 [34,748; 34,749].
- Paliurus florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 274, pl. 50, fig. 18 [415].
- Pimelia delicatula* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 168, pl. 33, figs. 15 [1,782], 16 [1,783].
- Pinus florissanti* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 138, pl. 21, fig. 13 [1,618].
- Plagiopodopsis scudderii* BRITTON and HOLLICK, Bull. Torr. Bot. Club, vol. 42, 1915, p. 10, figs. 1, 2 [34,759].
- Planera longifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 189, pl. 27, figs. 4 [234], 5 [235].  
 = *Fagopsis longifolia*.
- Planera longifolia myricaefolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 161, pl. 29, figs. 15 [1,725], 16 [1,726], 17 [1,727], 18 [1,728], 19 [1,729], 20 [1,730], 21 [1,731], 22 [1,732], 23 [1,733], 24 [1,734], 25 [1,735], 26 [1,736], 27 [1,737].  
 = *Planera myricaefolia*.
- Polytrichum? florissanti* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 245, pl. 12, fig. 4 [34,760].
- Podocarpus eocenica?* UNGER, Lesquereux, Rept. U. S. Geol. and Geogr. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 140 [50,339].  
 = *Planera myricaefolia*.
- Populus lesquereuxii* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 307, substituted for *Populus heerii* SAPORTA—LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 157, pl. 30, figs. 1 [1,712], 2 [1,695], 3 [1,691], 7 [1,692], 8 [1,697]; pl. 31, fig. 11 [1,690].
- Populus micro-tremuloides* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 261, pl. 19, fig. 2 [34,738, 34,739, counterparts].

- Populus pyrifolia* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 185, pl. 15, fig. 4 [33,687].
- Porana cockerelli* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 287, pl. 27, fig. 3.
- Porana similis* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1915, p. 288, pl. 27, figs. 1, 2 [34,736],—[3,4737].
- Porana tenuis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 173 [50,344].—KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 286, pl. 27, figs. 4-6.
- Potamogeton geniculatus* AL. BRAUN. LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8, (Cret. and Tert. Fl.), 1883, p. 142 [ . ].
- Potamogeton? verticillatus* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 142, pl. 23, fig. 5 [1,626].
- Pterocarya americana* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 290, pl. 58, fig. 3 [476].
- Quercus scudderi* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 265, pl. 21, fig. 3 [34,758].
- Rhamnus ellipticus* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 183, pl. 15, fig. 3 [33,688].  
= *Rhamnus kirchneri*.
- Rhus acuminata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 194, pl. 42, figs. 14 [1874], 15 [1871], 16 [1872].
- Rhus cassioides* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 193, pl. 41, fig. 11 [1887].
- Rhus hilliae* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 194, pl. 41, figs. 13 [1,892], 14 [1,890], 15 [1,891].
- Rhus rosaefolia* (LESQUEREUX) LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 293, pl. 42, figs. 7 [358], 8 [359], 9 [360].
- Rhus rotundifolia* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 184, pl. 12, fig. 2 [33,676].  
= *Hydrangea? florissantia*.
- Rhus subrhomboidalis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 195, pl. 41, figs. 16 [1,882], 17 [1,883].
- Rhus trifolioides* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 196 [50,325].—KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 279.
- Rhus vexans* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 195, pl. 41, fig. 20 [1,889].  
= *Schmalzia vexans*.
- Rosa hilliae* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 199, pl. 40, fig. 17 [1,912].
- Rosa? inquirenda* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 273, pl. 17, fig. 1 [34,741].
- Rosa scudderi* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1913, p. 272, pl. 22, fig. 4 [34,765].
- Salix amygdalaeifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 156, pl. 31, fig. 2 [1,682].
- Salix*, species KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 260, pl. 13, figs. 4, 5 [33,744, 33,745].
- Salvinia alleni* (LESQUEREUX) LESQUEREUX, see *Tmesipteris alleni*.
- Salvinia cyclophylla* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 64, pl. 8, fig. 10 [90].  
= *Phyllites cyclophyllus* (LESQUEREUX) Hollick.
- Sapindus augustifolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 265, pl. 49, figs. 3 [390], 4 [391], 6 [390]; vol. 8 (Cret. and Tert. Fl.), 1883, p. 181, pl. 37, figs. 3 [1,841], 6 [1,839]; pl. 39, fig. 12 [1,840].

- Sapindus lancifolius* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 182, pl. 32, fig. 3 [1,851], 5 [1,852].
- Sapindus stellariaeformis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 264, pl. 49, fig. 1 [389].
- Sequoia affinis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 75, pl. 7, figs. 1 [87], 2 [88].
- Sphenopteris guyottii* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 137, pl. 21, figs. 6 [1,613], 7 [1,614].  
= *Phegopteris guyottii* (LESQUEREUX) Cockerell.
- Staphylia acuminata* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 267, pl. 48, figs. 4 [387], 5 [388].
- Sterculia engleri* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 180, pl. 14, fig. 3 [33,684].
- Typha lesquereuxii* COCKERELL, Bull. Torr. Bot. Club, vol. 33, 1906, p. 307. Substituted for *Typha lattissima* Al. Braun.—LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 141, pl. 23, fig. 4 [1,569]. (Type from Uinta County, Wyoming, now Randolph County, Utah; since found abundantly at Florissant.)
- Ulmus hillix* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 160, pl. 28, fig. 1 [1,740].
- Ulmus tenuinervis* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 7 (Tert. Fl.), 1878, p. 188, pl. 26, figs. 1 [231], 2 [232], 3 [233].
- Vitis hesperia* KNOWLTON, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 284, pl. 26, fig. 4 [33,723].
- Weinmannia integrifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 178, pl. 42, figs. 8 [1,808], 9 [1,810], 10 [1,806], 11 [1,807], 12 [1,809], 13 [1,805].  
= *Weinmannia haydenii*.
- Weinmannia obtusifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 178, pl. 41, figs. 4 [1,814], 5 [1,817], 6 [1,815], 7 [1,813], 9 [1,818], 10 [1,819].
- Widdringtonia linguaeifolia* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 139, pl. 21, fig. 14 [58, 1,621].  
= *Sabina linguaeifolia* (LESQUEREUX) Cockerell.
- Zanthoxylon spireaefolium* LESQUEREUX, Rept. U. S. Geol. Surv. Terr., vol. 8 (Cret. and Tert. Fl.), 1883, p. 196, pl. 40, figs. 1 [1,904], 2 [1,906], 3 [1,907].  
= *Fagara spereaefolia*.
- Zizyphus obtusa* KIRCHNER, Trans. St. Louis Acad. Sci., vol. 8, 1898, p. 182, pl. 13, fig. 1 [33,679].

## EXPLANATION OF PLATES.

NOTE.—The figures on plates 12 and 13 and 16 to 27 were made natural size, but by an unfortunate error they have been reduced about one-tenth. Plates 14 and 15 are reduced about one-half.

## PLATE 12.

- FIG. 1. *Phegopteris guyottii* (Lesquereux) Cockerell.  
2. *Plagiopodopsis scudleri* Britton and Hollick,  $\times 3$ .  
3. *Pinus wheeleri* Cockerell.  
4. *Polytrichum? florissanti*, new species  $\times 3$ .

## PLATE 13.

- FIG. 1. *Muhlenbergia florissanti*, new species.  
2, 3. *Muhlenbergia florissanti*, new species  $\times 3$ .  
4, 5. *Salix*, species.

## PLATE 14.

*Sabina linguaefolia* (Lesquereux) Cockerell.

## PLATE 15.

*Juglans magnifica*, new species.

## PLATE 16.

FIG. 1. *Palaeopotamogeton florissanti*, new genus and species.

2. *Alnus*, species.

3. *Zizyphus obtusa* Kirchner.

4. *Populus*, species.

## PLATE 17.

FIG. 1. *Rosa inquirenda*, new species.

2. *Juglans florissanti* Lesquereux.

3. *Palaeopotamogeton florissanti*, new genus and species.

4. *Juglans sepultus* Cockerell.

## PLATE 18.

*Populus crassa* (Lesquereux) Cockerell.

## PLATE 19.

FIG. 1. *Alnus praecordata* Cockerell.

2. *Populus micro-tremuloides*, new species.

3. *Betula deltoides*, new species.

4. *Dalbergia coloradensis*, new species.

## PLATE 20.

FIGS. 1, 2. *Myrica drymeja* (Lesquereux) Knowlton. [Refigured from *Myrica acuminata* Unger. Lesquereux, Tertiary flora, 1878, p. 130, pl. 17, figs. 2, 3.

3, 4. *Myrica scottii* Lesquereux. [Refigured, *Myrica acuminata* Unger. Lesquereux, Tertiary flora, 1878, p. 130, pl. 17, figs. 1, 4].

5. *Fagopsis longifolia* (Lesquereux) Hollick.

## PLATE 21.

FIG. 1. *Myrica coloradensis*, new species.

2. *Planera myricaefolia* (Lesquereux) Cockerell.

3. *Quercus scudderi*, new species.

4. *Crataegus*, species.

5. *Cytisus florissantianus* Lesquereux.

6. *Nex microphylla* Lesquereux.

7. *Celastrinites elegans* Lesquereux.

## PLATE 22.

FIGS. 1, 2. *Aristolochia williardiana*, new species.

3. *Fraxinus ungeri* Lesquereux.

4. *Rosa scudderi*, new species.

## PLATE 23.

FIGS. 1, 2. *Fraxinus ungeri* Lesquereux.

3. *Cytisus florissantianus* Lesquereux.

4. *Vicia*, species.



## PLATE 24.

- FIG. 1. *Cotinus fraterna* Lesquereux.  
2. *Robinia brittoni* Cockerell.  
3. *Dalbergia minuta*, new species.  
4. *Cassia fischeri* Heer.  
5. *Fraxinus libbeyi* Lesquereux.  
6. *Celastrus lacoeci* Lesquereux.

## PLATE 25.

- FIGS. 1, 2. *Cercis parvifolia* Lesquereux.  
3, 4. *Ilex pseudo-stenophylla* Lesquereux.  
5. *Lomatia interrupta* Lesquereux.

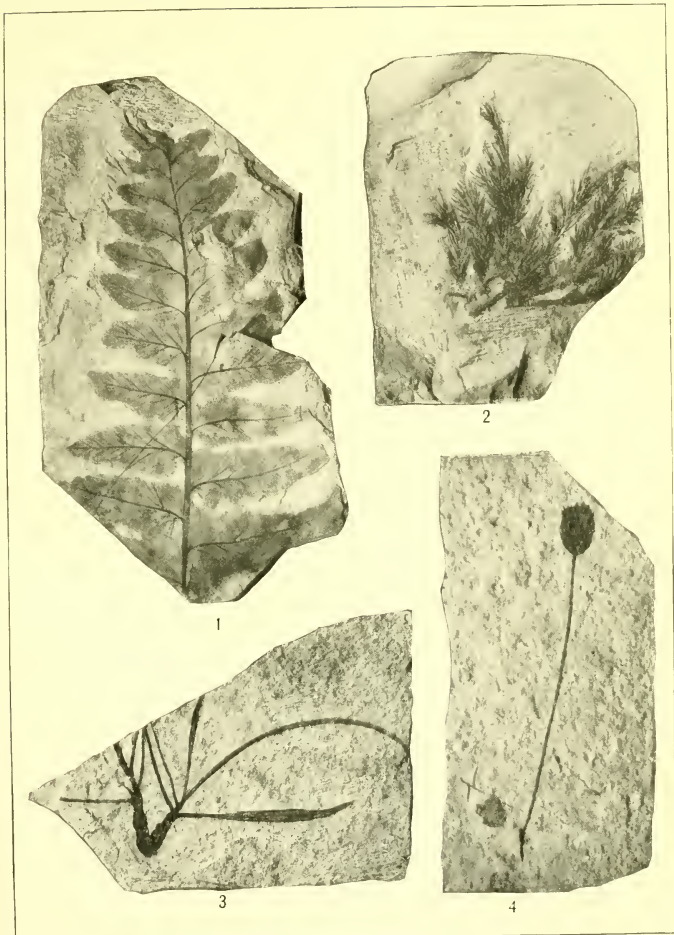
## PLATE 26.

- FIGS. 1, 2. *Lomatia hakeaefolia* Lesquereux.  
3. *Ilex knightiaefolia* Lesquereux.  
4. *Vitis hesperia*, new species.

## PLATE 27.

- FIGS. 1, 2. *Porana similis*, new species.  
3. *Porana cockerelli*, new species.  
4-6. *Porana tenuis* Lesquereux. (Fig. 6 is the type).  
7. *Carpolithes macrophyllus* Cockerell.





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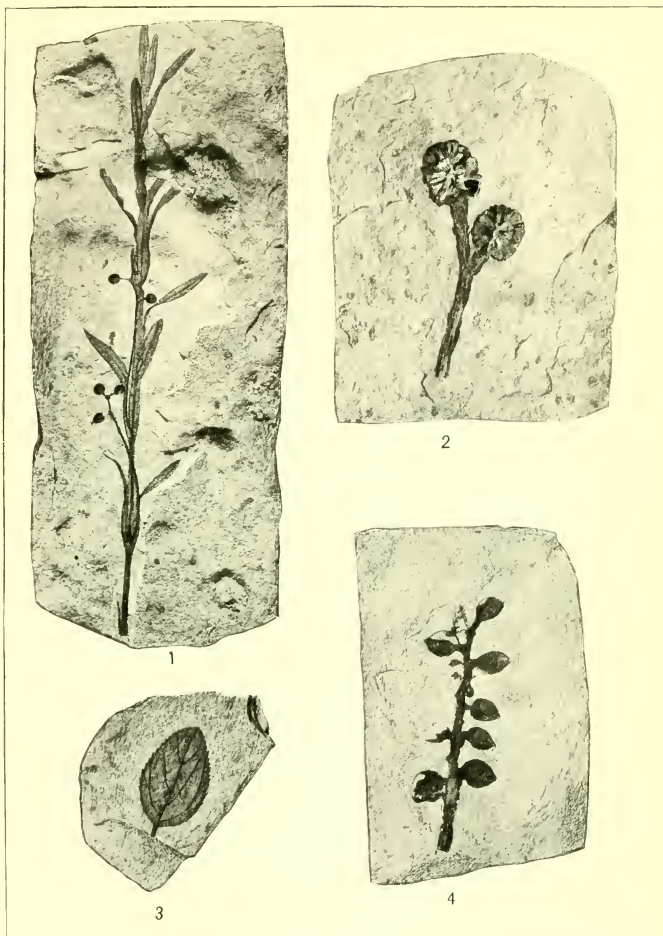




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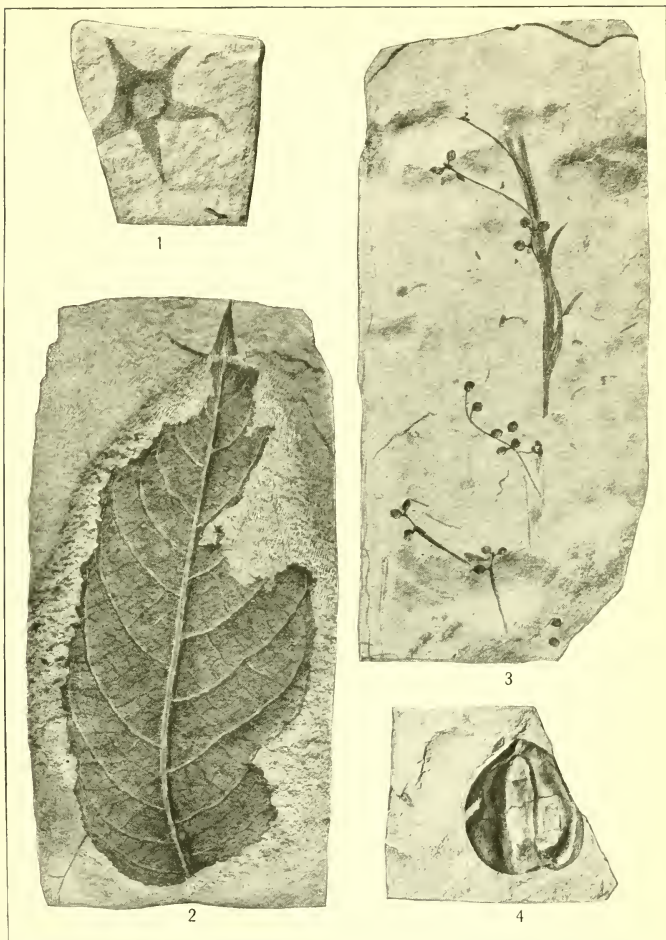




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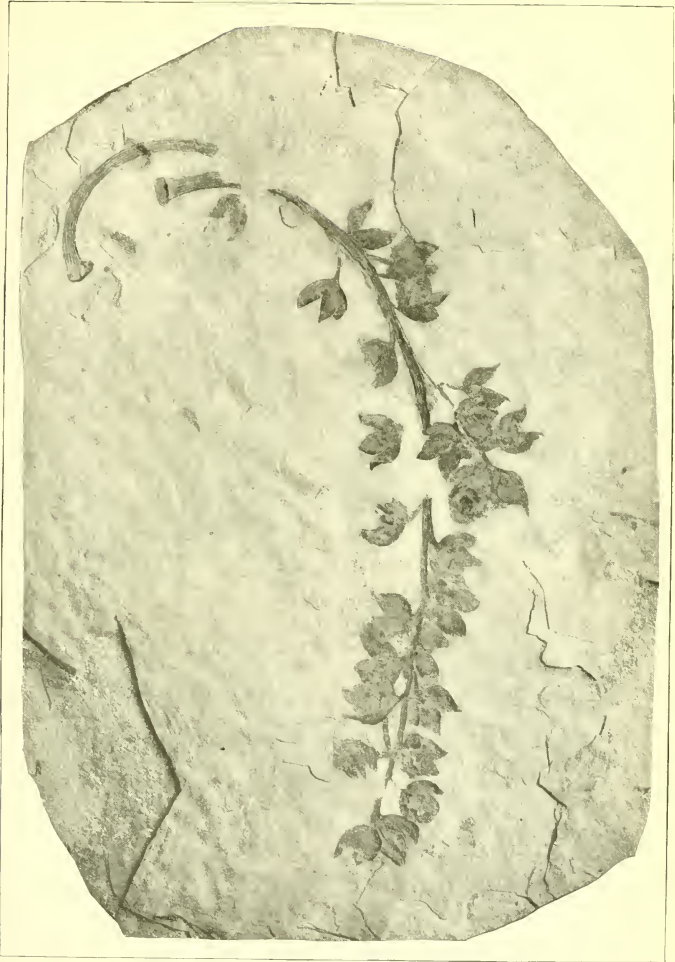




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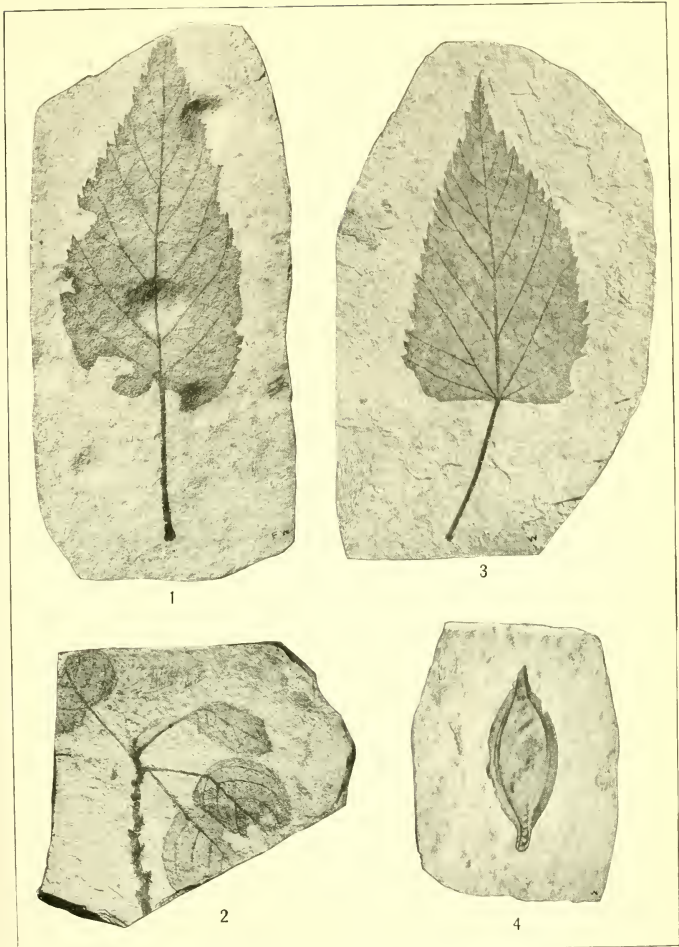


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1



2



3



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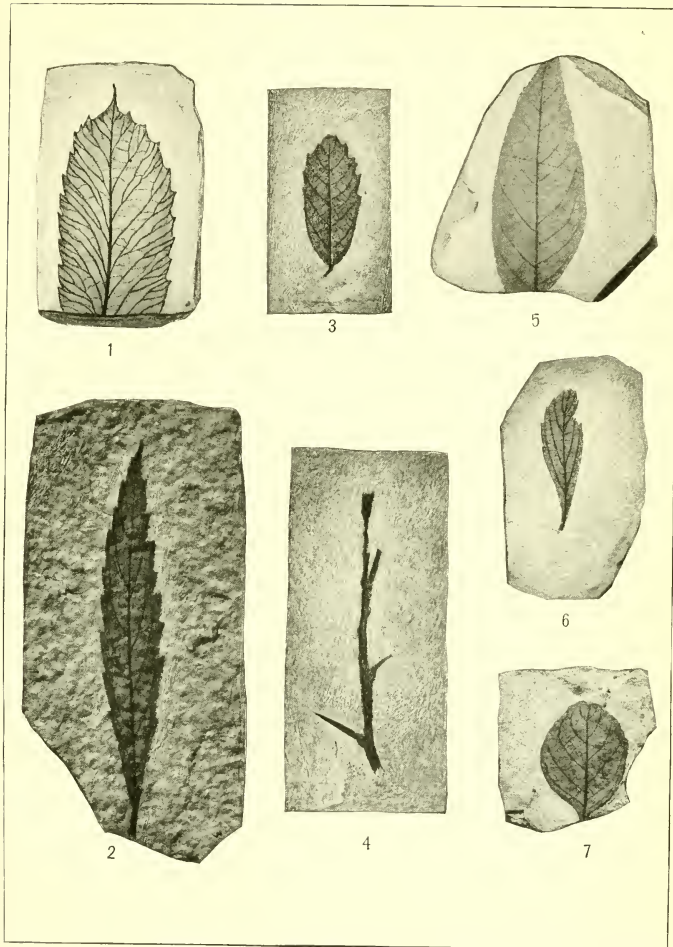


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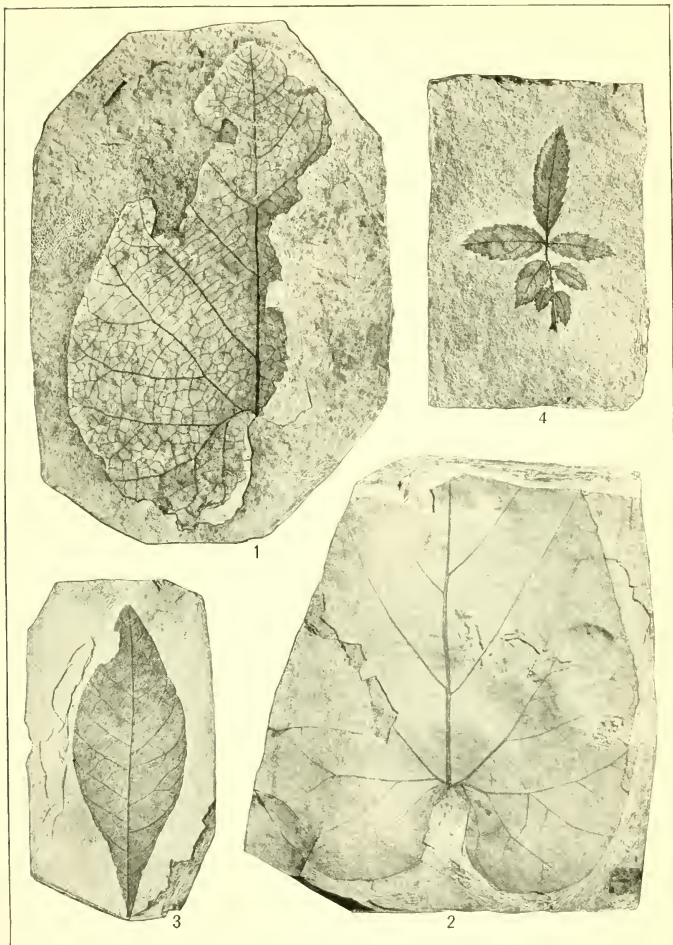




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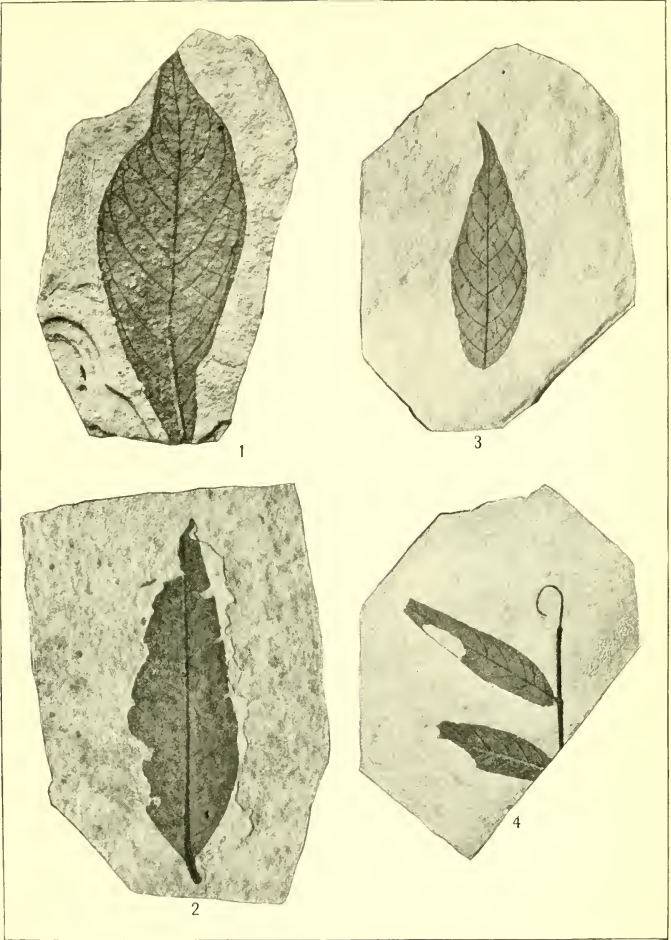


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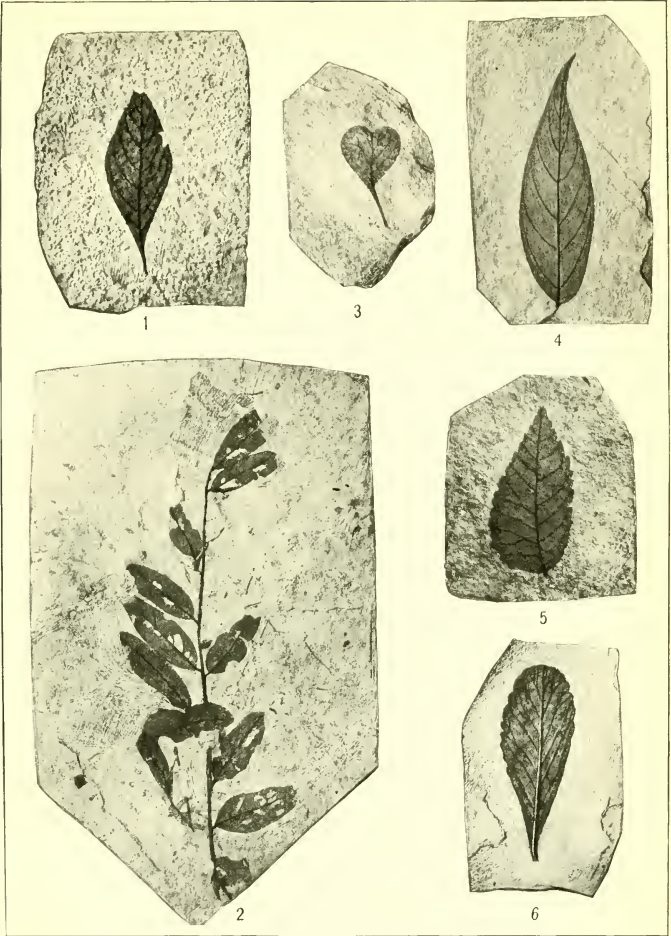




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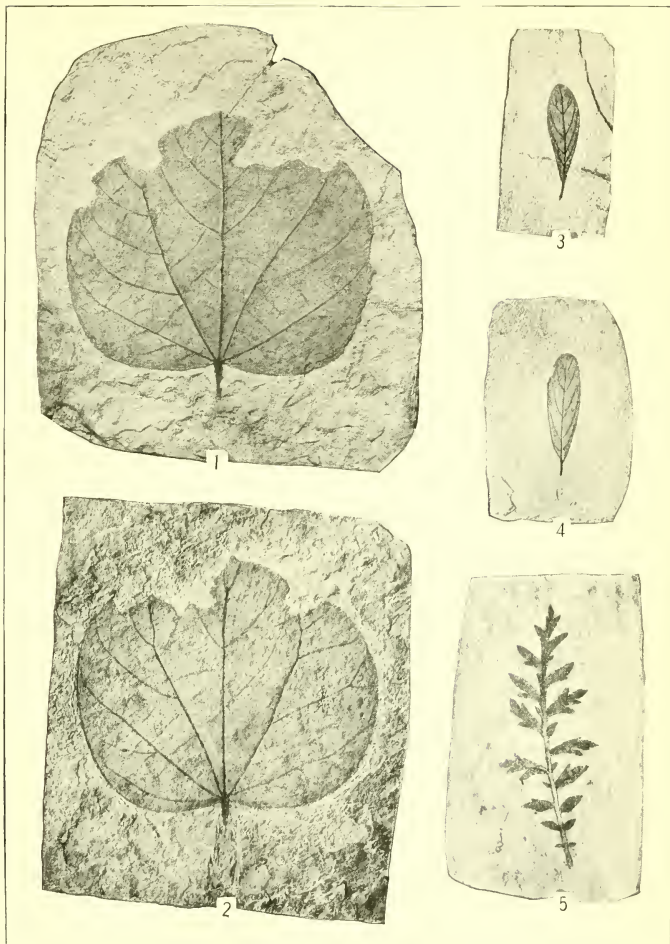




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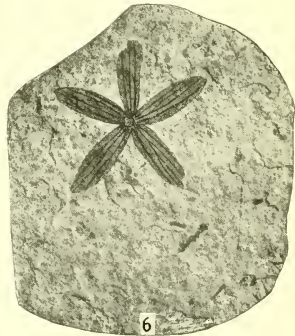
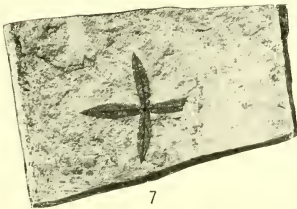
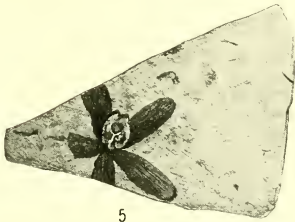
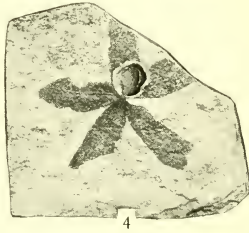
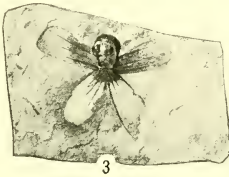
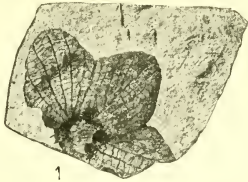


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