

# PLANT AND INSECT FOSSILS FROM THE GREEN RIVER EOCENE OF COLORADO

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The present paper continues the study of the Green River biota, the fossils now described having been obtained by Mrs. Cockerell, John P. Byram, and the writer during the summer of 1922. The oil shale region in Colorado is at the present time in a condition extremely favorable to the paleontologist, owing to the great quantities of shale thrown out from the very numerous assessment holes. In a few years this material will decay, and it is probable that the blasting out of fresh holes will be discontinued. The rock is very hard and can not be readily worked with pick and shovel, as is done at Florissant. We may therefore hope that means will be found in the near future to send additional collectors into the region, to secure the rich materials now readily obtainable.

Since I last published on this subject Dr. F. H. Knowlton's excellent Revision of the Flora of the Green River Formation<sup>1</sup> has appeared. This puts our knowledge of the flora, hitherto very imperfect and confused, on a good basis and makes further work relatively easy. One previously published species has been omitted; *Firmianites aterrimus* Cockerell<sup>2</sup> (Green River, Wyoming).

The new materials now described indicate certain general conclusions or results as follows:

(1) The plants show that the flora is in many ways similar to that of Florissant, with enough representative species to strongly suggest that part of the Florissant flora is directly descended from that of the Green River Epoch; while at the same time there has been interval enough to change all or almost all the species. It is probable that no Florissant species of flowering plant is actually identical with any Green River species.

(2) On the other hand, it is evident that part of the Florissant flora is derived from quite other sources; also that the Green River climate was warmer than that of Florissant. As we come to know

<sup>1</sup> U. S. Geological Survey, Professional Paper 131-F.

<sup>2</sup> Amer. Journ. Sci., November, 1909, p. 447.

more of the Green River biota, the comparisons with Florissant will certainly give results of great value and interest.

(3) The Proteaceae are in this paper clearly established in the Green River. The previously recorded *Lomatia microphylla* Lesquereux cannot be considered definitely Proteaceous.

(4) The Green River biota is by no means strictly or typically tropical though it contains elements suggestive of tropical or subtropical conditions.

## HEPATICAЕ

### Family JUNGERMANNIACEAE

#### LEJEUNEA EOPHILA, new species

Plate 1, fig. 1

Stem fairly stout, normal, bearing poorly preserved thin rounded leaves, apparently 3 mm. long or less, and well developed bifid underleaves, the latter about three in 5 mm. of stem; underleaves with very stout bases, the lobes more or less unequal, one thick, the other slender, both pointed, with their outer sides convex and inner concave; length of underleaf about 1.5 mm. The specimen consists of about 16 mm. of stem, with leaves.

Green River shales, head of East Alkali Gulch, about 8 miles south of DeBeque, Colorado; collected by John P. Byram in 1922.

*Holotype*.—Cat. No. 36851, U.S.N.M.

So far as can be seen, this does not differ from modern *Lejeunea*. Bifid underleaves and other characters readily distinguish it from *Jungermanniopsis cockerelli* Howe and Höllick of the Florissant Miocene. *Lejeunea eophila* is the oldest known member of the *Jungermanniaceae*. It might have existed in a tropical or subtropical habitat.

## EQUISETALES

### Family EQUISETACEAE

#### EQUISETUM WYOMINGENSE Lesquereux

Green River shales, head of East Alkali gulch, about 8 miles south of DeBeque, Colorado (J. P. Byram 1922). New to Colorado.

### Family SCHIZAEACEAE

#### LYGODIUM KAULFUSSII NEUROPTEROIDES (Lesquereux)

*Lygodium neuropteroides* LESQUEREUX, U. S. Geol. and Geogr. Surv. Territ., Annual Report for 1870, p. 384.

Since the Green River plant is not strictly identical with the European Eocene form, it seems best to retain the name proposed by Lesquereux in a subspecific sense.

Green River Eocene Station 2, large excavation with tunnel at head of Salt Wash, Roan Mountains, Colorado, 1922. Also obtained by Mrs. Cockerell at Station 1, on Ute trail.

This genus illustrates the difficulty of drawing conclusions concerning past climates from single species. *Lygodium* is in general a tropical genus, but the living *L. palmatum* (Bernhard) Swartz extends north to Massachusetts.

### Family SALICACEAE

#### POPULUS WILMATTAE, new species

Plate 2, fig. 8

Leaf broad, with approximately the shape of *P. trichocarpa* Hooker, length about or nearly (apex missing in type) 70 mm., width 71 mm.; base broadly truncate; margins distinctly but feebly and rather remotely dentate, the low obtuse teeth about 2 to 3 mm. apart; petiole about 1.5 mm. thick; midrib and two pairs of lateral veins very prominent, the first pair coming off at the base, the second about 3.5 mm. beyond, the latter at an angle of about 45°; the weak veinlets from the midrib above widely diverging, not far from transverse.

Green River Eocene, Roan Mountains, Colorado, 1922, Station 2, excavation at head of Salt Wash. Named after Mrs. Cockerell.

*Holotype*.—Cat. No. 36852, U.S.N.M.

Of all the forms of *Populus* known to me this most resembles the living *P. rasumowskiana* Dippel, which I saw growing in Kew gardens. The form and appearance are closely similar, but the fossil differs in lacking any really strong lateral veins above the two pairs near the base. Thus the venation, though not the shape, is more like that of the fossil *P. zaddachi* Heer.

### Family MELIACEAE

#### MELIA COLORADENSIS (Knowlton)

*Phyllites coloradensis* KNOWLTON, Revis. Flora Green River Formation, U. S. Geol. Surv., Prof. Paper 131-F, p. 176.

This appears to be a *Melia*, related to *M. expulsa* Cockerell from Florissant Miocene. We obtained it at Station 1, on Ute trail, and Station 2, near head of Salt Wash, Roan Mountains, Colorado. The terminal leaflet may be deeply notched, as Knowlton shows one of the lateral ones to be. The leaflets are larger than in *M. expulsa*, without any serration of the margin. In the living *M. azedarach* Linnaeus forms occur with the margins of the leaflets nearly entire. The living species inhabit Asia and Australia. The figure of *Phyllites winchesteri* Knowlton looks like a distorted leaflet of this species, but the description entirely negatives such an idea.

## Family ANACARDIACEAE

RHUS VARIABILIS (Newberry) Knowlton

At Station 2, near head of Salt Wash, Roan Mountains, Colorado, we found a very fine leaf with nine leaflets, showing the petiolules about 8 mm. long, the bases of the leaflets narrowly cuneate, the serrations coarse and few. Newberry's figure cited by Knowlton is not quite so coarsely toothed, but is doubtless the same thing. Newberry did not intend to take this leaf as typical of his species, but Knowlton has so restricted it, and must be followed. Knowlton's figure 11, of his *Rhus myricoides*, appears to be the same species, but apparently not figure 9, to which *R. myricoides* should be restricted. The leaflets of *R. variabilis* are widely spaced, the petiolules about 20 mm. apart.

## Family CELASTRACEAE

EVONYMUS FLEXIFOLIUS Lesquereux

The apical portion of a leaf, showing the very characteristic features, was collected by Mrs. Cockerell in the Green River shales at Station 1, near head of Ute trail, Roan Mountains, Colorado. The species has previously been known only by the unique type collected in Wyoming. The long "drip-tip" suggests a moist climate.

## Family SAPOTACEAE

BUMELIA COLORADENSIS, new species

Plate 1, fig. 5

Leaf apparently coriaceous, long oval, inequilateral and emarginate at apex, broad-cuneate at base, entire, with a short somewhat twisted petiole. Principal lateral veins few, widely spaced, about 6 to 8 mm. apart with short veins between their bases. Leaf about 60 mm. long and 32 wide, the widest part above the middle.

Green River Eocene, Roan Mountains Colorado, Station 2, large excavation at head of Salt Wash, 1922.

*Holotype*.—Cat. No. 36853, U.S.N.M.

This may as well be *Mimusops* as *Bumelia*, but it is evidently allied to *Bumelia florissanti* Lesquereux from the Miocene of Florissant, differing by being oval rather than pyriform in outline. It does not agree with any of the numerous fossil species described by Berry. It is indicative of a tropical or warm-temperate climate. Knowlton's *Carpolithus caryophylloides*, as figured, has the aspect of a *Mimusops* calyx. Could it belong to the plant now described?

## Family ARALIACEAE

## ARALIA WYOMINGENSIS Knowlton and Cockerell

Green River Eocene, Roan Mountains, Colorado, 1922, Station 8, half a mile east of our camp at head of Ute trail. A leaf of the same size as that figured by Knowlton,<sup>3</sup> but differing from Knowlton's figure and agreeing with Newberry's in having the principal lateral veins arising some distance above the base of the leaf.

## Family FABACEAE

## DALBERGIA KNOWLTONI, new species

Plate 1, fig. 3

Leaflet apparently coriaceous, oval with broadly angulate slightly inequilateral base and deeply emarginate (in the type strongly inequilateral) apex; margins entire. Length 40, width 25.5 mm.

Green River Eocene, Roan Mountains, Colorado, 1922, Station 8, near head of Ute trail.

*Holotype*.—Cat. No. 36854, U.S.N.M.

This is evidently identical with Knowlton's *D. retusa*, but as that name has been used twice, earlier, for living species, I take my specimen, which is better than Knowlton's, as the type.

## AMORPHA UTENSIS, new species

Plate 2, fig. 6

Leaflet 12 mm. long, 5 mm. across near apex, cuneate, with entire margins, apex broadly truncate and strongly mucronate; petiolule rather stout 3 mm. long.

Green River Eocene, Roan Mountains, Colorado, 1922. Station 1, near head of Ute trail.

*Holotype*.—Cat. No. 36855, U.S.N.M.

This leaflet is exactly as in *Amorpha*, but unusually cuneate at base.

## Family CLETHRACEAE

## CLETHRA (?) LEPIDIOIDES, new species

Plate 2, fig. 7

A slender flexible raceme, with crowded small fruits in the manner of *Clethra alnifolia* Linnaeus. Fruits globose, about 2.3 mm. in diameter, on short petioles, apparently enclosed in a calyx; raceme as preserved about 35 mm. long (but the end is missing) and 4 to 5 mm. wide, pure black.

<sup>3</sup> Revis. Flora, Green River Formation, pl. 4, fig. 12.

Green River Eocene, Roan Mountains, Colorado, Station 1, near head of Ute trail (Wilmatte P. Cockerell, 1922).

*Holotype*.—Cat. No. 36856, U.S.N.M.

It is impossible to prove that this is a *Clethra*, but it has that appearance. The genus contains two living North American species, and there is a species (*C. arborea* Aiton) living in Madeira.

The flowers of *C. berendtii* Caspary have been beautifully preserved in Baltic amber. *C. lepidioides* certainly shows much resemblance to the fossil *Andromeda protogaea* Unger, but I do not believe it is an *Andromeda*. The specific name is derived from the superficial resemblance to *Lepidium*.

## Family ROSACEAE

### POTENTILLA(?) BYRAMI, new species

Plate 2, fig. 9

Calyx with four acuminate sepals, having an expanse, from tip to tip of 10.5 mm., the width of a sepal near base 2 mm., the sides with a double curve free from hairs; corolla deciduous, absent; stamens very numerous, at least 20, with rather stout filaments about 1.8 mm. long and globose or subglobose anthers.

Green River Eocene, Roan Mountains, Colorado, Station 11, near top of ridge just beyond that on which is Station 1, on the side facing the latter (John J. Bryam, 1922).

*Holotype*.—Cat. No. 36857, U.S.N.M.

This seems to agree well with those forms of *Potentilla* which have sometimes been separated as *Tormentilla*, on account of the tetramerous flowers. The group is more characteristic of Europe than America at the present time. Although the generic reference remains somewhat uncertain, it is strongly suggested by the form of the sepals, the quickly deciduous petals, and the character of the numerous stamens.

## Family ALSINACEAE

### ALSINITES, new genus

Plant small, tufted with crowded flowers solitary on short stems, apparently arising separately from the tufted caudex; leaves apparently minute, not discernible; pedicels slender, 5 mm. long or less; flowers narrowly campanulate, with tapering (not abrupt or swollen) base; calyx with apparently five lobes, separated about halfway to base, rather narrow, with somewhat obtuse tips; corolla apparently absent; stamens ten, parallel, strongly exerted, with well developed anthers; capsules globose, smooth, with apparently mucronate apex.

*Type of the species*.—*Alsinites revelatus*, new species.

## ALSINITES REVELATUS, new species

## Plate 1, fig. 2

Calyx about 5 mm. long and 2.5 mm. broad; stamens exerted about 3.5 mm., with rather stout filaments; anthers oval hardly half a mm. long; capsules about 2 mm. in diameter.

Green River shales; spur above Roan Creek opposite Salt Wash, just beyond the spur on which is the Ute trail. Found, 1922, by John P. Byram.

*Holotype*.—Cat. No. 36858, U.S.N.M.

This is the first fossil caryophylloid plant from North America, with the possible exception of *Carpolithus caryophylloides* Knowlton, also of the Green River Eocene of Colorado, which has the base of the calyx (?) much broader and more abruptly separated from the pedicel. This comparison is based on the supposition that it is a calyx, but Knowlton prefers to consider it a capsule more or less resembling that of *Lychnis*, in which case the resemblance to *Alsinites* is even more remote.

Plants of this type exist in rocky and mountainous places, even in the tropics, but not in the humid lowlands. Presumably *Alsinites* grew on some mountain overlooking Green River lake and was washed down to the bottom of the valley as the result of a storm. Such specimens, only preserved as the result of a fortunate accident, are unusually precious and interesting.

*Alsinites* differs in no very marked characters from the modern *Alsine*, but it has a facies of its own and by reason of the long exerted stamens and absence of corolla may be considered generally distinct.

## Family PROTEACEAE

## LOMATIA OBTUSIUSCULA, new species

## Plate 1, fig. 4

Similar to *L. terminalis* Lesquereux, from the Florissant Miocene but the ends of the lobes of the leaf are obtuse instead of acutely pointed. The type is the end of a leaf, 38 mm. long, intense black as preserved. The venation only visible on wetting, the original texture evidently coriaceous. The apical lobe is lanceolate, 18 mm. long and 7 mm. broad, obtuse at tip; there are two lateral lobes on each side, those on one side with the upper margin 5 mm. long, on the other longer, 6 or 7 mm., and all obtuse and directed obliquely apicad.

Green River Eocene, Roan Mountains, Colorado, at Station 1, near head of Ute trail (Cockerell, 1922).

*Holotype*.—Cat. No. 36859, U.S.N.M.

The reference to *Lomatia* follows the usage for the Florissant fossils but actually the genera of Proteaceae can hardly be separated on the leaves. The living *Lomatia ferruginea* R. Brown and *L. tinctoria* R. Brown have foliage of the general type of *Grevillea robusta* A. Cunningham; while *L. obliqua* R. Brown, *L. dentata* R. Brown, and *L. polymorpha* R. Brown are entirely different. Were they all fossilized, they certainly would not be regarded as congeneric. I take this opportunity to note that the reference to fossil leaves resembling *Grevillea*, in American Museum Journal (vol. 16, p. 449), has to do with *Lomatia acutiloba*. The editor (p. 447), unfortunately inferred that the species figured (*L. tripartita*) was referred to, and this was later the occasion for a criticism from a South African botanist who does not believe in North American Proteaceae.

**BANKSITES LINEATULUS, new species**

Plate 2, fig. 3

Seed about 2.5 mm. long and 1.5 broad, with wing 5.8 mm. long the base of which falls short of end of seed about 1.6 mm.; the wing is 3 mm. broad, with six or seven widely spaced delicate veins; it is obtuse and inequilateral, and wing and seed together measure 7 mm. in length.

Green River Eocene, Roan Mountains, Colorado, at Station 2 of 1922 expedition, large excavation with tunnel at head of Salt Wash, some distance below top of hill (Cockerell).

*Holotype*.—Cat. No. 36860, U.S.N.M.

This is extremely similar to *B. lineatus* Lesquereux from the Miocene of Florissant but smaller and presumably a different species. It differs little from the seeds of living Proteaceae; there is even some suggestion of the projecting point near the upper end of the seed which is seen in *Banksia*. In *Banksia integrifolia* Linnaeus filius, the wing goes less than half way down the side of the seed; in *Banksites lineatulus* it goes much more than half way, but not nearly so far as in *Knightia excelsa* Robert Brown, in which it goes practically to the end.

The fossil leaves described as *Banksites saportanus* Velenovsky, recorded from the Upper Cretaceous of Marthas Vineyard, are much more like *Knightia* than *Banksia*.

**Family HAMAMELIDACEAE**

**LIQUIDAMBAR CALLARCHE, new species**

Plate 1, fig. 6; plate 2, fig. 5

Leaves similar in size and appearance to those of the living *L. styraciflua* Linnaeus, five-lobed, the lobes without accessory lobules, the basal margin (dentate in *L. styraciflua*) entire, sides of median



lobes with low obtuse teeth at intervals of about 7 mm, and only faint indications of denticulation between. The points in no case as distinctly produced as in *L. styraciflua*. I am unable to see any pubescence in the axils of the veins (it is absent in *L. orientalis* Miller of Asia Minor), but the state of preservation admits of no certainty in this regard. Fruit about 15 mm. in diameter, on a slender stalk, in all respects typical of the genus, the hardened projecting styles very numerous, slender, and straight or nearly so, features which distinguish the species from *L. europaeum* A. Braun.

Green River Eocene, Roan Mountains, Colorado, leaf found at Station 2 of 1922 expedition (head of Salt Wash) by John P. Byram. This may be taken as the type.

*Holotype*.—Cat. No. 36861, U.S.N.M.

Fruit found by Mr. Byram at head of East Alkali Gulch about eighth miles south of DeBeque, Colorado. The probability that the fruit and foliage belong together is so strong that this is presumed to be the case. This is not the European Miocene *L. europaeum*, the leaves of which agree in form and outline with *L. styraciflua*. (On the view that names of trees are feminine, we ought to write *L. europaea*). The so-called *L. europaeum* described from the American Eocene may be at least in part identical with *L. callarche*.

*L. convexum* Cockerell, from Florissant, is distinguished from the present species by the convex sides of the middle lobe of the leaf.

## INSECTA

### COLEOPTERA

#### Family ELATERIDAE

##### CARDIOPHORUS EXHUMATUS, new species

Plate 2, fig. 2

Length 9 mm., elytra 6 mm.; width of thorax 2.7 mm., length about 2.3 mm.; width of elytra in middle 1.5 mm. Thorax with sharply pointed posterior angles; elytra narrow, subacute, with eight very delicate, not punctate, striae, the whole surface apparently delicately pubescent. The metasternal cavity, middle coxal cavities, metasternum and hind coxal plates appear to agree with *Cardiophorus*, as also the delicately hairy feebly striate elytra. On comparison with the living *C. pubescens* Blanchard, from White Rocks, Boulder County, Colorado, the hind coxal plates are more pistol-shaped, narrower mesad, with the upper margin convex and the lower (posterior) concave. Also, the metasternal plates appear to be more obtuse or rounded at the outer hind corner than in *C. pubescens*. The scutellum is unfortunately not preserved. The elytra are without spots.

Green River Eocene; head of East Alkali Creek, about 8 miles south of DeBeque, Colorado (John P. Byram, 1922).

*Holotype*.—Cat. No. 69614, U.S.N.M.

The broad thorax, with convex sides and the elytra without evident punctures at once separate this from *C. braunii* Heer, from the Miocene of Oeningen. Among the Florissant (Miocene) species, it is perhaps nearest to *C. lithographus* Wickham, but the hind coxal plates are differently shaped. This is much the oldest known *Cardiophorus*.

## Family SCARABAEIDAE

### MELOLONTHITES AVUS Cockerell

A specimen about 11.5 mm. long was found by John P. Byram at our Station 10, which is a large excavation a short distance up the Ute trail from Station 1, in the Roan Mountains, Colorado. The clypeus is emarginate but not at all bidentate; the eyes are deeply emarginate, the elytra are strongly convex outwardly, and the hind spurs are very strongly curved. The insect is quite modern in appearance and may, I think, be termed *Phyllophaga avus*, though the protuberance on the outer side of the hind tibiae is very indistinct.

## HEMIPTERA

### Family CIXIIDAE

#### EOLIARUS, new genus

Resembling the modern genus *Oliarus* Stal, both in form and the spotting of the wings, but the radius branches at an acute angle a considerable distance before the large stigmatic spot, the upper division (R) proceeding very obliquely to the margin, traversing the upper part of the spot; the lower division (radial sector) emitting four very oblique branches above (as in the Mesozoic *Mesocixoides* of Tillyard), the first traversing the stigmatic spot, the second arising at its outer lower corner, the fourth traversing the upper part of the apical spot; media branching beyond level of forking of radius, its fork more open, the upper branch soon connected with the radial sector by a vertical cross-vein, and later forking at an acute angle, its upper division again forking at the level of the last branch of radial sector; cubitus forking at same vertical level as radius; hind wings with cross-veins beyond the bases of apical forks; body very stout, brown, pallid in scutellar region, abdomen distinctly branded.

*Type of the genus*.—*Eoliarus quadristrictus*, new species.

**EOLIARUS QUADRISTICTUS, new species**

## Plate 2, fig. 1

Length about 8 mm., width of abdomen near base 3.5 mm.; length of tegmen 9 mm., distance between stigmal and apical spots 2 mm.; wings hyaline with brown (not spotted) veins; four conspicuous spots, the large irregularly quadrate stigmal one, the smaller apical one, a small one near lower side of wing directly below stigma and another subapically in the region of the end of the cubitus. The venation differs to some extent on the two sides of the type. On the right side the upper branch of the media forks very near to the cross-vein, while on the left it forks at a distance a little greater than the length of the cross-vein.

Green River Eocene, Trail Gulch, on north side of Roan Creek, Colorado (John P. Byram, 1922).

*Holotype*.—Cat. No. 69615, U.S.N.M.

*Oliarus* (?) *lutensis* Scudder, from Green River, Wyoming, is clearly congeneric and must be called *Eoliarus lutensis*. Possibly the two forms belong to a single species, but in *lutensis* the fork of the upper branch of media is very much more distant, the tegmina do not appear to be distinctly four-spotted, and the insect is considerably smaller. I should nevertheless have hesitated to propose a second species were it not that in the modern genus *Oliarus* there are very numerous species, differing by similarly inconspicuous or relatively unimportant details. This insect gives us another example of spotting which is older than the finer details of structure.

## Family CICADELLIDAE

**THAMNOTETTIX PACKARDI, new species**

## Plate 2, fig. 4

Length 4 mm.; length of tegmina 4 mm.; their width about 1.4 mm.; width of thorax about 1 mm. or slightly more. Head and body dark, with scutellar region pale; tegmina slender, with longitudinal light and dark stripes. There is a dark line along the costa, perceptibly broadening basally; below the costa, nearly to the end of the wing, is a broad continuous pale band emitting a pointed lobe, directed apicad, from its basal third beneath; beyond this pointed lobe, separated from it by an oblique dark band, is an elongate pale mark but the apical part of the wing is dark; a broad light band covering the upper margin of the clavus, and a narrow curved light band in the extreme anal region. Hind wings strongly dusky; no visible marginal vein.

Green River Eocene, Roan Mountains, Colorado, 1922; Station 11, near top of ridge beyond that on which is Ute trail (John P. Byram); also a poorer specimen, found by Mrs. Cockerell.

*Holotype*.—Cat. No. 69616, U.S.N.M.

Scudder's *T. gannetti*, based on two specimens collected by Dr. A. S. Packard at Green River, Wyoming, is certainly very similar, but the specimens are not very well preserved. It is not certain that both specimens pertain to the same species, but one of them (Scudder's pl. 6, fig. 33), may actually be *T. packardi*. I will therefore take as the type of *T. gannetti* the other specimen (Scudder's pl. 7, fig. 5). The new species is named after the eminent discoverer of Scudder's *T. gannetti*. The venation of the hind wings in *T. packardi* is entirely of the same type as that of *T. eocenica* (Cockerell), but the latter is readily separable by the marking of the tegmina.

## DIPTERA

### Family TIPULIDAE

#### CYTTAROMYIA OBDURESCENS, new species

*Female*.—Length about 9.5 mm.; length of wing 9.5 mm.; its width 2.5. Thorax very small, dark brown; abdomen paler, subclavate. Wings pale brown throughout, quite without spots. The following measurements are in microns; length of discal cell about 1800, its width near end about 608; length of posterior cells beyond discal about 1360; length of marginal cell 3450, the proximal portion considerably longer than distal; cell above discal extending 320 beyond it; end of second basal 176 beyond basal corner of discal. Praefurca very strongly arched at base, not as long as rest of second longitudinal vein, but very much more than half as long.

Green River Eocene, Roan Mountains, Colorado, 1922, Station 11 (John P. Byram).

Easily known from *C. fenestrata* Scudder by the longer discal cell and absence of a dark cloud in end of marginal cell. In Scudder's table it runs nearest to *C. cancellata* Scudder, from Florissant, but is readily separated by the more produced cell above discal and the second basal extending more below base of discal.

## EXPLANATION OF PLATES

### PLATE 1

- FIG. 1. *Lejeunea eophila*, new species,  $\times 2.5$ .  
2. *Alsinites revelatus*, new species,  $\times 2.5$ .  
3. *Dalbergia knowltoni*, new species, natural size.  
4. *Lomatia obtusiuscula*, new species, natural size.  
5. *Bumelia coloradensis*, new species, natural size.  
6. *Liquidambar callarche*, new species, natural size.  
7. *Diatryma filifera* Cockerell, natural size.  
(Feather, described in Amer. Mus. Novitates, No. 62 (1923).)

### PLATE 2

- FIG. 1. *Eoliarus quadricticus*, new species,  $\times 3$ .  
2. *Cardiophorus exhumatus*, new species,  $\times 3$ .  
3. *Banksites lineatulus*, new species,  $\times 3$ .  
4. *Thamnotettix packardi*, new species,  $\times 6$ .  
5. *Liquidambar callarche*, new species,  $\times 2.5$ .  
6. *Amorpha utensis*, new species,  $\times 2$ .  
7. *Clethra lepidioides*, new species,  $\times 2$ .  
8. *Populus wilmattae*, new species,  $\times 1$ .  
9. *Potentilla ? byrami*, new species,  $\times 3$ .

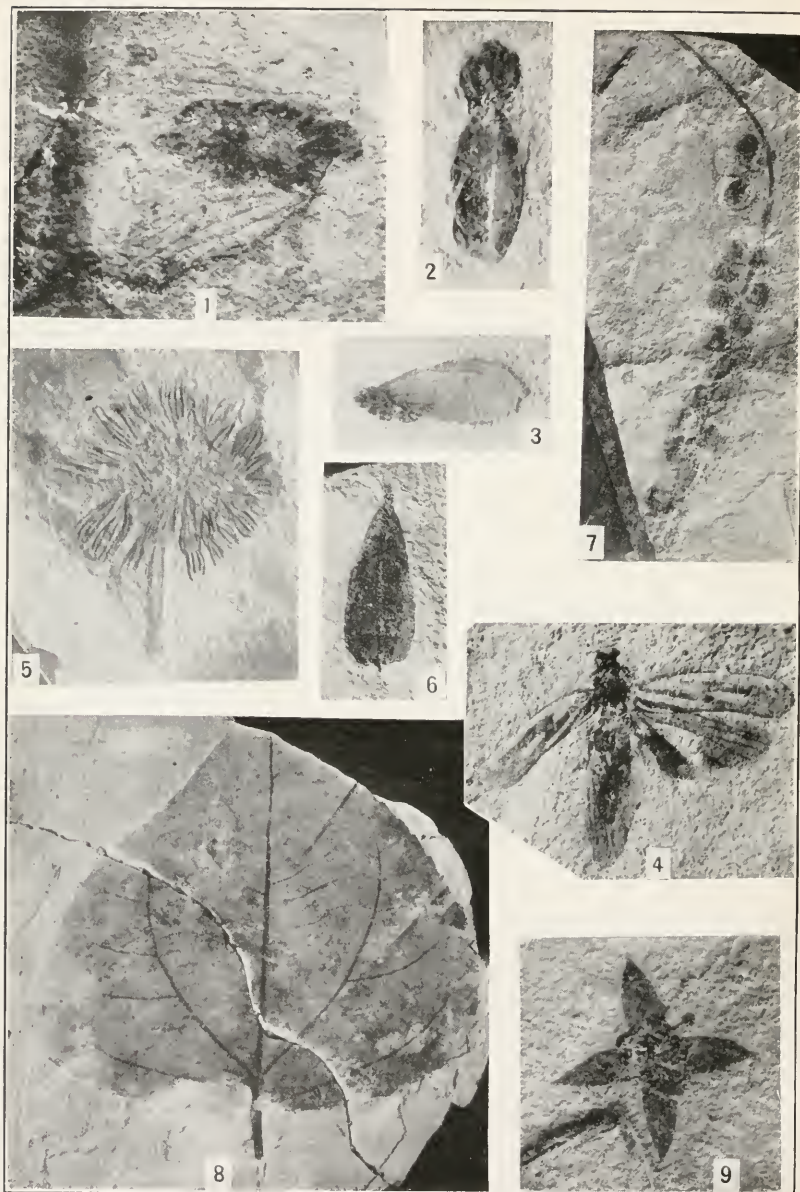






FOSSILS FROM THE GREEN RIVER EOCENE

FOR EXPLANATION OF PLATE SEE PAGE 13



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